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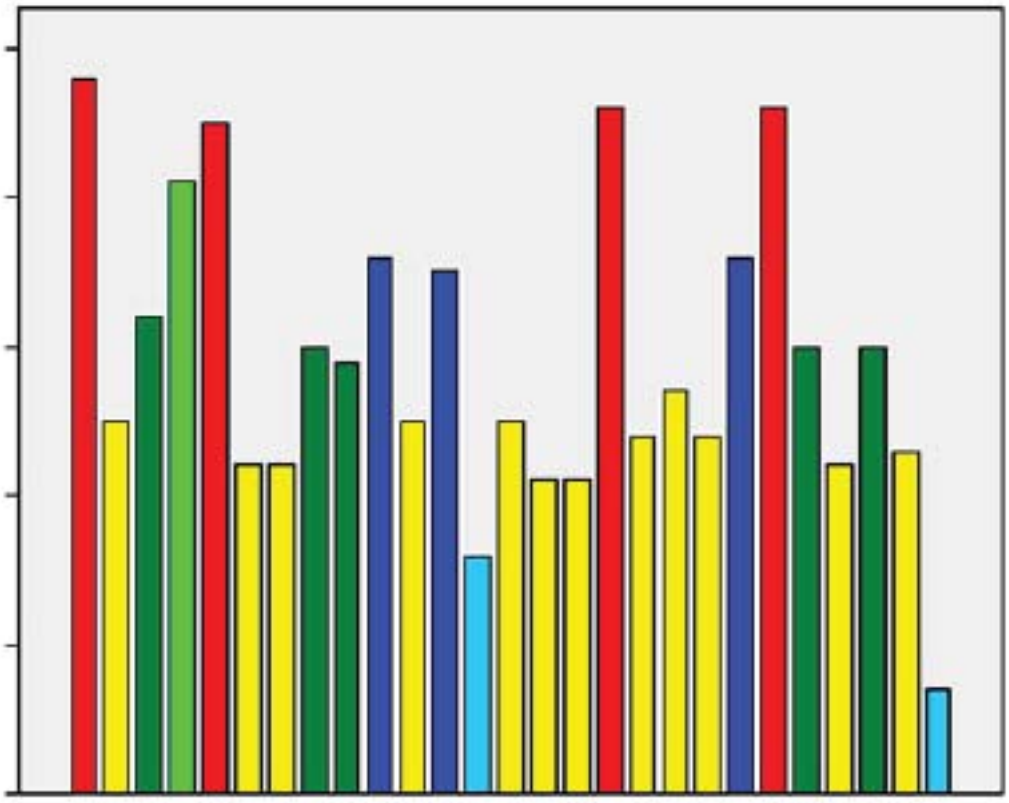
UNIVERSITY OF MISSOURI - ST. LOUIS

# Disparity of Assessment Results: Why Missouri School Funding Formula Doesn't Add Up



Study conducted by

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# PUBLIC POLICY RESEARCH CENTER

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# EXECUTIVE SUMMARY

When the Missouri General Assembly adopted a new method for funding public schools throughout Missouri during the 2005 legislative session, it tied allocation of future funds to the property assessments and tax rates in existence in 2004. Some may have suspected that the quality of property assessment data was unequal to this task. After all, the quality of a single reassessment cycles was proposed to serve as the foundation of a formula that might distribute $30 or $40 billion dollars over its lifetime. On the other hand, the only evidence then available was what the State Tax Commission of Missouri (STC) provided from its biennial studies. In sum, those studies report that most everything was fine with property assessments in 2003/2004. If others were skeptical, they had little evidence beyond the anecdotal.

The results of this research provide that evidence.

The Coalition to Fund Excellent Schools first contracted with the Public Policy Research Center at the University of Missouri – St. Louis in February 2005 to perform a limited study to examine whether the property tax related information then used to determine school fund distributions was accurate. Subsequently, the contract was expanded and extended several times. Ultimately, we were tasked to produce the following deliverables, all of which are accomplished by the delivery of this report:

- To conduct sales ratio studies in 25 counties to measure the assessment levels for residential properties. The studies were to be conducted in accordance with the Standard on Ratio Studies adopted by the International Association of Assessing Officers in 1999.

- To thoroughly examine the results from the corresponding study produced by the State Tax Commission of Missouri (STC).

- To produce a procedure manual to explain our process so that outside experts could evaluate our methodology.

- To produce a final report documenting our findings.

The report is divided into three major sections. Section I is the final report that summarizes the much more detailed findings presented in the following section.

Section II begins with an introduction that is a layman's guide for reviewing the next 27 chapters, representing ratio studies for each of 27 counties. To assure that we could produce 25 studies, we found we needed to attempt more since the availability of data was often questionable until late in the study. We began the process with sufficient sales information for 33 counties. Three were rejected because the sales information did not come from the primary board of realtors for the county. Three were eventually rejected due to problems with matching sales information with assessor information. All 27 other studies were completed.

Section III is the procedure manual that documents our methodology, written primarily for the benefit of experts – or at least those quite familiar with assessments, ratio studies and statistics.

This study found that the quality and level of assessment among Missouri counties varied widely. This finding, at least as to the general level of assessment, stood in stark contrast to the findings from the STC. A rigorous exam of STC processes, data and results provides overwhelming evidence that the studies conducted by the STC were unreliable. This study also uncovered empirical support for our findings that helps explain why so many counties produce unacceptably low assessments compared to the market values they are supposed to represent. In the end, just a few of the most relevant major consequences of disparate assessment results are examined.

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# Chapter 1. Assessment Levels: Results from the PPRC Study

Accurate assessments are critical to the proper allocation of the $5 billion (approx.) Missouri property tax burden. If assessment levels[1] are inaccurate, the ability of schools to generate local funding is compromised. Furthermore, if assessment levels are inconsistent among counties, the accurate distribution of state funds according to the design of the formula is compromised.[2]. This chapter proffers and answers the primary questions for this study, specifically:

- What were the actual assessment levels within a sample of Missouri counties in 2003?
- Were those assessment levels consistent with the requirement that they reflect true value (approximately 100% of market value)?
- Were assessment levels consistent among counties?

To reliably answer these questions, this study adopts the standard study method used in every state, a ratio study. Ratio studies compare values used by the assessor with values from an independent source[3]. This study was designed and conducted according to the guidelines promulgated by the International Association of Assessing Officers (IAAO), the pre-eminent authority regarding assessment practices as set out in the IAAO's, 1999 Standard on Ratio Studies (IAAO standard).

An exhaustive study of every Missouri assessing jurisdiction[4] for every subclass of property was impossible due to data and budget constraints. Nevertheless, the study examines a significant portion of the total state value of locally assessed real property. The following sections, describe the study counties and property types, then report study results and conclusions.

## 1. Study Counties and Properties

1.1 Selected Counties and Property Type: Ratio studies for residential properties were conducted in 27 counties. These studies use sales prices as the alternate value for measuring market value - sales ratio studies. The corresponding studies conducted by the State Tax Commission of Missouri (STC) use appraisals performed by the STC staff as the alternate value measure - appraisal ratio studies. Both sales and appraisal ratio studies are recognized approaches covered by the IAAO standard.

1.2 Residential: This study is limited to residential properties, the dominant subclass of property in Missouri. Residential property constituted 68.3% of the total locally assessed valuation of real property, whereas commercial properties represented 28.9% and agricultural properties only 2.8%[5].

1.3 Study Counties: The study includes individual ratio studies for 27 counties[6]. While 27 counties constitute just 23.5% of Missouri counties, these counties represented 71.7% of the total locally assessed residential value of the state in 2003.

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[1] Assessment level (level of assessment) refers to the percentage that the assessors' appraised value is in comparison with market value. E.g. if the market value of a property is $100,000, but the assessor bases the assessment on an appraised value of $80,000, then the assessment level is 80%.

[2] Chapter 5 specifically addresses the consequences of inaccurate assessments.

[3] A ratio study examines a relatively small portion (sample) of the properties in the county in order to make inferences about all properties (population).

[4] 114 counties and the City of St. Louis, hereinafter counties

[5] The sources for all statewide and county assessment data are STC Annual Reports and/or data files from the STC obtained from public record requests. All calculations were made by the PPRC.

1.4 County Diversity: The 27 studied counties are larger, on average, than other Missouri counties, but still represent a diverse sample:

- The three counties whose locally assessed residential values represent more than 5% of the state's total are included.
- Of the next largest 16 counties that individually represent at least 1% of the state total, the study evaluates ten.
- Of the next largest ten counties that individually represent between 0.5% and 1% of the state total, the study includes four.
- Of the next largest 24 counties that individually represent 0.25% to 0.50% of the state total, the study includes six.
- An additional seven smaller counties were examined. Iron County, ranked as the 94th county, is the smallest county included. The 21 even smaller counties, which individually represent only 0.01% to 0.08% of the state total, are excluded – not by design, but due to a lack of sufficient data.

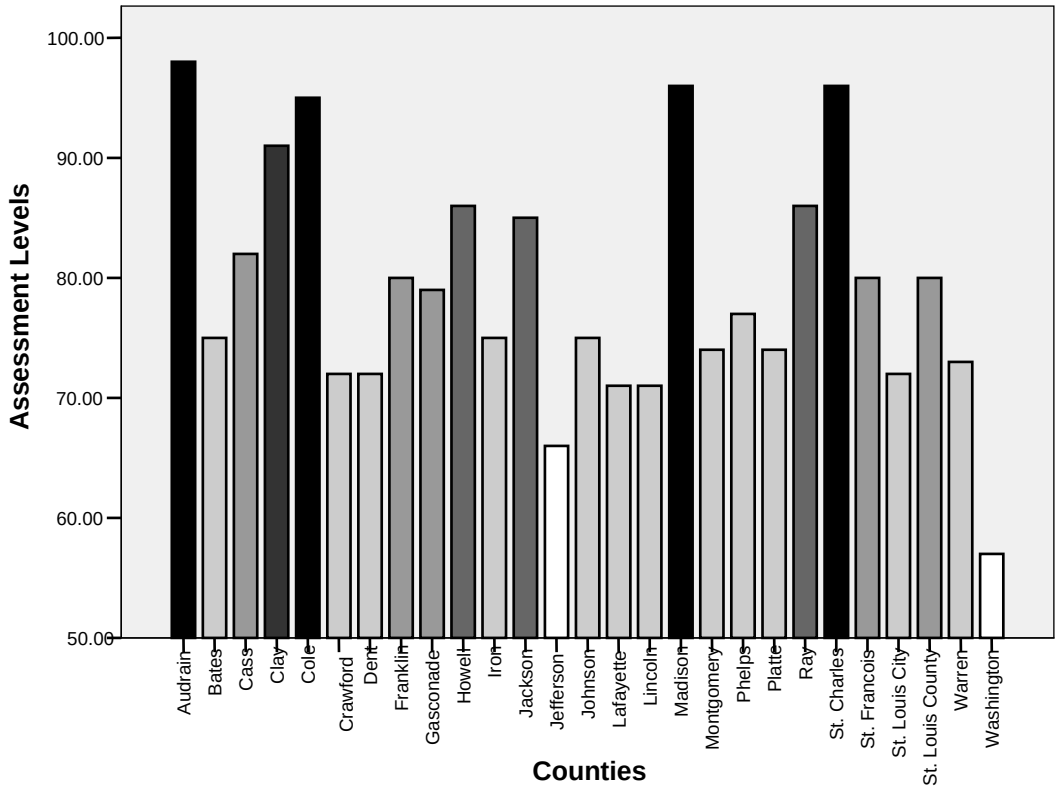
## 2. Results – Assessment Levels

In 2003, Missouri measured assessment level compliance based on capturing 95% (or more) of market value. The corresponding IAAO standard is that assessment levels fall between 90% and 110%. Most states adopt the IAAO standard or stricter ones (Dornfest, 2003). In this section, the results are first presented in graphical form and allowed to speak for themselves. The graphical presentation is then followed with specific results and interpretation.

2.1 County Assessment Levels: Figure 1 is the same as the cover graph, except with labels added and colors converted to grayscale. It demonstrates the inconsistency of results.

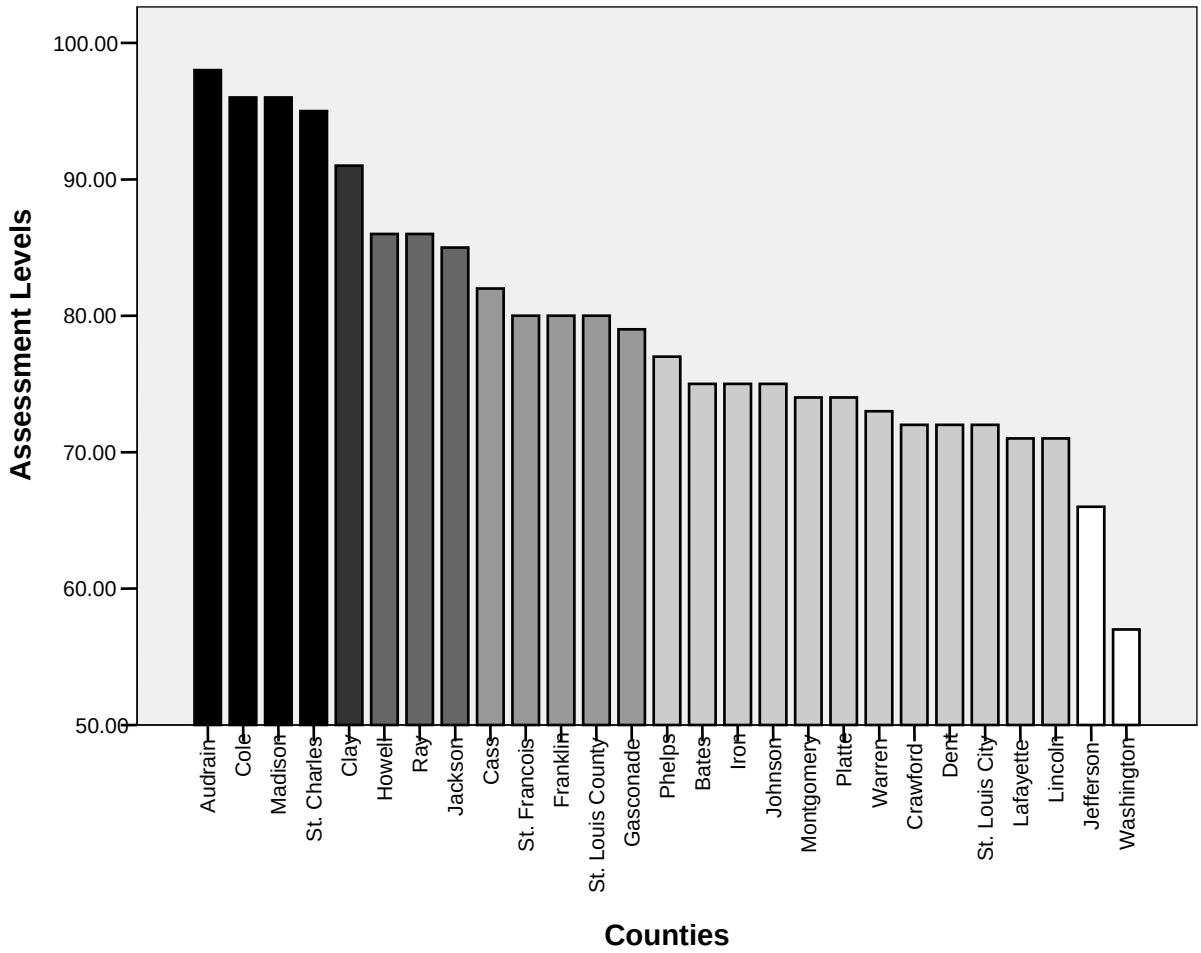
[6] Individual reports are provided in Section II.

**Figure 1: Assessment Levels. PPRC Results. Alphabetical Order.**



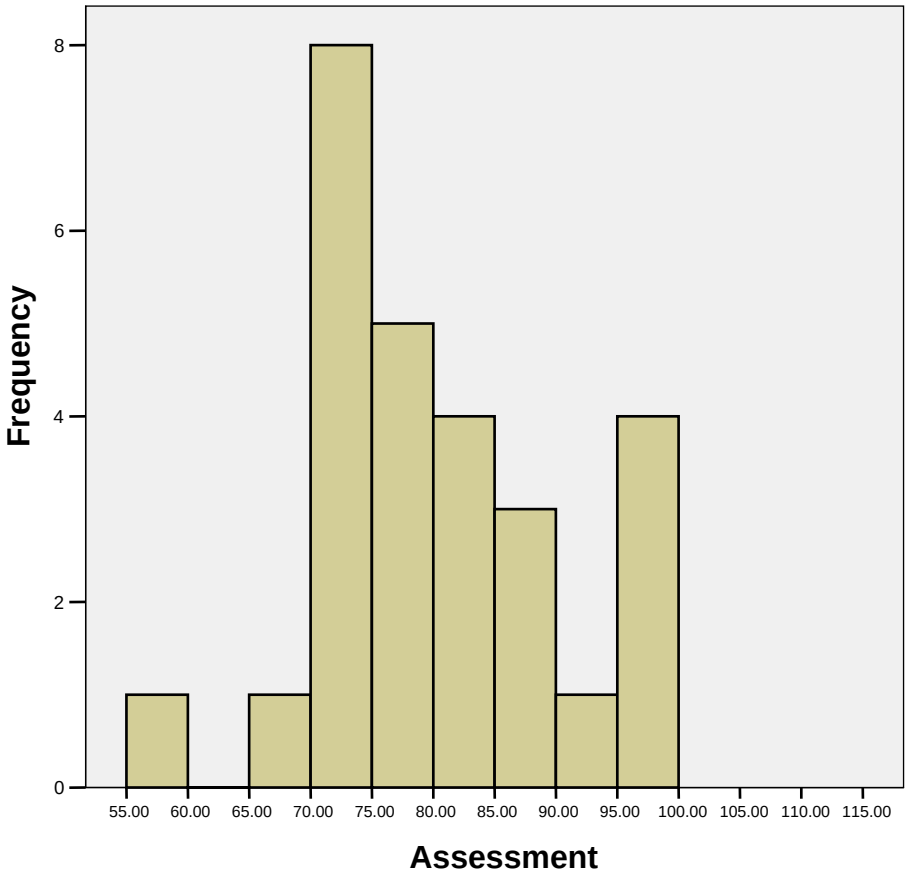
2.2 Assessment Levels Compared to 100%: Figure 2 reports the same results, but in a different order, from the highest to lowest result for assessment level. Note that none reaches 100% and that a broad range of results, from 98% to 57% was found. Four counties met the state standard of 95% and an additional county met the IAAO minimum standard of 90%.

**Figure 2: Assessment Levels. PPRC Results. Level Oder.**




Frequency of Assessment Levels: Figure 1 provided a clear picture of the inconsistency of assessment results. Figure 2 depicted the range of results. The next graph, Figure 3, shows what values are most and least common.

**Figure 3: Assessment Levels. PPRC Study. Frequency Chart (Histogram).**




The most common result was an assessment level between 70 and 75% of market value (eight counties). Only two counties had results below 70% and on the other hand, only four counties had results above 90%. Results in the 70%'s were found in 13 counties, while results in the 80%'s were found in seven. The only pattern that is consistent is that assessments do not exceed market values.

## 3. Results – A Different View

In this section, the conclusions for the assessment level are provided in tabular form, both alphabetically and in order of the assessment level.

**Figure 4: Assessment Levels: PPRC Study.**

| Assessment Level Conclusions. PPRC Study. | | | | |
|---|---|---|---|---|
| **Alphabetical Order** | | | **Assessment Level Order** | |
| **County** | **Level** | | **County** | **Level** |
| Audrain | 98% | | Audrain | 98% |
| Bates | 75% | | Madison | 96% |
| Cass | 82% | | St. Charles | 96% |
| Clay | 91% | | Cole | 95% |
| Cole | 95% | | Clay | 91% |
| Crawford | 72% | | Howell | 86% |
| Dent | 72% | | Ray | 86% |
| Franklin | 80% | | Jackson | 85% |
| Gasconade | 79% | | Cass | 82% |
| Howell | 86% | | Franklin | 80% |
| Iron | 75% | | St. Francois | 80% |
| Jackson | 85% | | STL County | 80% |
| Jefferson | 66% | | Gasconade | 79% |
| Johnson | 75% | | Phelps | 77% |
| Lafayette | 71% | | Bates | 75% |
| Lincoln | 71% | | Iron | 75% |
| Madison | 96% | | Johnson | 75% |
| Montgomery | 74% | | Montgomery | 74% |
| Phelps | 77% | | Platte | 74% |
| Platte | 74% | | Warren | 73% |
| Ray | 86% | | Crawford | 72% |
| St. Charles | 96% | | Dent | 72% |
| St. Francois | 80% | | St. Louis City | 72% |
| St. Louis City | 72% | | Lafayette | 71% |
| STL County | 80% | | Lincoln | 71% |
| Warren | 73% | | Jefferson | 66% |
| Washington | 57% | | Washington | 57% |

Source: Individual County Reports. See Section II.

The more notable results include:

- The lowest level of assessment was 57% for Washington and the highest was 98% for Audrain, a range of 41%. A 20% range is specified by the IAAO as acceptable.

- The median (middle) result is the 77% for Phelps. 15 of 27 counties (56%) had assessment levels of less than 80%.

- The mean (average) result was 79.2%, approximately the same as for Gasconade. This means that, on average, assessments would need to be adjusted upwards by 26% to fully accomplish indirect equalization[7].

## 4. Summary

The results reported in this chapter can be summarized as follows:

- Only four of 27 counties met the state required assessment level (95%) and only one more met the IAAO's minimum standard (90%).

- The only consistent pattern of results is that most counties' capture of market value is substantially below anyone's standards. 22 of the 27 counties had assessment levels below 90%

- Assessment levels of 75% or lower were common (13 of 27 counties).

In the next chapter, the corresponding results from the STC study are reported and compared to the PPRC results.

[7] Indirect equalization is a computation of taxable value by the state oversight body used to achieve the proper distribution of intergovernmental transfer funds according to a statutory allocation formula (IAAO, 1999, 60).

# Chapter 2. Assessment Levels: Results from the STC Study and Differences with the PPRC's

This chapter begins with the same questions posed in Chapter 1, except that results include all counties:

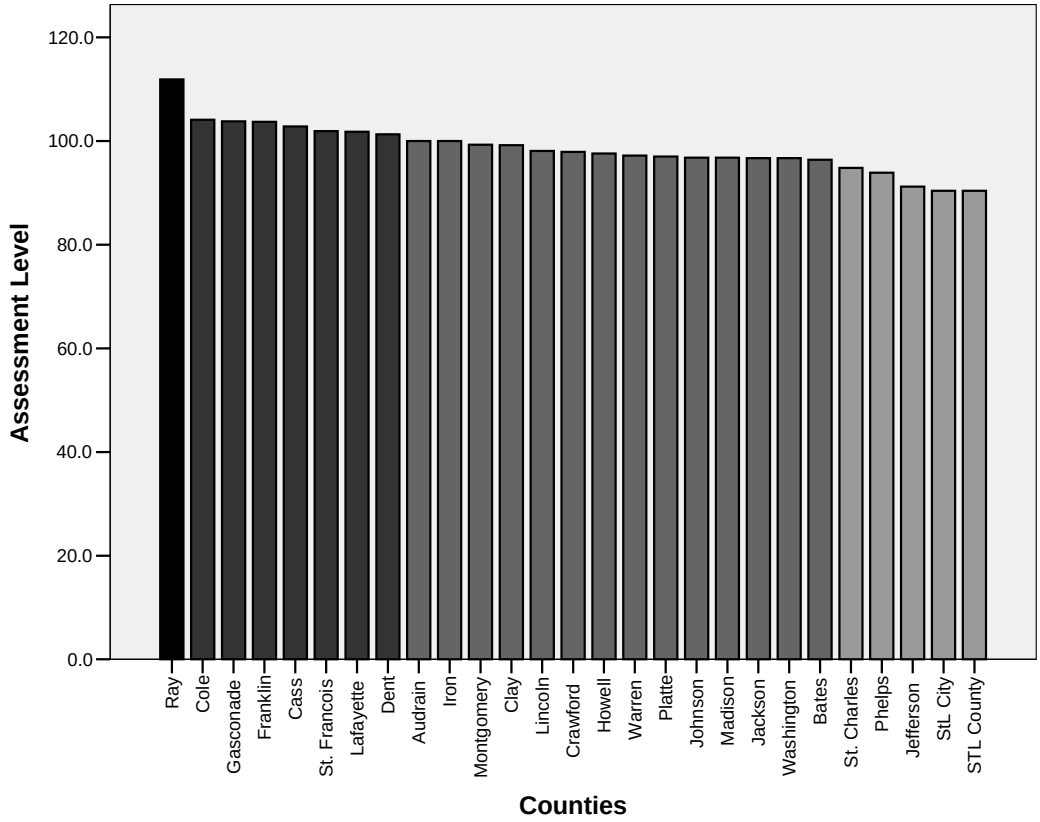
- What were the actual assessment levels within Missouri counties in 2003?
- Were those assessment levels consistent with the requirement that they reflect true value (approximately 100% of market value)?
- Were assessment levels consistent among counties?

The STC study after each biennial reassessment provides the answers for this chapter. First, the STC results for residential properties in the same counties studied by the PPRC, then all 115 counties, are depicted.

## 1. Assessment Results: Level and Consistency

1.1 Levels of Assessment (27 County Sample): The bar chart in Figure 5 shows results from the STC study sorted by result for the same counties studied by the PPRC. The range of results and the total disparity is minimal compared to the findings of the PPRC (Chapter 1, Figure 2).

**Figure 5: Assessment Levels. STC Study. Sample Counties. Assessment Level Order.**

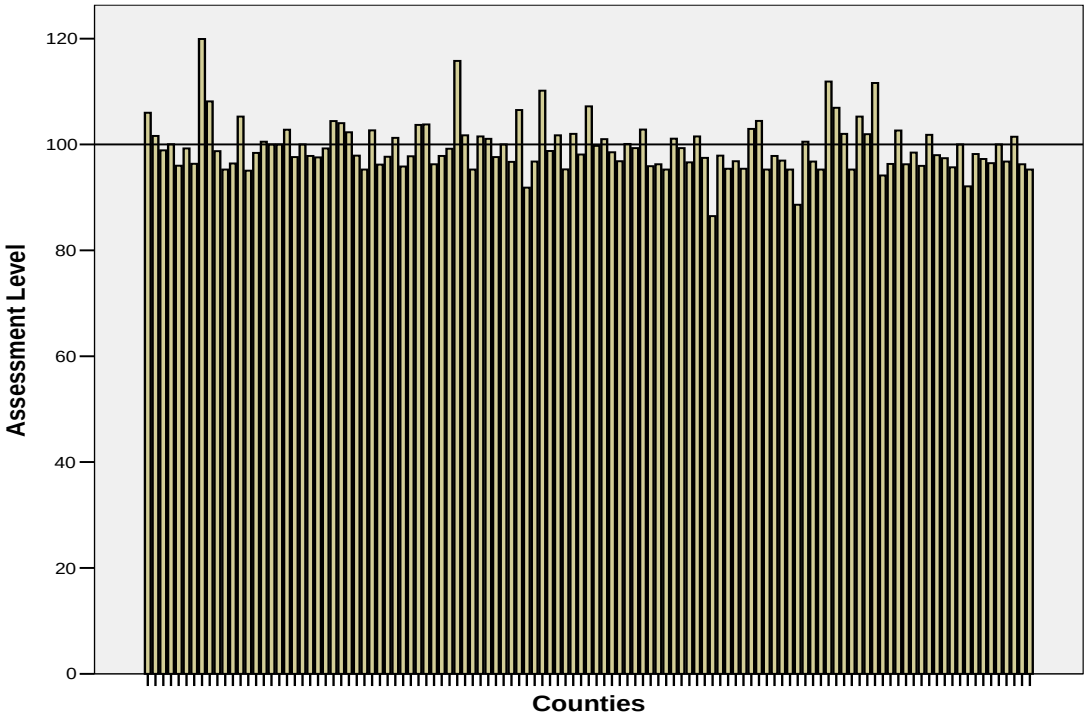



The lowest assessment level result calculated by the STC was 90.4% for St. Louis County. The highest assessment level reported, 111.9% for Ray, exceeds the maximum IAAO standard of 110%. This result means, if reliable, that the Ray County assessor is over-valuing more than half the residential properties by 12% or more. The STC found that twenty-three of the 27 counties met the state standard of 95%, whereas the PPRC found only four. The STC reports St. Charles County among the bottom five

counties, whereas the PPRC found St. Charles County's assessment level the second highest. In the STC study, the four largest counties in the St. Louis area are all among the lowest five and all below Washington (PPRC result of 57%). In sum, the results from the two studies do not compare.

1.2 Levels of Assessment (Statewide): Figure 6 depicts STC study results for all 115 counties in alphabetical order. The pattern from the 27 counties persists. Few counties have assessment levels much below 100% and as many have results above 100%. Overall, the level of disparity is small. Several other counties join Ray with the distinction of results above the maximum IAAO standard of 110%.

**Figure 6: Assessment Levels. STC Results. All Counties. Alphabetical Order.**[8]




The obvious question: Can these differences be explained? Yes, but first the rest of this chapter completes the process of putting the differences in context, before examining explanations in Chapter 3.

## 2. Examining the Differences between PPRC and STC Results

2.1 Differences Quantified and Summarized: Figure 7 shows how dramatically different the results from the two studies are. For some readers, these may still be just numbers, but the following subsection offers more perspective.

**Figure 7: Summary Measures of Differences between PPRC and STC Studies**

| Measure | PPRC Result | STC Result (27 counties) | STC Result (115 counties) |
|---|---|---|---|
| Maximum | 98% | 111.9% | 120% |
| Minimum | 57% | 90.4% | 86.5% |
| Median | 77% | 97.9% | 98.5% |
| Mean | 79.2% | 98.6% | 99.2% |
| Mode | 70-75% | 95-97.5% | - |

[8] Results from the 2003 STC Ratio Study for all counties are included in the Appendix, Table C.

2.2 Differences in Perspective: The content of Figure 8 leads to a discussion of what high assessment levels imply.

**Figure 8 Comparing Assessment Level Ranges**

| Counts | | | | | | | Percentages | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PPRC | STC | | | | | PPRC | STC | | | | |
| Assessment Level | PPRC (27) | Res (27) | Res | Agr | Com | All | PPRC (27) | Res (27) | Res | Agr | Com | All |
| over 105% | 0 | 1 | 12 | 36 | 12 | 60 | 0 | 3.7 | 10.4 | 31.6 | 10.4 | 17.4 |
| 101 - 105% | 0 | 7 | 25 | 29 | 22 | 76 | 0 | 25.9 | 21.7 | 25.4 | 19.1 | 22.1 |
| 95-100% | 4 | 14 | 67 | 44 | 58 | 169 | 14.8 | 51.9 | 58.3 | 38.6 | 50.4 | 49.1 |
| 90 - 94% | 1 | 5 | 7 | 4 | 15 | 26 | 3.7 | 18.5 | 6.1 | 3.5 | 13.0 | 7.6 |
| 85 - 89% | 3 | 0 | 4 | 1 | 5 | 10 | 11.1 | 0 | 3.5 | 0.9 | 4.3 | 2.9 |
| 75 - 84% | 9 | 0 | 0 | 0 | 2 | 2 | 33.3 | 0 | 0.0 | 0.0 | 1.7 | 0.6 |
| 65 - 74% | 9 | 0 | 0 | 0 | 1 | 1 | 33.3 | 0 | 0.0 | 0.0 | 0.9 | 0.3 |
| 55 - 64% | 1 | 0 | 0 | 0 | 0 | 0 | 3.7 | 0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total | 27 | 27 | 115 | 114 | 115 | 344 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |

The STC measures assessment levels using medians, meaning that in each study it found half the properties assessed higher than their reported assessment level. In total, the STC reports that:

- Over 30% of counties have residential assessment levels greater than 100%.
- Almost 60% of counties have agricultural assessment levels greater than 100%.
- Almost 30% of counties have commercial assessment levels greater than 100%

In other words, in each of those counties for those property classes at least half the properties were assessed at more than the appropriate value according to the STC. Furthermore, note that many other property classes in other counties are reported to assess at between 95% and 100% inclusive. If accurate, a large percentage of these properties must also be over-valued for tax purposes.

So, let's examine the final column. Approximately 40% of the total STC studies report that assessors are over valuing properties for tax purposes. Another 50% of the results are equal to 100%, or so near, that only exceptional uniformity would keep a near majority of their taxpayers outside the over-valued category.

For those of us familiar with Missouri property tax practices, these results are incredible. Given Missouri's multi-step process for appealing property assessments, why aren't the county courthouses overwhelmed? How do these assessors get re-elected? Why would any property owner approve of a property tax increase for any purpose?

At the other end of the spectrum, the STC finds only four counties (3.5%) with assessment levels below 90%. The PPRC, on the other hand, found 22 of 27 (81%) below 90%.

## 3. Result Differences Require a New Question

Earlier, we stated that the differences could be explained. That does not mean they can be reconciled. In Chapter 3, we provide the explanation. Suspicion of results does not equate with the evidence from robust examination, which was conducted and is reported in Chapter 3. As preface, the STC appraisal ratio studies for the 27 sample counties were almost universally invalid, making the results of their studies unreliable. Yet those results, indirectly, influence the allocation of billions of dollars in local taxes and billions of dollars of state school aid (See Chapter 5).

# Chapter 3. Explaining the Differences

The STC studies are conducted with several handicaps, which the PPRC study was able to avoid. Missouri has no statewide mandatory disclosure of sales prices for real property[9]. The STC has recommended statewide mandatory disclosure annually since 1979 as a way to enhance the quality of assessments and oversight. In the meantime, the STC has opted to measure county assessment levels with an appraisal ratio study.

One sure effect of using appraisals rather than sales is to limit sample[10] size because appraisals are costly. As will be seen within this chapter, sample size can compromise virtually every aspect of producing a high quality study. On the other hand, the PPRC study was conducted using a larger sample (sometimes hundreds of times larger and less than twice as large in only one county – Madison) composed of high quality sales data available in electronic form.

Second, in many counties assessors do not have ready access to important information that characterizes the population of properties in their county. In turn, that population data is unavailable to the STC. Certainly, some assessors have excellent software systems and know how to use them to full advantage. Within the 27 study counties, approximately a third had the resources and in-house knowledge to produce this information. To clarify, assessors and the STC have a great deal of information about properties. However, a properly designed ratio study requires more than this. For example, approximately a third of the study counties could determine what percent of assessments is attributable to single-family properties (as compared to multi-family or vacant land, etc.) without outside assistance. Similarly, assessments by property age groups (e.g.) were unavailable from the assessor or STC. Without these kinds of information to characterize the population, several significant aspects of the ratio studies are compromised. Whenever the PPRC successfully obtained a copy of assessments in electronic form, its researchers developed detailed information about the population that enabled a more robust study. Even when a copy of the assessment roll was unavailable, the study design called for the use of a much larger random sample than used by the STC for each of its studies to provide characterizations of the population – one large enough to permit various statistical examinations that were impossible for the STC to perform. Additional handicaps are identified in the appropriate places within this chapter. However, all the handicaps together do not fully account for the different results between the STC and PPRC studies.

Once the explanation for why the conduct of the STC ratio studies produces unreliable and/or invalid results is complete, this chapter turns to other systemic issues that result in inaccurate portrayals of assessment levels and consistency.

## 1. Size and Design Problem:

The STC begins its ratio study process by drawing a random sample that will ultimately lead to the completion of approximately 35 appraisals. Random sampling is often used in statistical studies. However, when limited to 35 samples and drawn on a purely random basis, will it provide the necessary data for analysis? Using an example with the assumption that the STC defies odds and makes a perfect draw, the results might look like those found in Figure 9.

[9] In 2003, three jurisdictions had locally mandated disclosure: St. Louis City, St. Louis County and St. Charles County. Subsequently, Jackson County has adopted mandatory disclosure. Only by virtue of their charters are these counties permitted to adopt these requirements locally.

[10] When a complete examination of all members of any group, e.g. residential properties in a county cannot be examined, statistical analysis uses a sample that is representative of the population (group). Properly performed statistical analysis then allows the analyst to make valid inferences about the population based on the exam of the sample.

**Figure 9: Example of Results from Random Sampling**

| **Assumptions:**<br>Population: 3500 Total Properties<br>STC Sample: 35 Properties, randomly drawn.<br>STC Draw Result: Perfect representation by parcel. | | | | | | Example County | |
|---|---|---|---|---|---|---|---|
| **Total $ Value** | **Percent of Total Value** | **$ Value Range** | **Average $ Value: Population and Sample** | **Number of Properties** | **Samples Selected** | **% of Total Properties for Sample and Population** | **% of Total Value for Sample and Population** |
| 15,000,000 | 20% | 100,000-200,000 | 150,000 | 100 | 1 | 2.9% | 35.1% |
| 7,500,000 | 20% | 50,000-99,999 | 75,000 | 100 | 1 | 2.9% | 17.5% |
| 7,500,000 | 20% | 25,001-50,000 | 37,500 | 200 | 2 | 5.7% | 17.5% |
| 6,250,000 | 20% | 5,001-25,000 | 12,500 | 500 | 5 | 14.3% | 14.6% |
| 6,500,000 | 20% | 1-5,000 | 2,500 | 2600 | 26 | 74.3% | 15.2% |
| 42,750,000 | 100% | | | 3500 | 35 | 100.0% | 100.0% |

In the example in Figure 9, a county with 3500 properties will be represented by a sample of 35. Exactly 1% of each value group was selected by the random draw, thus providing a perfectly proportional representation of the population (3500 properties) – by parcel count. However, when the purpose of the study is indirect equalization, as with using results to recalculate assessments used to distribute state aid, the appropriate measure for representivity (proportionality) is as a percent of the dollars (IAAO, 1999). The last two right hand columns provide a comparison. The single property from the highest value group represents exactly 1% of the properties within the group, it represents the appropriate percentage of total properties, but it represents more than 35% of the dollars of the entire sample, compared to the group's appropriate percentage of 20% of the total value (second column). This provides an example of problem one with the STC process. Sampling based on parcel count is unlikely to provide a sample representative of the dollar values. This could be corrected by weighting the results of each sample, but the STC does not use this method.

However, other problems are even more important. In this sample, one property represents 20% of the value of the county while another single property represents the second 20% of value. Two properties represent another 20%. On the other hand, 26 properties are devoted to representing 20% of value. In fact, our analysis found that STC samples over-represent very low valued properties, especially for vacant land – properties that some experts consider remnants with little or no normal market (Gloudemans, 2004). A third problem is that the STC process does not permit an examination of assessment levels for different property types, so they cannot make appropriate corrections. For example, assume that in this county lower valued properties are assessed at levels much above the assessment levels for high valued properties. The few samples for higher valued properties will have minimal effect on the median calculated by the STC, but the large number of low valued properties assures a relatively high median, one that does not properly represent county results for the purpose of indirect equalization.

The STC appreciates the value of random sampling, but fails to appreciate the subtleties required for a proper design to achieve the objective of indirect equalization. Once it generates and uses a random sample, the STC assumes its sample is representative of the population, which is not appropriate for achieving valid results.

## 2. Additional Sample Size Issues

The use of small samples, a result of opting for an appraisal ratio study rather than a sales ratio study, presents other problems for producing reliable results.

2.1 Stratification: The IAAO strongly supports the use of stratification in ratio studies. Stratification is the process of grouping similar properties together and examining them as a group (stratum). Once all strata (pl.) have been analyzed, it is then possible to weight the results for each stratum to create an overall result that closely represents the population. A sample size of 35 is insufficient for stratification. While it is permissible to use some small strata, (we limited this to a minimum of 5 properties) to optimize representivity, it is preferable that most strata contain 30 samples. Examining properties within strata that are more homogenous produces results that are more precise. There is an additional important reason to use stratification. Examining properties by strata allows comparisons, i.e. which property types, location, values, ages, etc. are assessed lower and which higher. Which strata show more uniformity and which demand attention? The substantial benefits that can be produced by a ratio study with sufficient sample size are lost in Missouri.

**2.2** Precision: All else being equal, the larger the sample, the more precise the result. When assessments are not uniform, as is frequently found by both the STC and PPRC – larger sample sizes become even more important in providing sufficient precision to determine whether results are reliable enough to use for important purposes, such as distributing school funds, withholding state reassessment payments, etc. However, the STC's sample size is both small and fixed in size. The precision generated by increased sample size is measurable. Each county report specifies the relative precision provided by the PPRC sample compared to the STC sample. A brief summary, shows that:

- The minimum relative precision for the PPRC samples was 1.26, meaning that 26% more precision was provided (Madison).
- The maximum precision gain was 1919% (St. Louis County).
- For 19 of the 27 counties the gain was at least 100 %.( all results are reported within the individual county studies in Section II).

## 3. Valid Results: Part 1, A Representative Sample

The ultimate aim of a ratio study is to produce valid results so that the analysis allows inference and conclusions about the population – in this case residential properties within the county. The IAAO sets out three conditions for achieving representivity and therefore valid results. One of these deals only with sales ratio studies, so the STC must demonstrate that it meets the requirements for the other two criteria to claim validity. The STC does not examine whether its studies meet either condition, but the PPRC has examined the STC studies to make this determination.

3.1 Proportionality: In simple terms, the sample would ideally mirror the population on a variety of property characteristics that affect property value. These include location, size, value level, property age, property use, condition, etc. However, achieving an ideal sample is not practical. Demonstrating approximate proportionality on one or two important characteristics is generally considered sufficient, though more is always desirable. In fact, a sample that fails to achieve proportionality can still produce valid results as long as the under or over-represented properties have results that are similar to the overall sample. The IAAO states that even random samples should be examined to determine whether they meet this criterion. Since the STC does not conduct that examination, we did. Our results showed that the STC sample did not represent the population sufficiently in 15 counties. Even when a sample does not meet this criterion initially, valid results can be produced using weighting to compensate for over or under-representation. The PPRC used weighting in all 27 counties, even when not essential, to optimize its representivity.

Still, the final judgment regarding this first criterion for validity is often somewhat subjective; therefore, we never concluded that a STC study was invalid on this basis alone. The final criterion is far more important in an appraisal ratio study and proved the undoing of the STC studies.

## 4. Valid Results: Part 2, Representing Market Value

The final requirement for producing a valid ratio study when using appraisals is to demonstrate that the appraisals represent market values.

4.1 Background: Missouri is the only state (other than California whose assessments are not tied to market values) that relies exclusively on appraisals for its ratio study. The other 48 either use sales exclusively, or supplement sales data with appraisals when sales data is sparse (Dornfest, 2003 and Gardner, 2006). Especially for residential properties, it is uncommon to use appraisals in lieu of sales data, since sufficient sales information can usually be gathered, even in states without mandatory disclosure (Ibid.). Some of the reasons for this propensity are obvious from what has already been covered in this chapter (e.g. sample size, cost, ability to stratify and weight), but the over-arching reason for the preference for sales ratio studies, as identified by the IAAO, is that appraisals introduce subjectivity into the process. Still, appraisal ratio studies are professionally acceptable and have some advantages. However, it is essential that the appraisals be proven as representative of market values. The STC performs no analysis to demonstrate that their appraisals represent market values. Again, we provide the missing analysis.

4.2 Methodology: The IAAO standard recommends a specific test for determining whether appraisals meet the essential requirement that they represent market values. The PPRC conducted the recommended test and another appropriate statistical procedure to further assure the reliability of its conclusions. While each test is designed to make the same determination, they use different approaches and sometimes reach slightly different conclusions. In addition to examining the full sample, the PPRC repeated each test using only single-family properties. This added caution provides several advantages. First, single-family properties dominate the total assessed value for the residential sub-class. Secondly, appraising single-family properties is easier than appraising vacant land or multi-family properties. Finally, it assured that any differences in the distribution of property types between the STC and PPRC sample were eliminated.

4.3 Findings: In statistical analysis, results are reported in terms of the degree of statistical confidence. The required minimum level of confidence for drawing a conclusion depends on how the result will be used. Most often, supporting conclusions with 90% or 95% statistical confidence is considered acceptable. The detailed results from the four tests are reported in each county study. The conclusions are summarized here:

- In 25 counties, we concluded that the STC appraisals did not represent market values.
  - In 20 counties, the conclusion for all four tests was with 99% statistical confidence.
  - In three counties, the conclusion for all four tests was with 95% statistical confidence.
  - In two counties, the results were mixed, but only slightly. In both counties, three tests rejected the possibility that STC appraisals represented market values with at least 95% statistical confidence, while the confidence level for the fourth test was between 90% and 95%.

- In only two counties, Madison and St. Charles, were we unable to reject the conclusion that STC appraisals did not represent market values.

## 5. Systemic Bias – Some Statute, Some STC Action, Some "Natural" Outgrowth?

The problems discussed thus far render the results of the STC ratio studies unreliable. There are additional systemic issues that further compromised the state's process for accomplishing indirect equalization.

5.1 Evolving Results: From the time a field appraiser concludes a value for a property to the time a final value is used in the final STC results, the conclusion is reviewed at many stages, some formal and others informal. A brief example of a possible flow is:

i. Field appraiser reaches conclusion
ii. Review appraiser disagrees
iii. New value is used
iv. Value reported to assessor, who disagrees and a conference results
v. New value is used
vi. Value reported to school district. Disagreements persist and additional conferences take place.
vii. New value is used.
viii. If county does not meet the needed level, a second sample can be requested
ix. Second sample repeats the process above
x. If second sample helps the result, it is used in combination with first sample. If it does not help, it is dismissed.

Of course, few properties, or few counties in a given year actually experience all the possible changes within the review chain. Furthermore, in many cases the first overall result (referred to by the STC as the preliminary result) is identical to the final result. Nevertheless, this process (largely dictated by state law) introduces tremendous potential for subjectivity. To determine how significant this process affects results, we examined how much change occurred between the preliminary result and the final calculated result during the 2003/2004 examination cycle. In Figure 10, we note that 56 of the 230 ratios for residential and commercial properties changed. Of these, 50 increased. This is not to say that review is inappropriate. An opportunity to correct mistakes for so important a matter, makes sense. That approximately 90% (50 of 56) changed in the same upward direction, not only raised medians, it raises the specter of a system with built in bias.

Outside the assessment community, it is unlikely that many are aware that even after the review process the STC offers two "bonus" opportunities, so that in the end the STC may never use its calculated results.

**Figure 10: Changes after the First Review of Field Results**

| | RES | COM | TOTAL |
|---|---|---|---|
| Ratio Increased | 25 | 25 | 50 |
| Ratio Decreased | 2 | 4 | 6 |
| COD Bonus | 10 | 2 | 12 |
| Midpoint Bonus | 2 | 8 | 10 |

5.2 Bonus Opportunities: Once the process of calculating results and reviewing them is complete, the results are reviewed to see if the counties will be given a COD bonus and/or whether using a different measure than the median would provide a higher result.

i. COD Bonus: The coefficient of dispersion (COD) is a measure of uniformity with lower values indicating better uniformity (explanation in Introduction to Section II). The STC has adopted a practice whereby if the county COD is less than 25%, then the calculated median is tossed and replaced by 18.1 (i.e. 95.36%). Given that the IAAO identifies a COD measure of 25% as a poor result, why would this measure result in ignoring the results of an expensive process of study and substitution with an arbitrary value? Is it a reward for achievement or just a process that helps lead to a desired result? In any case, it is doubtful that an unbiased expert would support its use. In addition, we wonder why County A with a measure of 94% gets a 1% bump to 95%, while County B with a measure of 85% gets a bump of 10% to the same 95% result. Can there be an explanation beyond the end justifying the means?

ii. Midpoint Bonus: When a county does not qualify for a COD bonus, they might qualify for a mid-point bonus. The calculated median is compared to a number with no special statistical significance.[11] The higher of the two was used.

iii. Results: As seen in figure 10, 22 bonuses were awarded in the 2003/2004 cycle.

5.3 The Equivalent Sales Ratio: The state was not done here. There was another opportunity to make sure that effective indirect equalization did not occur. Missouri law required that the Department of Elementary and Secondary Education use calculations from the current year, or the best three of the past four years – whichever generated the highest measure of assessment level. The result of all these processes was that of the last 920 results used (an 8-year period ending in 2004), all but 18 were "perfect", meaning no recalculations of assessments for the purposes of indirect equalization were used.

## 6. Summary

The state process does not provide reliable results, yet the state relied heavily on those results. It appears that the process was designed more to produce acceptable results than to produce reliable results.

[11] The midpoint of the 95% confidence interval for the median is used.

# Chapter 4. Explaining Assessment Levels

This report provides evidence using valid ratio studies of the actual level of assessment for residential properties in 27 counties for 2003 (Chapter 1). It documents the corresponding results from the STC study and quantifies the differences (Chapter 2). Furthermore, in the last chapter (Chapter 3) it analyzes the STC studies finding them generally invalid and unreliable and identifies other elements of the state process that allow low assessment levels to go uncorrected.

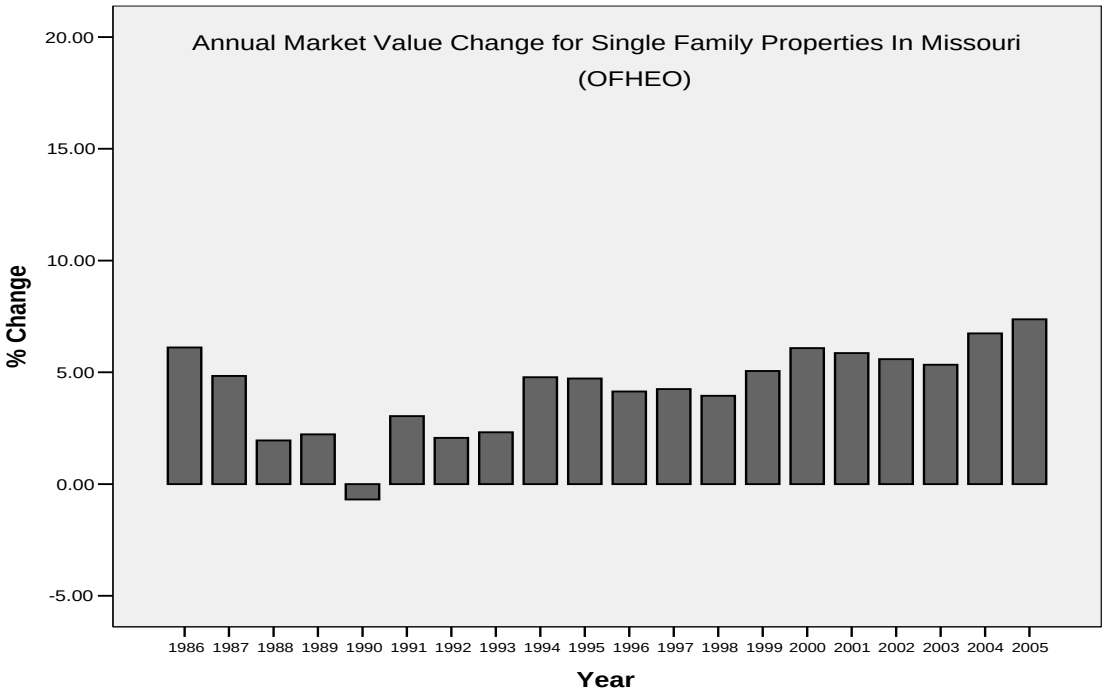
In this chapter, we leave ratio studies behind to explore the existence of empirical evidence that helps explain assessment levels and confirm the results of the PPRC study.

## 1. Reassessment Frequency

1.1 Biennial Reassessment: Missouri law calls for a biennial reassessment. One of the primary reasons for the reassessment is to enable assessors to adjust assessments to changes in market value during the previous two-year period. If this process is completed effectively, assessment levels maintain pace with their previous level. If, however, serious reassessment is a pretense in a period of rapidly rising market values, assessment levels decline.

1.2 The Market: Since 1991 property values for single-family properties, the dominant contributor to residential values, has been on the constant rise in Missouri according to the most comprehensive index available. The market has been particularly strong since 1999, showing annual increases in value of more than 5%. Since, this is a statewide index the expectation is that some counties have experienced more value inflation and others less. Nevertheless, it provides a first litmus test to see how counties are progressing in their efforts to assure that assessments reflect market values.

**Figure 10: Market Value Changes**




Source: Office of Federal Housing and Enterprise Oversight

1.3 Measuring Biennial Reassessment: One pattern we noted in the conduct of our study was that the increase in valuation during each two-year reassessment cycle was often low. In each county report we noted whether this tendency existed and its impact (again, with the caution that the index may not be as relevant in some counties as it is in others). Here, we re-examine this pattern as it applies to all 115 Missouri counties. We adopted a very soft test: Did the reassessment produce a total 2-year rise of at least 3%. If not, we draw the tentative conclusion that a serious reassessment of values is unlikely to have occurred.

**Figure 11: Inferring Meaningful Reassessments**

| Frequency of 3% Increases (for 2-yr cycle) | Number of Counties |
|---|---|
| 0 of 4 | 14 |
| 1 of 4 | 24 |
| 2 of 4 | 44 |
| 3 of 4 | 19 |
| 4 of 4 | 14 |

Reassessments of 1999 through 2005.

A third of Missouri's counties (38/115) appear to have reassessed only once, or never, in the last eight years. Only 12% (14/115) appear to have actually reassessed during each cycle. Furthermore, only 31 of the 115 counties' cumulative value increases equaled even one-half of an outside index of value change. (Appendix, Table B). When market values are rising and assessments are not keeping pace, only one result can occur, lower assessment levels.

## 2. A Special Pattern for the Lack of Reassessment

Another pattern in some counties was a tendency to produce little or no increase in assessments when the re-assessment preceded an election year. These were followed by more normal increases in other years. We classified counties that produced assessment increases of less than 2% in pre-election years, followed by increases in the off years of greater than 4% as fitting this pattern.

- 15 counties fit the pattern of 4-year reassessment cycles (Appendix, Table B).

## 3. Capturing Partial Increases in Market Value Changes

In some counties, and/or in some years, the pattern fits neither of the above. Rather, the noted pattern was that each reassessment proved "meaningful," but not in line with expectations of value increase based on the OFHEO index. To provide definition for this characterization, we looked at the series of three reassessments that were intended to capture market value changes from 1997 through 2003. For this category, we split counties based on whether they produced half of the total expected change (Appendix, Table B). Only 31 (27%) of Missouri's counties showed assessment value increases equal to even one-half of the index change from 1997 through 2003.

## 4. Failing to Capture Value for Some Property Types

Readers of each ratio study will find that many counties have one or more groups of properties that are assessed particularly low. Most often, these included older properties, lower valued properties and vacant parcels. Even when assessment levels are generally good, the failure to keep some groups up to market value will lower the overall result and reduce the equitable distribution of local tax burdens.

# Chapter 5. Consequences of Disparate Assessment Levels

In this chapter, no effort is made to exhaust the list of consequences from low assessment levels or levels that are inconsistent among Missouri counties. Instead, the focus is on four major issues. Two issues directly affect school funding. The other two issues directly affect a substantial number of Missouri property owners. Indirectly the final two also affect schools because taxpayers with little confidence in the property tax process are unlikely to support its expanded use.

## 1. Distribution of State Funds

Under the new state funding formula for schools, the state's allocation depends in part on the relative wealth of each school district. This is measured by the ability of the local school to raise revenues based on a set tax rate of $3.43 per $100 of assessed valuation. The assessments used are also fixed as of 2004 (essentially the same as 2003 other than one year of new construction). However, if assessment data is faulty, all calculations regarding what is "due" a school district are erroneous. Furthermore, if the assessment data is inconsistent, then it is reasonable to presume that districts lying within highly assessed counties are harmed, while those within lowly assessed counties are benefited through inaccuracy.

To make this point clearer, refer to the sample in Figure 12.A. For simplicity, the assumption is made that both districts are equal in all regards to the formula, other than as specified.

**Figure 12.A: Example: Beginning Data**

| | County A. | County B. |
|---|---|---|
| Formula Fixed Tax Rate: | 3.43 | 3.43 |
| Assessment/Student | 116,618 | 116,618 |
| Local (per student) | 4,000 | 4,000 |
| Other includable revenue | 800 | 800 |
| State Target (per student): | 6,117 | 6,117 |
| Total Local Target (per student): | 4,800 | 4,800 |
| State Aid: | 1,317 | 1,317 |

Thus far, all is equal, or at least it appears so. However, what if the reality is that in County B assessments represent 75% of market value while in County A assessments represented 100% of market value. In other words, the true value of property wealth in County B is understated and its ability to raise local revenue is similarly understated. Now, we can re-examine using Figure 12.B. assuming that County B's reported assessments are adjusted using indirect equalization.

**Figure 12.B: Example: Adjusted Data**

| Assessment Level: | 100% | 75% |
|---|---|---|
| Assessment/Student | 116,618 | 155,491 |
| Formula Fixed rate | 3.43 | 3.43 |
| Local target | 4000 | 5333 |
| Other includable revenues | 800 | 800 |
| total target | 6,117 | 6,117 |
| less local | 4,800 | 6,133 |
| State Aid Due | 1,317 | 0 |

In essence, scarce state resources that could have been allocated to needier districts went instead to the district in County B, albeit through no fault of its own. The actual affect, of course, is much more complex. Some districts now funded as "hold harmless" districts might no longer be if accurate and effective indirect equalization occurred. The reverse is equally true. It might be possible to dramatically speed the phase in of the current formula, etc. Those matters are outside the scope of this study, but this study may bring them back into the discussion arena.

## 2. Special Case of the 2.75 Districts

Missouri school districts are permitted to levy an operating rate up to $2.75 by action of the elected school board; and, approximately 25% of all Missouri school districts had an operating levy of $2.75 or less in 2004. However, this constitutional provision is frustrated by low assessments.

| | |
|---|---|
| **Nominal Tax Rate** | **2.75** |
| **Actual Assessment Level** | **75%** |
| **Effective Tax Rate** | **2.0625** |

The meaning is simple; the school board is denied the effect of the constitutional provision to raise the revenues consistent with an effective tax rate of $2.75. This affects far more than those districts with tax rates of $2.75. For example, a district with an operating levy of less than $3.66 in any county where the assessment level is 75% or below has an effective tax rate of less than $2.75.

## 3. Boundaries

Hundreds of Missouri taxing authorities lie within two or more counties, including many school districts. Unless all counties that share a school district assess at similar levels, disparities are certain. This may help or hinder a school depending on how much revenue comes from which county; and which county represents the school district's home county. It quickly gets dizzying. When a system, such as Missouri's current property tax system, operates inaccurately and inconsistently, the permutations of possible effects difficult to analyze. For the local property taxpayer though, the ramification is straightforward. Consider the situation of two taxpayers living in different counties, but the same school district.

**Figure 13. Cross Boundary Example**

| | County A | County B |
|---|---|---|
| Home Value: | 100,000 | 100,000 |
| Assessment Level: | 100% | 75% |
| Assessed at 19%: | 19,000 | 14,250 |
| Tax Rate 4.00 per | | |
| One Hundred: | 760.00 | 570.00 |

The property owner in County A is paying 33% more. So, is he paying 33% too much or is the owner in county B paying 16.7% too little and the owner in County A 16.7% too much, or does it depend?

## 4. Taxpayer Rights

Another consequence of low assessments is that it compromises the appeal rights for typical taxpayers. Hypothetically assume that you know your property is worth around $250,000. You receive a notice from the assessor that your assessment is increasing 33% based upon his new appraised value of $200,000. Do you complain about the 33% increase, or keep your head low knowing that your property is still 20% undervalued? What you have no practical way of knowing is that in this hypothetical county the normal assessment level is 70%. Under that circumstance, you have a right to a reduced appraisal to $175,000. More appropriately, all properties should be adjusted to 100% and appropriate laws regarding tax rate limitations should take effect. When true market value is the effective standard, you know that when the assessor appraises your $250,000 property for $300,000 that it is time to appeal. However, when the normal assessment level is unknown, what are your practical rights for achieving equity?

## 5. Changing Circumstances

While not directly a part of our study, we would feel derelict in our duty to Missouri if we did not make the point that fixing school funding based on 2004 property wealth, even if that property wealth had been properly measured, is certain to cause problems. If the current formula lasts for ten to 15 years as its predecessors did, some counties will experience substantially changed circumstances – either a significant decline or increase in local property wealth. The arrival or departure of one major employer in a small county might produce substantial change – one unrecognized by the funding formula.

## 6. Summary

Inaccurate and inconsistent assessments create problems that in turn create new ones. Effective indirect equalization could compensate for some of the problems, but only accurate assessments can address them all.

Missouri's current funding formula locks in the effect of poor and un-equalized 2004 assessments. The statutes providing for school funding provide no corrective mechanism, short of new legislation.

# Chapter 6. Conclusions

- While some Missouri county's assessment levels in 2003 approximately represented market values, these were a distinct minority, only five of the 27 studied counties.

- The STC ratio studies, which showed dramatically different results than found by the PPRC, are generally invalid. As a result or this and other state practices, the indirect equalization process in effect when 2004 assessments were evaluated did not work.

- The low assessments in most study counties are accompanied by empirical data that suggests that re-assessment was not always serious and/or only a portion of increases in market value were captured.

- The inconsistent assessments among Missouri counties lead to a wide variety of real and potential consequences for schools, taxpayers and the state. Moreover, using the seriously flawed assessment data from 2004 for many years to distribute state funds guarantees inaccurate allocation

# SECTION II. RATIO STUDIES

## Introduction

Each chapter in this section reports the results of a sales ratio study for an individual county and other pertinent analyses. A ratio study compares property values determined by the assessor with those from another source. Our study used sales prices as the other value source, while other studies such as the STC 2003 studies, use independent appraisals for the other source. The individual county reports do not supply the context needed to fully understand the results or their derivation for either expert or lay readers. This introduction is written to provide that context and additional explanation for lay readers. This introduction does not replace the more detailed account of procedure, methodology and interpretation found in the Procedure Manual (SECTION III), which is written primarily for readers familiar with professional standards for conducting ratio studies and the relevant statistical analyses. The next two pages address some critical issues related to the purpose of ratio studies and the requirements for assuring that study results are valid. The remaining pages lead the reader through the format of each chapter, explaining terms, methods and interpretation.

**Ratio Study Purpose:** The purpose of a ratio study is to examine a sample (small percentage) of the population (all the properties being studied) within an assessing jurisdiction (county). The results from a properly designed ratio study allow the analyst to make statistically valid inferences about the subject population even though the sample may be relatively small. If the study is not properly designed, results may be invalid or suspect. It is obviously a futile expenditure of time, money and effort to conduct ratio studies that are invalid or suspect. Worse, if improperly portrayed as valid studies, the results may lead to serious inappropriate consequences for some taxpayers and various governmental units and mislead policy makers.

**Validity and Representativeness:** What criteria must be met to produce a valid study? The acknowledged expert organization in this field is the International Association of Assessing Officers (IAAO), which has developed a standard for the conduct of a study. Compliance with these standards was part of this study's design. The most important requirement for a valid study is that the sample be representative:

> "In general, a ratio study is valid to the extent that the sample is *representative* of the population….Operationally, representativeness is achieved when (1) appraisal procedures used to value the sample parcels are similar to procedures used to value the corresponding population, (2) sample properties are not unduly concentrated in certain areas or types of property whose appraisal levels differ from the general level of appraisal in the population, and (3) sales prices or independent appraisals provide good surrogates for market values" (IAAO 1999, 31).

The first criterion addresses a practice known as sales chasing, whereby assessments for recently sold properties are adjusted, but unsold properties are not re-assessed based on market values. This insidious and inequitable practice can make a sales ratio study invalid unless it is detected and corrective action is taken. In this study, multiple professionally recognized methods were used to unearth any possibility of sales chasing. Even when the possibility was minimal, corrective action was taken. This criterion is not a challenge to an appraisal ratio study such as the STC's.

The second essential criterion identified by the IAAO refers to proportionality. A valid ratio study should include a sample that is representative of the population. In other words, the sample should not over-concentrate with properties from one area of the county, or one value range, etc. Note, however, that criterion 2 proffers this as a problem only where appraisal levels differ from the general level. In the following chapters, you will note that we first identify whether proportionality (representivity) is an issue, then evaluate whether it has a material effect. Elsewhere the IAAO standard makes clear that a sample can be disproportional (i.e. insufficiently representative, not proportional) and still valid. The use of stratification and weighting can produce valid results, regardless of the distribution of the original sample.

The final criterion suggests that the sales or appraisals should reflect market value. The 1999 IAAO Standard defines market value sales as those where:

- The buyer and seller are typically motivated.
- Both parties are well-informed or well advised and acting in what they consider their best interests.
- A reasonable time is allowed for exposure in the open market.
- Payments made in terms of cash or in terms of financial arrangements comparable thereto.
- The price represents the normal consideration for the property sold unaffected by special or creative financing or sales concessions granting by anyone associated with the sale.

Sales that involve realtors that are listed on their multi-listing services (MLS) typically meet these requirements, though additional screening, such as is done in this study, is desirable. Since Missouri is one of the few states with no form of mandatory disclosure of sales prices, MLS data is highly sought by assessors, appraisers and others seeking to value property.

What follows is a sample "county report" in the same format as all 27 chapters to follow, with brief explanations for each section. Highly technical explanations are avoided here but are supplied in Section III, the Procedure Manual.

# Chapter X. Sample County

1. **Significant Findings**: This section of each chapter repeats findings from the rest of the study and indicates where the relevant analysis appears.

   1.1 Assessment Level: This section reports our study's overall 2003 level of assessment for the county from Section 3.5. We also report conclusions about the corresponding STC study based on analysis in Sections 4.2 and 4.3.

   1.2 Assessment Equity: This section highlights significant findings about assessment equity from the analyses reported in Section 3.6

   1.3 Reassessment History: This section reports findings related to the reassessment history of the county as discussed in Section 5.1.

2. **Data and Related Issues:** This section provides information about the data used for the study, which varies depending on the availability of data.

   2.1 Assessment Data: The report indicates the source of assessment information and other information specific to that county.

   2.2 Sales and Ratio Data: This section includes three figures that describe the data used in the analysis. First is a histogram (bar chart) that indicates how often different sales prices were found in the sample. The histogram below indicates that 12 properties with sales prices just above $50,000 are included in the study, that the lowest three sales prices are between $12,500 and $25,000 and that the highest price was between $175,000 and $187,500.

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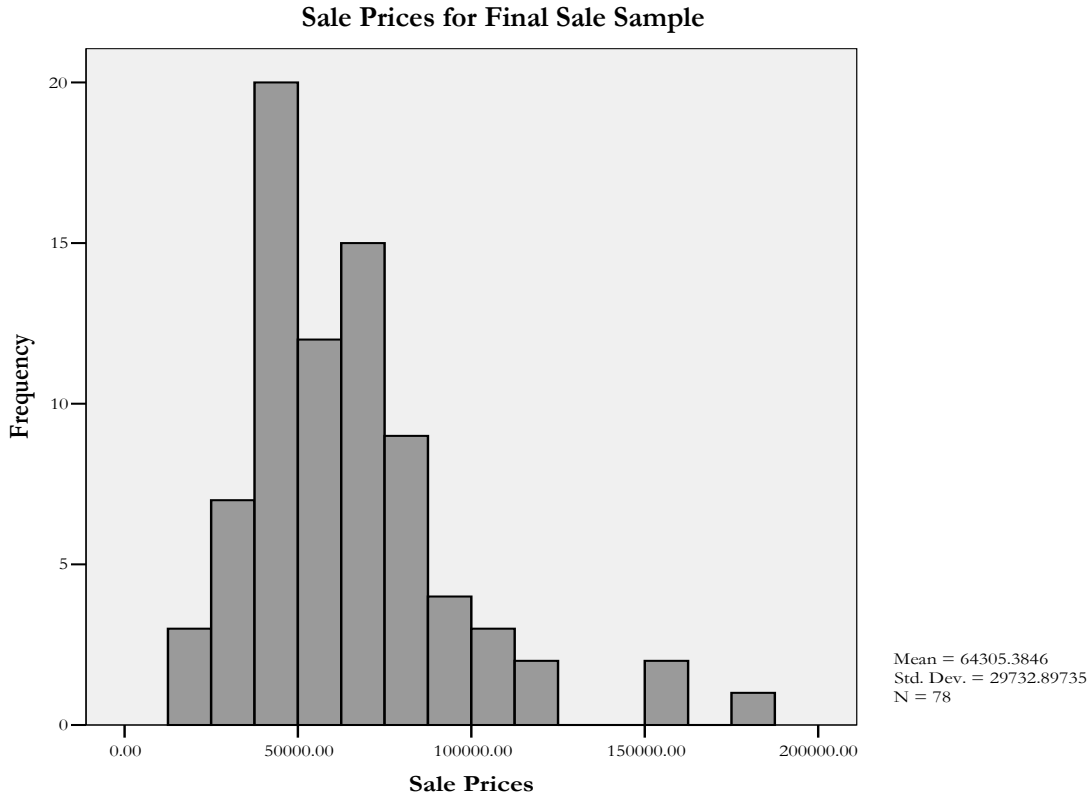
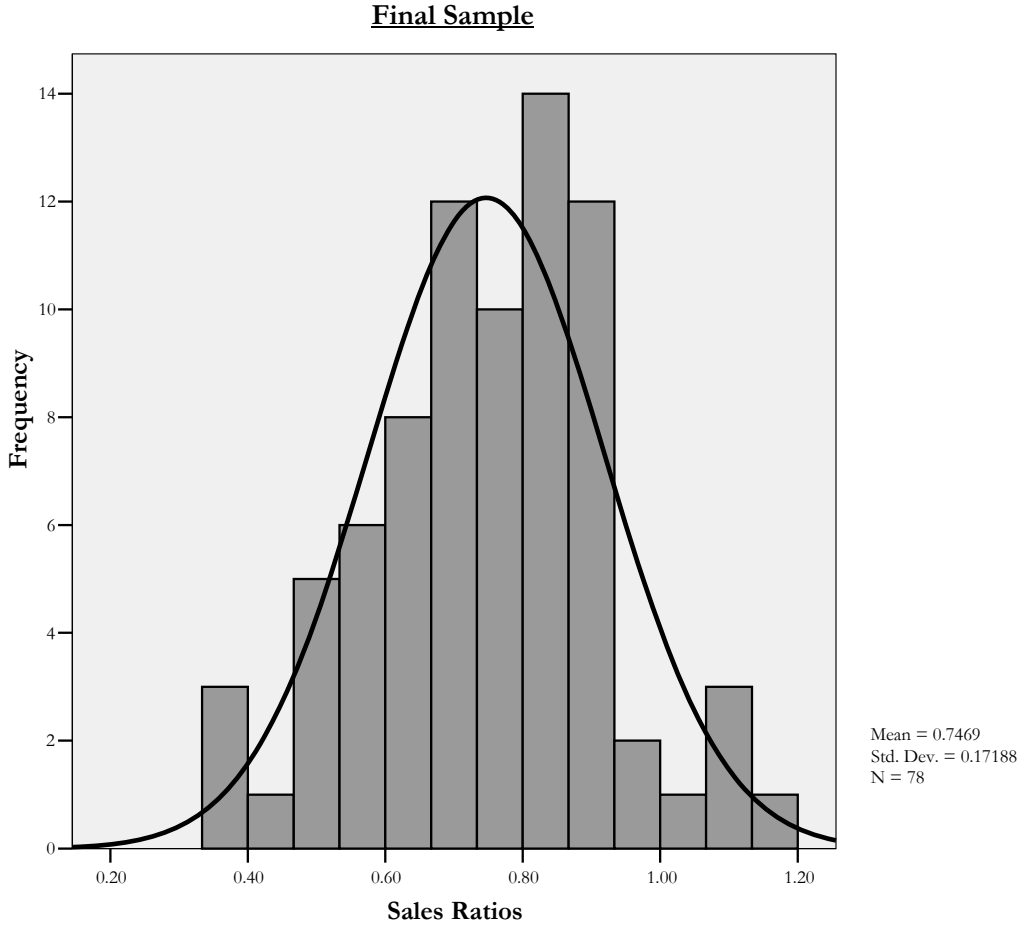



Next is a table that reports results of the data screening and trimming processes. Once the initial process of matching sales data with assessment data is complete, the sales are screened again to assure accuracy and to eliminate sales that should not be included in a sale ratio study. Another process evaluates whether unusual values (outliers) should be included to represent common findings or whether they should be trimmed. Finally, we identify whether some sales represent price outliers that can have an unduly large effect on results, especially the weighted mean, and should be trimmed. In the following table, the screened sales (88) are those where sales and assessment data were matched and viewed as appropriate for the study. The remaining ratios represent the sample on which all the study's results are based. In this example, ten ratios were deemed outliers that deserved exclusion from the study, leaving 78 ratios as the sample on which all results were based.

| Trimming of Outliers | | | | |
|---|---|---|---|---|
| | | Improved Properties <=$43,200 | Improved Properties >$43,200 | Total |
| **Screened Sales** | | 45 | 43 | 88 |
| Excluded | High Trims | 4 | 4 | 8 |
| | Low Trims | 1 | 1 | 2 |
| **Remaining Ratios** | | **40** | **38** | **78** |

The final figure in this subsection is another histogram showing the distribution of the final ratios used in the study. A sales ratio is the value as determined by the assessor divided by the value indicated by the sale price. If both numbers were the same, the ratio would be 1.00. If the assessor's

value is half that of the sale price, the ratio is .5,. indicating that the assessor's value represents 50% of the sale price.




2.3 Population: The goal of a ratio study is to learn about the population by studying the sample. The more that is known about the population of properties, the more detailed the analysis can be. The source and extent of that knowledge is reported in this subsection. For some counties, a copy of the assessor's computerized data was available. In those cases, we were able to precisely characterize the population by usage, value level, location, property age, etc. In other counties, the assessor's data was not available. When the characteristics of the population cannot be directly determined, the examination of a random sample is often substituted as a means for fairly representing the population, provided the sampling is done properly and is of sufficient size. In these cases, we used the collective random sample for all the STC's ratio studies from 1999 onward,. as a pseudo-population, which generally gave us a sample offering approximately twice the precision of the individual random samples used by the STC.

## 3. Ratio Study Results: Section 3 reports the findings of our study.

3.1 The Sample: We first examine whether the sample sufficiently represents the population. The following table shows the percent of the dollar value represented for four property groups and the corresponding values for the sample. For the values below, it is rather obvious that the sample closely mirrors the population, but this is not always the case. In still other cases, the

misrepresentation of a stratum or combination of strata may be obvious, but still have no material effect on the results. A simple explanation of our method is that we first identify each stratum whose weight is more than 3% different from the population. Next, we determine whether those misrepresentations individually or collectively can have an overall effect of 1% or more on the level of assessment. If so, we deem our sample as insufficiently representative and ignore results from the un-stratified sample. Greater detail is provided in the Procedure Manual.

| Comparing Representivity | | | | | | |
|---|---|---|---|---|---|---|
| | Population Distribution | | | PPRC 2003 Sale Sample | | |
| **Strata** | **N** | **$** | **$ Weight** | **N** | **$** | **$ Weight** |
| Single-Family Properties <=$43,200 | 80 | 1,801,895 | 29.7% | 40 | 1,202,600 | 32.3% |
| Single-Family Properties >$43,200 | 51 | 4,129,789 | 68.1% | 38 | 2,523,800 | 67.7% |
| Unimproved Properties | 14 | 83,358 | 1.4% | 0 | 0 | 0% |
| Multi-family | 1 | 46,105 | 0.8% | 0 | 0 | 0% |
| Total | 146 | 6,061,147 | | 78 | 3,726,400 | |

3.2 Representing the Population with the Sample: Often, this section will include the following wording: "Since the un-stratified sample is sufficiently representative of the population (Section 3.1), the use of stratification and weighting is not essential. Nevertheless, we used stratification because it produces additional analytical benefits and further optimizes representivity." In fact, whether our initial sample (un-stratified) is perfectly representative or insufficiently representative, we always stratify to the extent the data allows. The reasoning will be clearer if we explain each critical term and concept:

i. Un-stratified sample: The original sample of 78 properties combined without regard to usage, value level, location, etc.

ii. Stratification: Breaking the sample down into sub-samples that are more homogenous. In the example above, four strata are shown in the left-hand column – though the weighting for the bottom two strata makes their results inconsequential. In some counties, however, we use as many as 8 primary strata and more than 20 strata for additional analysis.

iii. Weighting: Assume a sample has only half the weight of low valued single-family properties compared to the population. The effect of this misrepresentation is correctable by using weighting, i.e. by giving the results for that group (stratum) twice the weight. In this manner, a sample can be made to very closely reflect the population using one or more characteristics of the population. Because population data regarding property use and value group was always available, that approach to stratification and standardization is always used. When other population data is available, additional analyses and results are found within the county report.

iv. Additional analytical benefits: In this study, we often found differences in the level of assessment for different property value groups, usage, age and/or locations. This finding is significant, but may create the wrong impression – i.e. that there is a bias in the assessor's methods that favors lower valued properties. While that may be the result, it may not be the cause. In some instances, we found that older properties were also assessed at a lower level and with less uniformity than new ones. In other cases, the findings were the same for different locations within the county. By looking at differences in assessment level and uniformity from multiple perspectives, the real cause becomes clearer – and by combining these views, the overall analysis is more precise.

v. Further optimizes representivity: Whether a sample for a stratum is 85% or 65% representative of its corresponding population stratum, weighting the results to reflect a 100% representation optimizes representivity and is therefore always desirable, even when non-essential.

3.3 Sales Chasing: This concept and its importance were explained at the beginning of this introduction. For every county, we examined for the possibility of sales chasing. In only two counties did we find a possibility that this problem could compromise our study. In both cases, we adjusted the time-period of our sales sample to avoid any effects this might cause. It was not our responsibility to determine whether sales chasing was certain, just to be certain that it did not affect our analysis.

3.4 Study Validity: Our study was designed to meet the requirements for achieving valid results and does so in every case. This subsection reports that the process of demonstrating validity is complete before moving forward to report results.

3.5 Assessment Level: The table that accompanies this section will always have two results lines, one for the original sample, "Overall Un-weighted" and one for "Combined by Property Use and Value Range" because this information is available for every county and because we standardized on that approach. If population data was available from the county, other forms of stratification and weighting are shown.

When the purpose of a ratio study is for indirect equalization, such as with the distribution of state funding for education, the weighted mean is the preferred measure of the level of assessment and the median is the second choice. Use of the weighted mean is not always statistically appropriate. Its reliability is compromised if the distribution of the ratios is not approximately normal. Those familiar with statistics will understand that term and most others will not. Suffice it to say that we test for the condition and report results within the report. Furthermore, we sometimes use small sample sizes for some strata. This is desirable as a means for improving representivity, but it can sometimes compromise results based on the weighted mean. Therefore, in this section we report whether the weighted mean or median is used as the primary indicator when reaching a conclusion for the level of assessment. Once the preferred measure is identified, we use the other indicators to help estimate the overall ratio. Finally, we state our conclusion regarding the county's 2003 assessments as a percentage of market value. In this sample, you can see that all values are within the narrow range of 74.3% to 77.2%. In fact, this is a wider range than found in most of the following studies. For this sample, the use of the weighted mean was appropriate and our conclusion was a level of 75%.

| Assessment Level (Based on Percent of Market Value) | | | | |
|---|---|---|---|---|
| | Stratification and Weighting | Reference | Weighted Mean | Median |
| **Overall Un-weighted** | None | Table 3 | 74.3% | 75.6% |
| **Combined** | By Property Use and Value Range | Table 4 | 74.6% | 77.2% |

3.6 Equity Measures and Evaluation: A key aspect of mass appraisal is that properties of similar value should be assessed at similar levels, regardless of other factors like age, location, etc. For example, all properties with a true market value of $100,000 should have the same assessment (with a reasonable margin for error since mass appraisal is not an exact science). Properties worth more than $100,000 should be assessed higher and at a similar percentage, etc. Measuring performance in these areas is an important aspect of monitoring assessments. Examining for equity issues within counties was not a high priority for our study; however, problems here often suggest problems that affect assessment level, so we performed several analyses regarding equity.

i. Uniformity within Strata: A key aspect of determining equity is making sure that properties with similar characteristics are uniformly assessed. To test this, we use a measure called the coefficient of dispersion (COD) which identifies strata where properties are not uniformly assessed at the same rate. For example, a typical COD of 12.5% for single-family properties valued less than $40,000 would suggest that there is uniformity in assessment. .The IAAO standard for residential properties is 10-20% depending on the nature of the properties under study, so therefore a higher value of the COD, particularly above 20% suggests lack of uniformity within specific strata. For each county, we identify each stratum with sufficient size where the COD does not meet the IAAO standard of 20% and identify them as problem areas. The following table is an example of strata where the COD is greater than 20%.

| Strata with Inadequate Uniformity | |
|---|---|
| **Property Strata** | **COD** |
| Unimproved Properties | 28.6% |
| Multi-family | 23.8% |
| Single Family <=$49,000 | 35.9% |
| Kansas City | 28.0% |
| Built before 1950 | 34.1% |

ii. Uniformity between Strata: Another form of inequity exists when different strata are assessed at different levels. The IAAO has established procedures for identifying such inequity, but compliance can be heavily affected by sample size and uniformity. We report particular strata where assessment levels are lower/higher than corresponding strata (i.e. lower-valued versus higher-valued properties). We also note some strata with medians that vary by 5% from the overall assessment level.

iii. Vertical Equity: According to the IAAO, a final form of inequity can be systematic discrepancies in the appraisal of low-value and high-value properties. To determine this, we report the price-related differential (PRD) for the Overall Un-weighted sample. More information about the PRD can be found in the Procedure Manual.

**4. STC Study:** A necessary part of our study is to evaluate the corresponding STC study for each county to determine whether any differences in results could be a matter of chance. In each of the sections, we highlight key differences between our study and the results reported from the STC. We also examine the STC sample to determine whether the two challenges to validity for an appraisal ratio study are satisfied, i.e. whether the sample represents the population and whether the appraisals reflect market value.

4.1 Comparative Results: The first section contrasts results from the STC sample to our results reported in Section 3. Sometimes, our results are very dissimilar to those reported by the STC. Since our study complied with professional standards, and we demonstrated that the requirements for achieving validity were satisfied, either the STC study is invalid or the differences can be attributed to chance. The rest of Section 4 examines those questions.

| Comparison of Study Results | | | |
|---|---|---|---|
| **Measure** | **STC Study*** | **PPRC Study*** | **PPRC Study Combined**** |
| Assessment Level - median | 96.4% | 75.6% | 77.2% |
| Assessment Level - weighted mean | 92.7% | 74.3% | 74.6% |
| COD | 27.0% | 17.7% | |
| PRD | 1.11 | 1.01 | |
| Sample Size | 35 | 78 | |
| Relative Precision | 1.00 | 1.49 | |
| * Overall sample (un-stratified and un-weighted) | | | |
| ** Stratification and weighting by Property Use and Value Range | | | |

4.2 Representing the Population with the Sample: To further examine the validity of the STC sample, we test the representivity of the STC sample in the exact same fashion as our sample. We first identify strata whose weights are more than 3% different from the population and then determine whether those misrepresentations individually or collectively can have an overall effect of 1% or more on the level of assessment. If any do have an effect, we conclude that the STC does not closely represent the population. Serious misrepresentation may of itself render a study invalid. Remember that when we conclude our un-weighted sample is insufficient, we take corrective action by weighting our sample to correspond with the population. The STC study does not.

| Comparing Representivity | | | | | | |
|---|---|---|---|---|---|---|
| | **Population** | | | **STC 2003 Appraisals** | | |
| **Strata** | **N** | **$** | **%** | **N** | **$** | **%** |
| Single family <=$43,200 | 80 | 1,801,895 | 29.7% | 17 | 419,211 | 28.7% |
| Single family >$43,200 | 51 | 4,129,789 | 68.1% | 13 | 974,158 | 66.7% |
| Unimproved | 14 | 83,358 | 1.4% | 5 | 68,053 | 4.7% |
| Multi-family | 1 | 46,105 | 0.8% | 0 | 0 | 0% |
| Total | 146 | 6,061,147 | | 35 | 1,461,421 | |

4.3 Market Value: The final requirement for producing a valid appraisal study is that appraisals must represent market values. As discussed in greater depth in the Procedure Manual (Section III), we use 4 tests to make this determination. The explanation of the method of each is too technical, but the results, found at the conclusion of the tables are understandable.

| Mann-Whitney Test | | | | |
|---|---|---|---|---|
| **For the Entire Sample** | | | | |
| Study | Observations | Rank sum | Expected | |
| 0 | 35 | 2770 | 1995 | Ho: Ratios (35 STC Appraisals)=Ratios (78 Sales) |
| 1 | 78 | 3671 | 4446 | z = 4.812 |
| Combined | 113 | 6441 | 6441 | Prob > \|z\| = 0.0000 |
| **For Single Family Properties Only** | | | | |
| Study | Observations | Rank sum | Expected | |
| 0 | 30 | 2348 | 1635 | Ho : Ratios (30 STC Appraisals)=Ratios (78 Sales) |
| 1 | 78 | 3538 | 4251 | z = 4.891 |
| Combined | 108 | 5886 | 5886 | Prob > \|z\| = 0.0000 |

| K-Sample Test For the Entire Sample | | | | |
|---|---|---|---|---|
| Study | Not Greater than the median | Greater than the median | Total | Ho: Ratios (35 STC Appraisals)=Ratios (78 Sales)<br>Pearson chi2(1) = 18.7978 Pr = 0.000<br>Continuity corrected:<br>Pearson chi2(1) = 17.0749 Pr = 0.000 |
| 0 | 7 | 28 | 35 | |
| 1 | 50 | 28 | 78 | |
| Total | 57 | 56 | 113 | |
| **For Single Family Properties Only** | | | | |
| Study | Not Greater than the median | Greater than the median | Total | Ho: Ratios (30 STC Appraisals)=Ratios (78 Sales)<br>Pearson chi2(1) = 18.4615 Pr = 0.000<br>Continuity corrected:<br>Pearson chi2(1) = 16.6615 Pr = 0.000 |
| 0 | 5 | 25 | 30 | |
| 1 | 49 | 29 | 78 | |
| Total | 54 | 54 | 108 | |

In this example, all four tests lead to the conclusion that the STC appraisals do not represent market values (all with 99% statistical confidence). See the lines to the bottom right for each test that report Pr=0.000 or Prob>|z| = 0.000. These indicate that because they are below .01 that the level of statistical confidence is greater than 99%. In this sample, we conclude that the STC study is invalid and its reported results are unreliable.

## 5. Additional Analysis and Findings

5.1 Analysis of Reassessment History: We also use STC provided data and market data from the Office of Federal Housing Enterprise Oversight (OFHEO), an agency of the U.S. Department of Housing and Urban Development, to examine the reassessment history of each county. The following table provides a comparison of actual assessment changes (net of new construction) for each county to those that might have been expected for each of the last four reassessments as well as the six-year period leading up to 2003. We calculated the value captured by dividing the net assessment change information by the appropriate value indicator to obtain a percentage. These percentages are then reported. Value changes from 70 percent to 150 percent were considered in line with reassessments capturing the change in actual market value. In this example, none of the reassessments produced changes in line with OFHEO market indications. This enables us to ascertain whether low levels of assessment are explained, at least in part, by the failure to fully capture changes in market value during reassessments.

| Actual Value Changes from Reassessment vs. Expected Value Change | | | | | |
|---|---|---|---|---|---|
| Biennial Year | % Net Assessment Change | Missouri OFHEO Index | % Value Change: Actual vs. Expected | KC MSA OFHEO Index | % Value Change: Actual vs. Expected |
| 1999 | 0.9 | 8.4 | 11% | 12.3 | 7% |
| 2001 | 5.0 | 11.4 | 44% | 13.0 | 38% |
| 2003 | 6.6 | 11.8 | 56% | 9.9 | 67% |
| 2005 | 2.7 | 12.4 | 22% | 10.5 | 26% |
| Cumulative 1997 - 2003 | 12.9 | 35.0 | 37% | 39.5 | 33% |

6. **Figures and Tables:** Section 6 contains all graphs, tables, and figures cited in the previous sections. It contains supporting material that is generally of interest to those within the field. For more information on specific terms or measures, please consult the Procedure Manual.

   Previous STC Results-Table 1 contains all results from previous STC ratio studies. It is important to note there that the 2005 STC studies are not final and that the data is used only for evaluating population distributions.

   Sample Distribution Figures: Figures 1, 2, and 3 report the overall distribution of our sample. We include two box-plot distributions, one prior to outlier trimming and one after outlier trimming. We also provide histograms for sale ratios based on each strata used in the final analysis.

   Normality Test Results: In our study, we use two types of normality tests: the Shapiro-Francia test and the SK test, depending upon strata size, to determine approximately how normal each distribution of sale ratios is within each stratum.

   Strata Tables**:** The final report for each county will contain a number of different tables (2-10) depending upon how the county was stratified. These tables report vital statistics related to each strata.

   Price-Trending Graphs: Whenever the examination of price-time trends resulted in adjustments to sale prices, the trend line, related regression, and affected properties are reported.

# Chapter 1. Audrain County

## 1. Significant Findings

1.1 Assessment Level: Audrain County's 2003 residential property assessments were approximately 98% of market value (Section 3.5). The results from the corresponding STC study are invalid because the STC's appraisals did not meet the requirement that they reflect market values (Section 4.3).

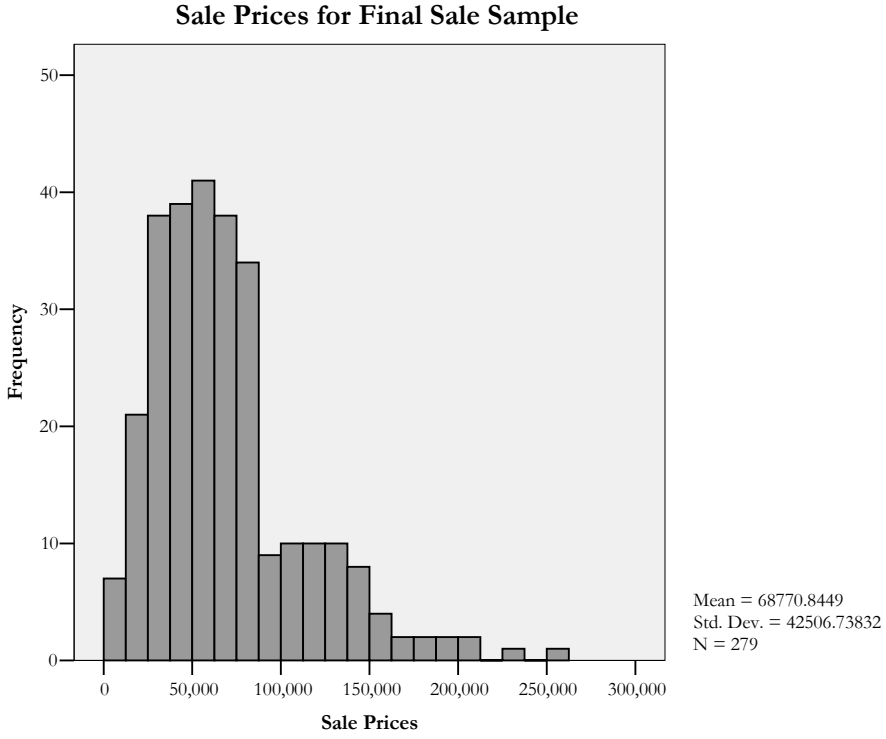
1.2 Assessment Equity: There were no substantial problems (Section 3.6).

1.3 Reassessment History: The high assessment level suggests that state market indicators may not be relevant for this county. However, a thorough review of assessment changes between 2002 and 2003 makes clear that no thorough revaluation occurred during the 2003 reassessment (Section 5.1).

## 2. Data and Related Issues

2.1 Assessment Data: Sales and assessment information was available in electronic format. Sales were matched using a combination of computer techniques and software and then screened. The assessor answered all questions regarding the contents and coding of data when requested. The files received contained information allowing us to identify properties affected by new construction and to screen as appropriate.

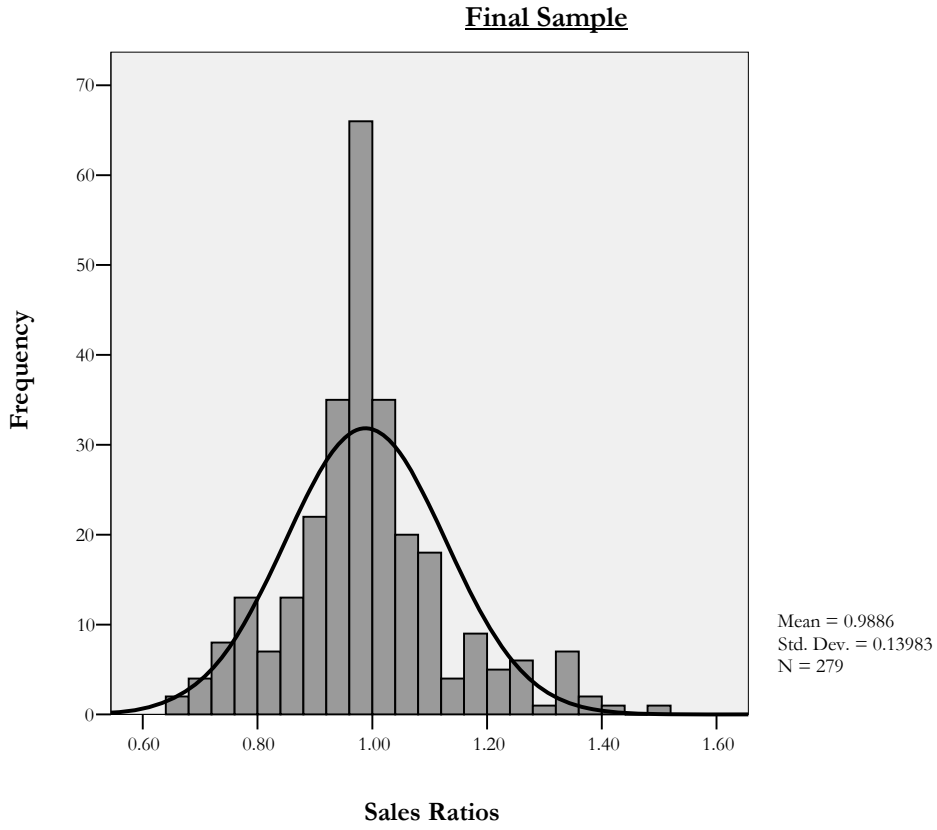
2.2 Sales and Ratio Data: The distribution of sale prices used is reflected in the following histogram.



The next table reports results of the data screening and trimming process. The "screened sales" represent the initial screened sample. The screened sales that were excluded from the final analysis because their ratios were deemed unrepresentative are identified as high or low trims. The "remaining ratios" represent the sample on which all the study's results are based.

| Trimming of Outliers | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Single Family <=$40,000 | Single Family $40,001 - $60,000 | Single Family $60,001 - $75,000 | Single Family $75,001 - $105,000 | Single Family $105,000 | Unimproved Properties | Multi-family | Total |
| **Screened Sales** | | 72 | 70 | 51 | 49 | 40 | 16 | 7 | 305 |
| Excluded | High Trims | 7 | 9 | 3 | 3 | 1 | 1 | 0 | 24 |
| | Low Trims | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| **Remaining Ratios** | | **63** | **61** | **48** | **46** | **39** | **15** | **7** | **279** |

The histogram below shows the distribution of the ratios for the sample.




2.3 Population: Since a complete copy of the 2003 assessment rolls in electronic form was available, we were able to analyze the county's population in detail. This allowed us to stratify and weight sales on a variety of property and location characteristics. The 2003 file was also supplemented with current assessment roll information.

## 3. Ratio Study Results

3.1 The Sample: The following table shows that five of the strata, including all of the single family strata and the unimproved stratum, vary from 3% to 8.3% from the population. Initially, this exhibits

excessive variability from the sample to the population. However, upon closer examination, this variation has no material effect and thus we conclude that the un-stratified sample is sufficiently representative of the population.

| Comparing Representivity | | | | | | |
|---|---|---|---|---|---|---|
| | Population Distribution | | | PPRC 2003 Sale Sample | | |
| Strata | N | $ | $ Weight | N | $ | $ Weight |
| Single Family <=$40,000 | 2758 | 69,490,368 | 15.6% | 63 | 1,814,526 | 9.7% |
| Single Family $40,001-$60,000 | 1451 | 71,667,579 | 16.1% | 61 | 3,069,316 | 16.4% |
| Single Family $60,001-$75,000 | 759 | 50,761,737 | 11.4% | 48 | 3,228,737 | 17.2% |
| Single Family $75,001-$105,000 | 918 | 80,506,316 | 18.1% | 46 | 4,078,474 | 21.8% |
| Single Family >$105,000 | 831 | 123,133,000 | 27.6% | 39 | 5,730,895 | 30.6% |
| Unimproved Properties | 1569 | 50,036,105 | 11.2% | 15 | 544,737 | 2.9% |
| Multi-family | 8 | 339,947 | 0.1% | 7 | 283,053 | 1.5% |
| Total | 8294 | 445,935,053 | | 279 | 18,749,737 | |

3.2 Representing the Population with the Sample: Since the un-stratified sample is sufficiently representative of the population (Section 3.1), the use of stratification and weighting is not essential. Nevertheless, we used stratification because it produces additional analytical benefits and further optimizes representivity.

3.3 Sales Chasing: There was no indication of sales chasing.

3.4 Study Validity: The sample meets the requirements for producing valid inferences about the county's population of residential properties.

3.5 Assessment Level: Measures of the assessment level are summarized below. For the purposes of this study, the weighted mean from combined stratification is the preferred measure as long as both of the requirements from using the weighted mean are met. In this case, the distributions are not normal (Figure 3) and weighting is compromised by the use of seriously undersized samples. Since both requirements are not met, we focus on the median, though taking notice of the weighted mean, to conclude that the County's assessments for 2003 reflect approximately 98% of market value.

| Assessment Level (Based on Percent of Market Value) | | | | |
|---|---|---|---|---|
| | Stratification and Weighting | Reference | Weighted Mean | Median |
| **Overall Un-weighted** | None | Table 2 | 97.7% | 97.7% |
| **Combined** | By Property Use | Table 3 | 97.6% | 97.6% |
| **Combined** | By Property Use and Value Range | Table 5 | 97.5% | 97.8% |
| **Combined** | By Property Location | Table 7 | 96.4% | 96.9% |
| **Combined** | By Property Age | Table 9 | 97.5% | 97.5% |
| **Combined** | By Property Town and Rural Lots | Table 11 | 97.2% | 97.4% |

3.6 Equity Measures and Evaluation:

i. Uniformity within Strata: Results from Tables 2, 4, 6, 8 & 10 for the strata with sufficient sample size for individual evaluation indicate no problem areas for internal uniformity.

ii. Uniformity between Strata: Another form of inequity exists when different strata are assessed at different levels. The IAAO has established guidelines for identifying such inequity, but compliance can be heavily affected by sample size and uniformity. Therefore, we confine our remarks to identify where assessment levels differ markedly from the norm. For this county, there were no substantial differences.

iii. Vertical Equity: The final form of potential inequity examined is vertical equity. The PRD for the overall sample of 1.012 complies with the IAAO standard.

## 4. STC Study

4.1 Comparative Results: The following table contrasts our results with those from the STC study. The STC found the level of assessment adequate, as do we. The STC reports a similarly acceptable measure for horizontal equity, however it also reports a substandard measure for vertical equity, while our analysis finds otherwise. We have already demonstrated that the PPRC study meets the criteria for achieving valid results. The rest of Section 4 examines the validity of the STC's study.

| Comparison of Study Results | | | |
|---|---|---|---|
| **Measure** | **STC Study*** | **PPRC Study*** | **PPRC Study Combined**** |
| Assessment Level - median | 100.0% | 97.7% | 97.8% |
| Assessment Level - weighted mean | 102.8% | 97.7% | 97.5% |
| COD | 15.5% | 10.0% | |
| PRD | 1.08 | 1.01 | |
| Sample Size | 35 | 279 | |
| Relative Precision | 1.00 | 2.82 | |
| * Overall sample (un-stratified and un-weighted) | | | |
| ** Stratification and weighting by Property Use and Value Range | | | |

4.2 Representing the Population with the Sample: The STC does not examine the representivity of its sample, nor does it have the necessary sample size or information to do so. Therefore, in the following table, we provide that missing analysis. In this case, the table shows that three of the strata in the STC sample, the middle and second-highest single family value strata and the unimproved stratum, vary from 10.6 to 17.8%. Initially, this exhibits excessive variability from the sample to the population. However, upon closer examination, this variation has no material effect and thus we conclude that the STC sample is sufficiently representative of the population.

| Comparing Representivity | | | | | | |
|---|---|---|---|---|---|---|
| | **Population** | | | **STC 2003 Appraisals** | | |
| **Strata** | **N** | **$** | **%** | **N** | **$** | **%** |
| Single Family <=$40,000 | 2758 | 69,490,368 | 15.6% | 13 | 357,895 | 17.8% |
| Single Family $40,001- $60,000 | 1451 | 71,667,579 | 16.1% | 6 | 303,947 | 15.1% |
| Single Family $60,001- $75,000 | 759 | 50,761,737 | 11.4% | 8 | 585,895 | 29.2% |
| Single Family $75,001- $105,000 | 918 | 80,506,316 | 18.1% | 0 | 0 | 0.0% |
| Single Family >$105,000 | 831 | 123,133,000 | 27.6% | 5 | 722,632 | 36.0% |
| Unimproved Properties | 1569 | 50,036,105 | 11.2% | 2 | 11,684 | 0.6% |
| Multi-family | 8 | 339,947 | 0.1% | 1 | 24,789 | 1.2% |
| Total | 8294 | 445,935,053 | | 35 | 2,006,842 | |

4.3 Market Value: The final requirement for producing a valid appraisal study is that appraisals must represent market values. As discussed in the introduction for this Section II, and in greater depth in

the Procedure Manual (Section III), we use 4 tests to make this determination. The results of each test are reported in the following tables.

| Mann-Whitney Test | | | | |
|---|---|---|---|---|
| **For the Entire Sample** | | | | |
| Study | Observations | Rank sum | Expected | Ho: Ratios (35 STC Appraisals)=Ratios (279 Sales)<br>z = 2.040<br>Prob > \|z\| = 0.0413 |
| 0 | 35 | 6545.5 | 5512.5 | |
| 1 | 279 | 42909.5 | 43942.5 | |
| Combined | 314 | 49455 | 49455 | |
| **For Single Family Properties Only** | | | | |
| Study | Observations | Rank sum | Expected | Ho : Ratios (32 STC Appraisals)=Ratios (257 Sales)<br>z = 1.784<br>Prob > \|z\| = 0.0744 |
| 0 | 32 | 5435.5 | 4640 | |
| 1 | 257 | 36469.5 | 37265 | |
| Combined | 289 | 41905 | 41905 | |

| K-Sample Test | | | | |
|---|---|---|---|---|
| **For the Entire Sample** | | | | |
| Study | Not Greater than the median | Greater than the median | Total | Ho: Ratios (35 STC Appraisals)=Ratios (279 Sales)<br>Pearson chi2(1) = 5.4343 Pr = 0.020<br>Continuity corrected:<br>Pearson chi2(1) = 4.6304 Pr = 0.031 |
| 0 | 11 | 24 | 35 | |
| 1 | 146 | 133 | 279 | |
| Total | 157 | 157 | 314 | |
| **For Single Family Properties Only** | | | | |
| Study | Not Greater than the median | Greater than the median | Total | Ho: Ratios (32 STC Appraisals)=Ratios (257 Sales)<br>Pearson chi2(1) = 5.1542 Pr = 0.023<br>Continuity corrected:<br>Pearson chi2(1) = 4.3382 Pr = 0.037 |
| 0 | 10 | 22 | 32 | |
| 1 | 135 | 122 | 257 | |
| Total | 145 | 144 | 289 | |

Three of the four tests lead to the conclusion that the STC appraisals do not represent market values (all with 95% statistical confidence). The Mann-Whitney test for single family properties supports the same conclusion but with only 90% statistical confidence.

## 5. Additional Analysis and Findings

5.1 Analysis of Reassessment History: The following table provides a comparison of actual assessment changes (net of new construction) to those that might have been expected for each of the last four reassessments as well as the six-year period leading up to 2003. Only one of the reassessments produced changes in line with the market indicator. On the other hand, the high level of assessment suggests that state market indicators may not be relevant for this county. In our study, previous assessment information was available for Audrain County, so we were able to test for the real reassessment rate. Using this information, we found clear evidence that a real reassessment did not take place in 2003.

| Actual Value Changes from Reassessment vs. Expected Value Change | | | |
|---|---|---|---|
| Biennial Year | % Net Assessment Change | Missouri OFHEO Index | % Value Change: Actual vs. Expected |
| 1999 | 3.6 | 8.4 | 42% |
| 2001 | 6.9 | 11.4 | 60% |
| 2003 | 1.8 | 11.8 | 15% |
| 2005 | 1.5 | 12.4 | 12% |
| Cumulative 1997 - 2003 | 12.7 | 35.0 | 36% |

## 6. Figures and Tables

**Table 1. STC's Appraisal Ratio Studies**

| | | Group | | | |
|---|---|---|---|---|---|
| | | 1999 | 2001 | 2003 | 2005* |
| Number of Appraisals | | 40 | 41 | 35 | 35 |
| Median | | .981 | 1.040 | 1.000 | .911 |
| 95% Confidence Interval for | Lower Bound | .964 | 1.001 | .982 | .894 |
| Median | Upper Bound | 1.005 | 1.075 | 1.036 | .962 |
| Weighted Mean | | .993 | 1.027 | 1.028 | .913 |
| 95% Confidence Interval for | Lower Bound | .947 | .979 | .989 | .866 |
| Weighted Mean | Upper Bound | 1.038 | 1.075 | 1.067 | .959 |
| Minimum | | .480 | .395 | .896 | .441 |
| Maximum | | 1.576 | 3.547 | 3.940 | 3.743 |
| Std. Deviation | | .168 | .517 | .508 | .581 |
| Price Related Differential | | 1.009 | 1.101 | 1.083 | 1.154 |
| Coefficient of Dispersion | | .098 | .246 | .155 | .270 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 72.5% | 56.1% | 82.9% | 45.7% |
| *The STC has not completed its studies for the 2005 reassessment cycle. These results may not represent final values. | | | | | |

**Figure 1. Ratios before Outlier Trimming**

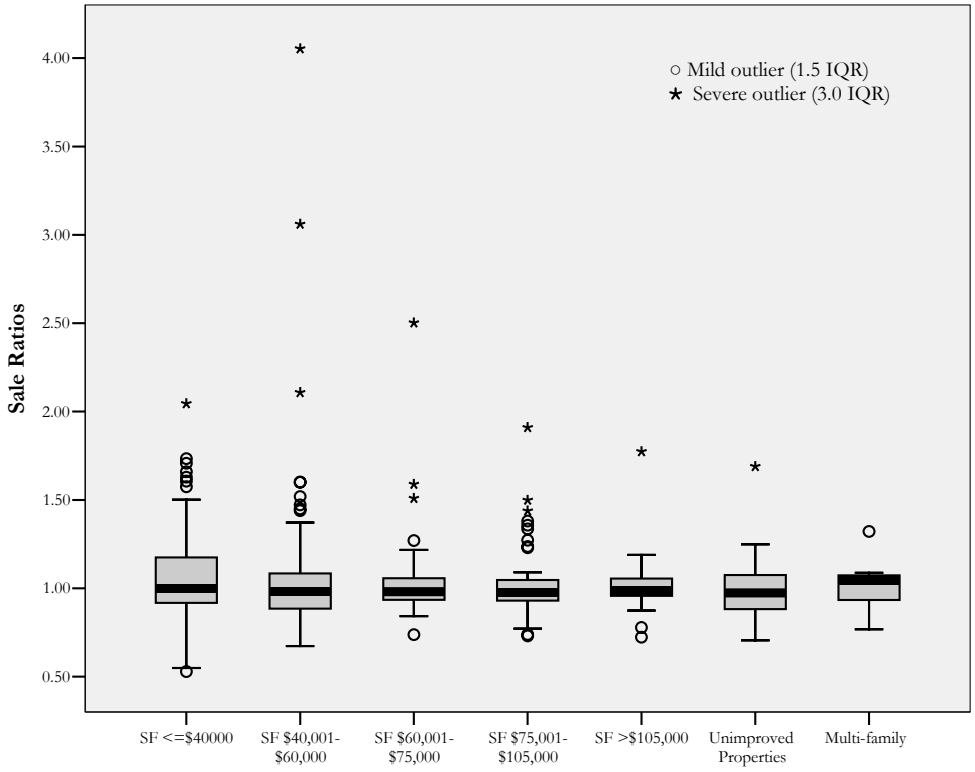
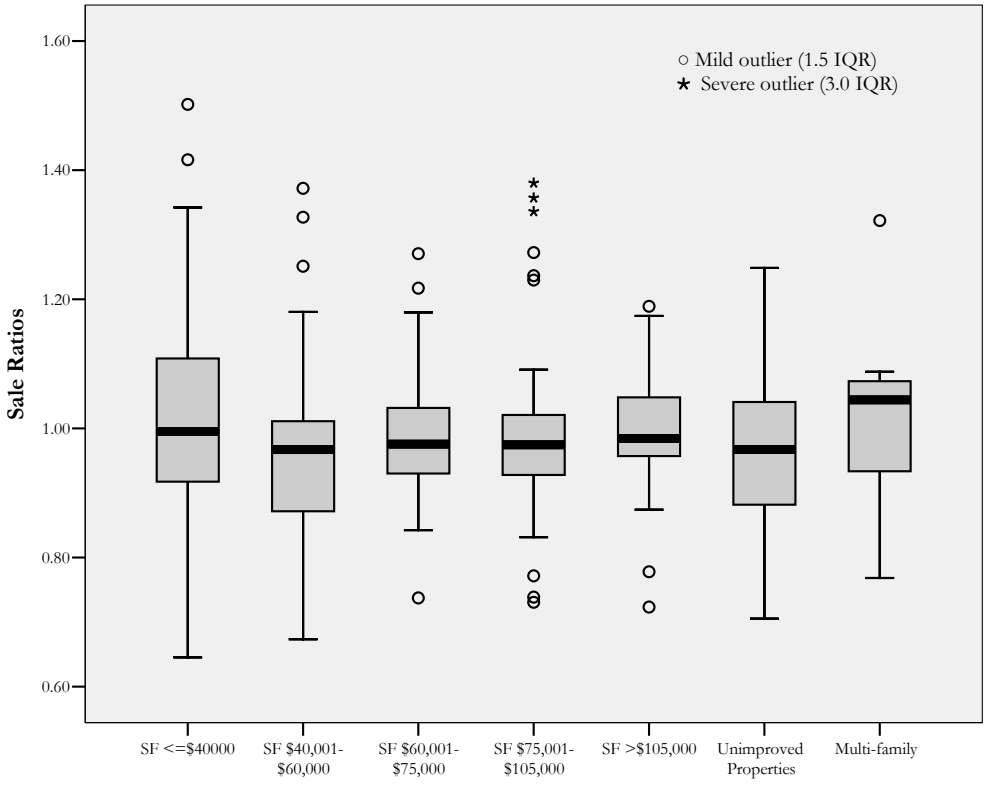
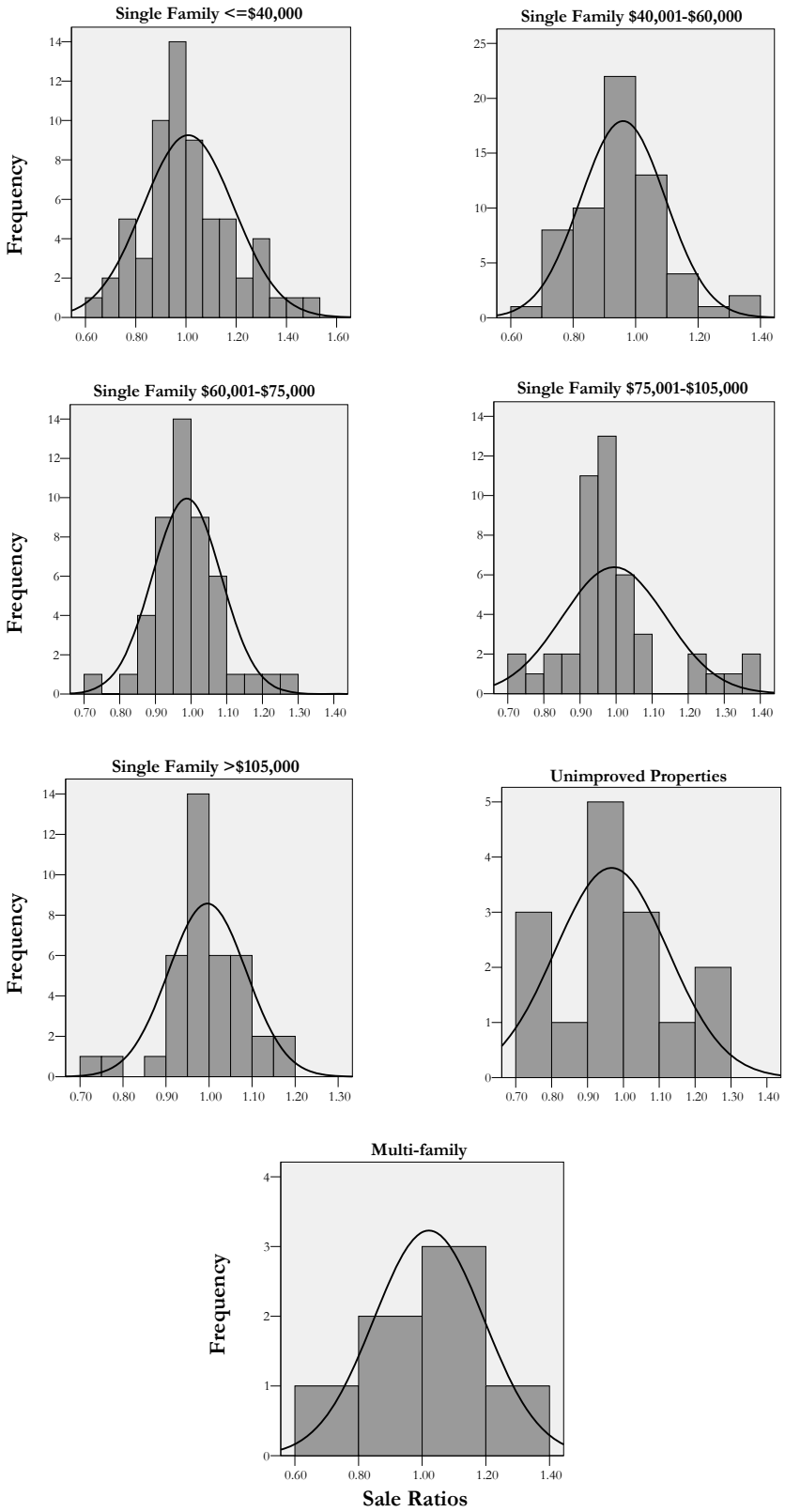



**Figure 2. Ratios after Outlier Trimming**



## Figure 3. Distribution of Final Sale Ratios



## Figure 3 (cont.). Distribution of Final Sale Ratios

**Shapiro-Francia W' Tests for Normality for Various Strata**

| Strata | Observations | W' | V' | z | Prob* |
|---|---|---|---|---|---|
| Single Family | 257 | 0.94924 | 10.122 | 4.798 | 0.00001 |
| Unimproved Properties | 15 | 0.97306 | 0.579 | -0.925 | 0.82259 |
| Multi-family | 7 | 0.94688 | 0.740 | -0.434 | 0.66793 |
| Single Family <=$40,000 | 63 | 0.97418 | 1.606 | 0.926 | 0.17726 |
| Single Family $40,001- $60,000 | 61 | 0.95854 | 2.515 | 1.774 | 0.03805 |
| Single Family $60,001- $75,000 | 48 | 0.95337 | 2.342 | 1.611 | 0.05357 |
| Single Family $75,001- $105,000 | 46 | 0.87770 | 5.943 | 3.283 | 0.00051 |
| Single Family >$105,000 | 39 | 0.93191 | 2.913 | 1.984 | 0.02365 |
| Overall Un-weighted | 279 | 0.95453 | 9.733 | 4.745 | 0.00001 |
| *This value represents the indicated probability that the underlying population is normally distributed. A value of less than .05 indicates a distribution that is not normal. | | | | | |

## Table 2. Sales Ratio Analysis: Stratified by Property Use

| | | Strata | | | |
|---|---|---|---|---|---|
| | | Single Family | Unimproved Properties | Multi-family | Overall Un-weighted |
| Number of Sales | | 257 | 15 | 7 | 279 |
| Median | | .977 | .967 | 1.044 | .977 |
| 95% Confidence Interval for Median | Lower Bound | .968 | .864 | .768 | .968 |
| | Upper Bound | .992 | 1.044 | 1.322 | .992 |
| Weighted Mean | | .977 | .966 | .998 | .977 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .961 | .912 | .853 | .962 |
| | Upper Bound | .993 | 1.019 | 1.142 | .993 |
| Minimum | | .645 | .705 | .768 | .645 |
| Maximum | | 1.502 | 1.249 | 1.322 | 1.502 |
| Std. Deviation | | .138 | .157 | .173 | .140 |
| Price Related Differential | | 1.012 | 1.002 | 1.024 | 1.012 |
| Coefficient of Dispersion | | .098 | .123 | .114 | .100 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 66.5% | 53.3% | 57.1% | 65.6% |

## Table 3. Combined Results – Post Stratification and Weighting

| | **Population Assessor's Value** | **Median** | **Estimated Actual Value** | **% of Total Est. Mkt. Value** | **Subtotal** |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Single Family | 395,559,000 | 0.977 | 404,871,034 | 88.6% | 0.866 |
| Unimproved Properties | 50,036,105 | 0.967 | 51,743,646 | 11.3% | 0.110 |
| Multi-family | 339,947 | 1.044 | 325,620 | 0.1% | 0.001 |
| Total | 445,935,053 | | 456,940,300 | 100.0% | 97.6% |

| | **Population Assessor's Value** | **Weighted Mean** | **Estimated Actual Value** | **% of Total Est. Mkt. Value** | **Subtotal** |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Single Family | 395,559,000 | 0.977 | 404,871,034 | 88.6% | 0.866 |
| Unimproved Properties | 50,036,105 | 0.966 | 51,797,210 | 11.3% | 0.109 |
| Multi-family | 339,947 | 0.998 | 340,629 | 0.1% | 0.001 |
| Total | 445,935,053 | | 457,008,873 | 100.0% | 97.6% |

## Table 4. Sales Ratio Analysis: Stratified by Use and Value

| | | Strata | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | SF <=$40000 | SF $40,001 - $60,000 | SF $60,001 - $75,000 | SF $75,001 - $105,000 | SF > $105,000 | Un-improved Properties | Multi-family | Overall Un-weighted |
| Number of Sales | | 63 | 61 | 48 | 46 | 39 | 15 | 7 | 279 |
| Median | | .995 | .967 | .976 | .975 | .984 | .967 | 1.044 | .977 |
| 95% Confidence Interval for Median | Lower Bound | .958 | .931 | .960 | .939 | .964 | .864 | .768 | .968 |
| | Upper Bound | 1.014 | .994 | 1.005 | .998 | 1.029 | 1.044 | 1.322 | .992 |
| Weighted Mean | | .973 | .943 | .979 | .977 | .997 | .966 | .998 | .977 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .925 | .908 | .952 | .935 | .967 | .912 | .853 | .962 |
| | Upper Bound | 1.020 | .979 | 1.006 | 1.018 | 1.028 | 1.019 | 1.142 | .993 |
| Minimum | | .645 | .674 | .738 | .731 | .723 | .705 | .768 | .645 |
| Maximum | | 1.502 | 1.372 | 1.271 | 1.380 | 1.189 | 1.249 | 1.322 | 1.502 |
| Std. Deviation | | .181 | .136 | .096 | .144 | .091 | .157 | .173 | .140 |
| Price Related Differential | | 1.038 | 1.017 | 1.009 | 1.018 | .999 | 1.002 | 1.024 | 1.012 |
| Coefficient of Dispersion | | .134 | .102 | .071 | .096 | .065 | .123 | .114 | .100 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 52.4% | 57.4% | 79.2% | 71.7% | 82.1% | 53.3% | 57.1% | 65.6% |

## Table 5. Combined Results – Post Stratification and Weighting

| | Population Assessor's Value | Median | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Single Family <=$40,000 | 69,490,368 | 0.995 | 69,839,566 | 15.3% | 0.152 |
| Single Family $40,001 - $60,000 | 71,667,579 | 0.967 | 74,113,318 | 16.3% | 0.157 |
| Single Family $60,001 - $75,000 | 50,761,737 | 0.976 | 52,009,976 | 11.4% | 0.111 |
| Single Family $75,001 - $105,000 | 80,506,316 | 0.975 | 82,570,580 | 18.1% | 0.177 |
| Single Family >$105,000 | 123,133,000 | 0.984 | 125,135,163 | 27.5% | 0.270 |
| Unimproved Properties | 50,036,105 | 0.967 | 51,743,646 | 11.4% | 0.110 |
| Multi-family | 339,947 | 1.044 | 325,620 | 0.1% | 0.001 |
| Total | 445,935,053 | | 455,737,870 | 100.0% | 97.8% |

| | Population Assessor's Value | Weighted Mean | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Single Family <=$40,000 | 69,490,368 | 0.973 | 71,418,673 | 15.6% | 0.152 |
| Single Family $40,001 - $60,000 | 71,667,579 | 0.943 | 75,999,554 | 16.6% | 0.157 |
| Single Family $60,001 - $75,000 | 50,761,737 | 0.979 | 51,850,599 | 11.3% | 0.111 |
| Single Family $75,001 - $105,000 | 80,506,316 | 0.977 | 82,401,551 | 18.0% | 0.176 |
| Single Family >$105,000 | 123,133,000 | 0.997 | 123,503,511 | 27.0% | 0.269 |
| Unimproved Properties | 50,036,105 | 0.966 | 51,797,210 | 11.3% | 0.109 |
| Multi-family | 339,947 | 0.998 | 340,629 | 0.1% | 0.001 |
| Total | 445,935,053 | | 457,311,727 | 100.0% | 97.5% |

## Table 6. Sales Ratio Analysis: Stratified by Location

| | | Strata | | |
|---|---|---|---|---|
| | | Taxcode 1 | Other taxcodes | Overall Un-weighted |
| Number of Sales | | 244 | 35 | 279 |
| Median | | .983 | .949 | .977 |
| 95% Confidence Interval for Median | Lower Bound | .972 | .920 | .968 |
| | Upper Bound | .997 | .974 | .992 |
| Weighted Mean | | .984 | .936 | .977 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .967 | .892 | .962 |
| | Upper Bound | 1.001 | .979 | .993 |
| Minimum | | .645 | .690 | .645 |
| Maximum | | 1.502 | 1.249 | 1.502 |
| Std. Deviation | | .140 | .122 | .140 |
| Price Related Differential | | 1.013 | .992 | 1.012 |
| Coefficient of Dispersion | | .101 | .093 | .100 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 66.0% | 62.9% | 65.6% |

## Table 7. Combined Results – Post Stratification and Weighting

| | Population Assessor's Value | Median | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Taxcode 1 | 268,773,211 | 0.983 | 273,421,374 | 59.4% | 0.584 |
| Other taxcodes | 177,161,842 | 0.949 | 186,682,658 | 40.6% | 0.385 |
| Total | 445,935,053 | | 460,104,032 | 100.0% | 96.9% |

| | Population Assessor's Value | Weighted Mean | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Taxcode 1 | 268,773,211 | 0.984 | 273,143,507 | 59.1% | 0.581 |
| Other taxcodes | 177,161,842 | 0.936 | 189,275,473 | 40.9% | 0.383 |
| Total | 445,935,053 | | 462,418,979 | 100.0% | 96.4% |

## Table 8. Sales Ratio Analysis: Stratified by Age

| | | Strata | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Un-improved Property | Multi-family | Un-known Age | Built be-fore 1950 | Built 1950s | Built 1960s | Built 1970s | Built 1980s | Built 1990 thru 1995 | Built 1996 and newer | Overall Un-weighted |
| Number of Sales | | 15 | 7 | 21 | 67 | 54 | 34 | 35 | 21 | 13 | 12 | 279 |
| Median | | .967 | 1.044 | 1.008 | .968 | 1.000 | .969 | .968 | .964 | .981 | .978 | .977 |
| 95% Confidence Interval for Median | Lower Bound | .864 | .768 | .979 | .939 | .967 | .930 | .936 | .923 | .949 | .928 | .968 |
| | Upper Bound | 1.044 | 1.322 | 1.173 | .992 | 1.019 | 1.000 | .987 | 1.003 | 1.087 | 1.050 | .992 |
| Weighted Mean | | .966 | .998 | 1.036 | .967 | .987 | .990 | .959 | .949 | 1.005 | .978 | .977 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .912 | .853 | .980 | .925 | .957 | .932 | .927 | .898 | .954 | .906 | .962 |
| | Upper Bound | 1.019 | 1.142 | 1.092 | 1.010 | 1.018 | 1.047 | .991 | 1.000 | 1.055 | 1.050 | .993 |
| Minimum | | .705 | .768 | .836 | .645 | .743 | .738 | .772 | .731 | .832 | .723 | .645 |
| Maximum | | 1.249 | 1.322 | 1.502 | 1.380 | 1.416 | 1.357 | 1.174 | 1.129 | 1.217 | 1.336 | 1.502 |
| Std. Deviation | | .157 | .173 | .164 | .161 | .141 | .136 | .075 | .103 | .100 | .140 | .140 |
| Price Related Differential | | 1.002 | 1.024 | 1.034 | 1.009 | 1.018 | .991 | 1.001 | 1.000 | 1.012 | 1.013 | 1.012 |
| Coefficient of Dispersion | | .123 | .114 | .118 | .121 | .097 | .095 | .056 | .076 | .077 | .090 | .100 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 53.3% | 57.1% | 61.9% | 55.2% | 64.8% | 70.6% | 77.1% | 71.4% | 76.9% | 83.3% | 65.6% |

## Table 9. Combined Results – Post Stratification and Weighting

| | Population Assessor's Value | Median | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Unimproved Properties | 50,036,105 | 0.967 | 51,743,646 | 11.3% | 0.109 |
| Multi-family | 339,947 | 1.044 | 325,620 | 0.1% | 0.001 |
| Unknown Age | 13,395,526 | 1.008 | 13,289,213 | 2.9% | 0.029 |
| Built before 1950 | 93,628,526 | 0.968 | 96,723,684 | 21.1% | 0.205 |
| Built 1950s | 57,819,053 | 1 | 57,819,053 | 12.6% | 0.126 |
| Built 1960s | 55,011,263 | 0.969 | 56,771,169 | 12.4% | 0.120 |
| Built 1970s | 68,560,421 | 0.968 | 70,826,881 | 15.5% | 0.150 |
| Built 1980s | 32,693,947 | 0.964 | 33,914,883 | 7.4% | 0.071 |
| Built 1990 thru 1995 | 29,033,684 | 0.981 | 29,596,008 | 6.5% | 0.063 |
| Built 1996 and newer | 45,416,579 | 0.978 | 46,438,220 | 10.2% | 0.099 |
| Total | 445,935,053 | | 457,448,377 | 100.0% | 97.5% |
| | **Population Assessor's Value** | **Weighted Mean** | **Estimated Actual Value** | **% of Total Est. Mkt. Value** | **Subtotal** |
| **Strata** | | | | | |
| Unimproved Properties | 50,036,105 | 0.966 | 51,797,210 | 11.3% | 0.109 |
| Multi-family | 339,947 | 0.998 | 340,629 | 0.1% | 0.001 |
| Unknown Age | 13,395,526 | 1.036 | 12,930,045 | 2.8% | 0.029 |
| Built before 1950 | 93,628,526 | 0.967 | 96,823,709 | 21.2% | 0.205 |
| Built 1950s | 57,819,053 | 0.987 | 58,580,600 | 12.8% | 0.126 |
| Built 1960s | 55,011,263 | 0.99 | 55,566,932 | 12.2% | 0.120 |
| Built 1970s | 68,560,421 | 0.959 | 71,491,576 | 15.6% | 0.150 |
| Built 1980s | 32,693,947 | 0.949 | 34,450,946 | 7.5% | 0.071 |
| Built 1990 thru 1995 | 29,033,684 | 1.005 | 28,889,238 | 6.3% | 0.063 |
| Built 1996 and newer | 45,416,579 | 0.978 | 46,438,220 | 10.2% | 0.099 |
| Total | 445,935,053 | | 457,309,105 | 100.0% | 97.5% |

## Table 10. Sales Ratio Analysis: Stratified by Town and Rural Lots

| | | Strata | | |
|---|---|---|---|---|
| | | Rural Lots | Town Lots | Overall Un-weighted |
| Number of Sales | | 25 | 254 | 279 |
| Median | | .949 | .982 | .977 |
| 95% Confidence Interval for Median | Lower Bound | .872 | .972 | .968 |
| | Upper Bound | .974 | .996 | .992 |
| Weighted Mean | | .937 | .983 | .977 |
| 95% Confidence Interval for | Lower Bound | .889 | .967 | .962 |
| Weighted Mean | Upper Bound | .985 | .999 | .993 |
| Minimum | | .723 | .645 | .645 |
| Maximum | | 1.130 | 1.502 | 1.502 |
| Std. Deviation | | .100 | .142 | .140 |
| Price Related Differential | | .992 | 1.012 | 1.012 |
| Coefficient of Dispersion | | .077 | .102 | .100 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 64.0% | 65.7% | 65.6% |

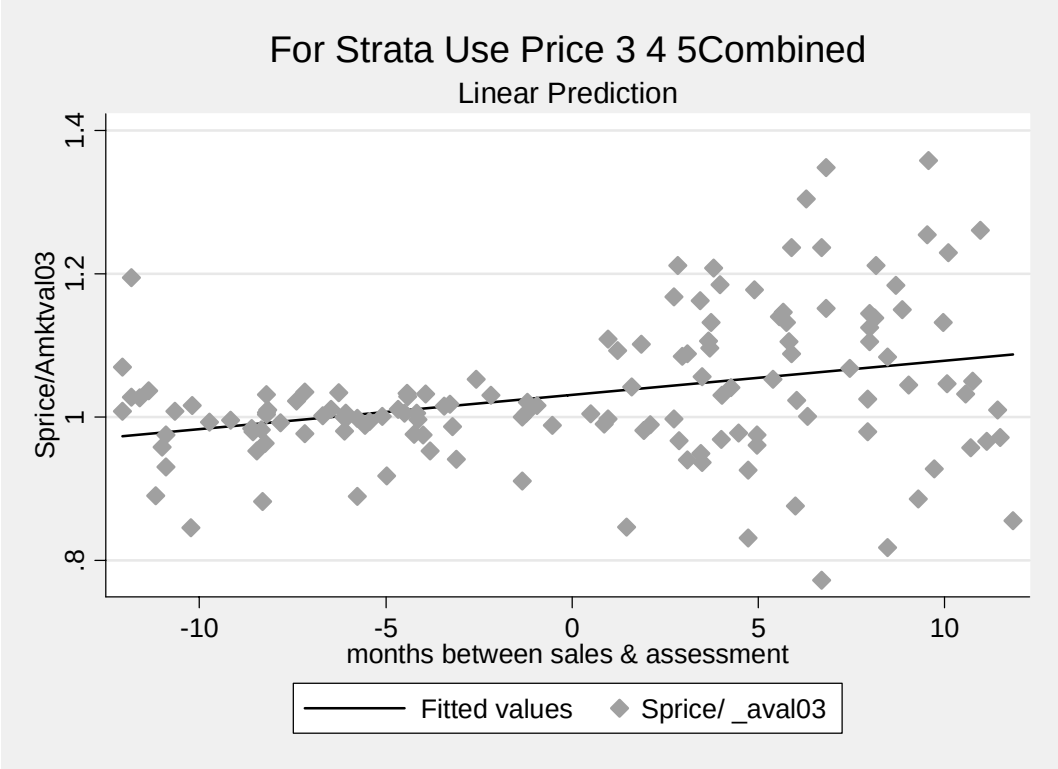
## Table 11. Combined Results – Post Stratification and Weighting

| | **Population Assessor's Value** | **Median** | **Estimated Actual Value** | **% of Total Est. Mkt. Value** | **Subtotal** |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Town Lot | 340,441,632 | 0.982 | 346,681,906 | 75.7% | 0.744 |
| Rural Lot | 105,493,421 | 0.949 | 111,162,720 | 24.3% | 0.230 |
| Total | 445,935,053 | | 457,844,626 | 100.0% | 97.4% |

| | **Population Assessor's Value** | **Weighted Mean** | **Estimated Actual Value** | **% of Total Est. Mkt. Value** | **Subtotal** |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Town Lot | 340,441,632 | 0.983 | 346,329,229 | 75.5% | 0.742 |
| Rural Lot | 105,493,421 | 0.937 | 112,586,362 | 24.5% | 0.230 |
| Total | 445,935,053 | | 458,915,591 | 100.0% | 97.2% |

**Graph 1. Single Family Property Price Trend**

A thorough analysis of price-time trends by price strata determined that adjusting reported prices was desirable for the three highest valued single family property strata. The prices for these strata ranged from $55,000 - $110,000. The resultant trend and statistical analysis is shown below.



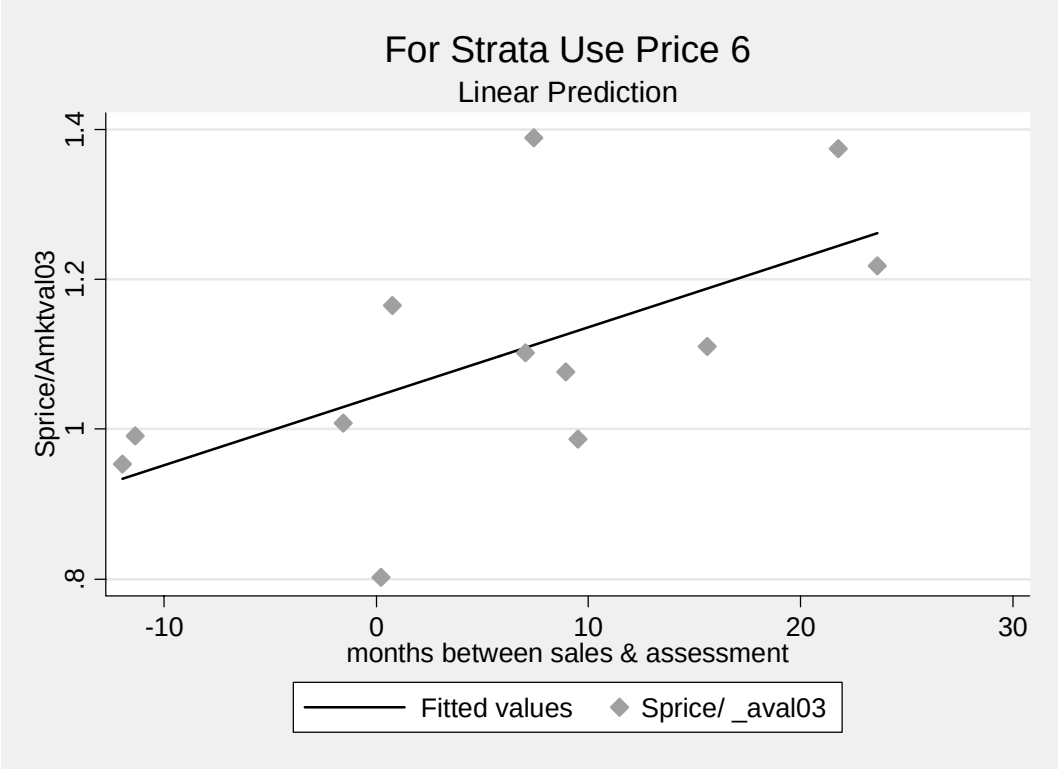

**Price Trend Regression Statistics**

| Source | SS | df | MS | | |
|---|---|---|---|---|---|
| Model | .157847222 | 1 | .157847222 | Number of obs = 142 | R-squared = 0. 1071 |
| Residual | 1.31660778 | 140 | .009404341 | F( 1, 140) = 16.78 | Adj R-squared= 0. 1007 |
| Total | 1.474455 | 141 | .010457128 | Prob > F = 0. 0001 | Root MSE = .09698 |

| _aratio | Coef. | Std. Err. | t | P> t | [80% Conf. Interval] | |
|---|---|---|---|---|---|---|
| _adjperiod | .004781 | .001167 | 4.10 | 0.000 | .0032784 | .0062837 |
| _cons | 1.030814 | .0081458 | 126.55 | 0.000 | 1.020325 | 1.041303 |
| Monthly adjustment rate=.00463808 | | | | Annualized adjustment rate=.05565696 | | |

**Graph 2. Unimproved Property Price Trend**

A thorough analysis of price-time trends by price strata determined that adjusting reported prices was desirable for the unimproved property stratum. The prices for this stratum ranged from $1,550 - $207,000. The resultant trend and statistical analysis is shown below.




**Price Trend Regression Statistics**

| Source | SS | df | MS | | |
|---|---|---|---|---|---|
| Model | .120558438 | 1 | .120558438 | Number of obs = 12 | R-squared = 0. 3751 |
| Residual | .200872842 | 10 | .020087284 | F( 1, 10) = 6.00 | Adj R-squared= 0. 3126 |
| Total | .32143128 | 11 | .029221025 | Prob > F = 0. 0343 | Root MSE = .14173 |

| _aratio | Coef. | Std. Err. | t | P> t | [80% Conf. Interval] | |
|---|---|---|---|---|---|---|
| _adjperiod | .0092206 | .0037638 | 2.45 | 0.034 | .0040561 | .0143852 |
| _cons | 1.0443 | .0464275 | 22.49 | 0.000 | .9805932 | 1.108007 |
| Monthly adjustment rate=.00882946 | | | | Annualized adjustment rate=.10595352 | | |

# Chapter 2. Bates County

## 1. Significant Findings

1.1 Assessment Level: Bates County's 2003 residential property assessments were approximately 75% of market value (Section 3.5). The results from the corresponding STC study are invalid because the STC's appraisals did not meet the requirement that they reflect market values (Section 4.3).

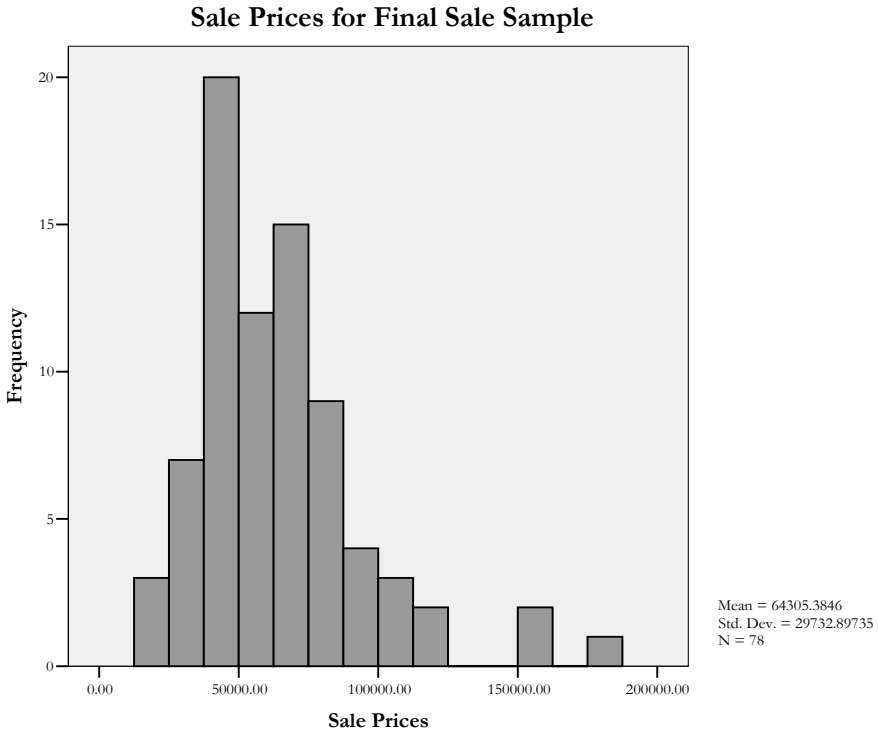
1.2 Assessment Equity: Lower-valued properties are assessed less uniformly and at a lower level than higher-valued properties (Section 3.6 and Table 3).

1.3 Reassessment History: Two indicators of market value changes suggest that three of the past four biennial reassessments have produced lower value increases than the market. Cumulatively, the reassessments from 1997 through 2003 produced only 37% of the expected rise in assessments. The net change in assessments in 1999 raises questions regarding whether any serious revaluation occurred (Section 5.1).

## 2. Data and Related Issues

2.1 Assessment Data: Sales and assessment information were matched at the county offices. Subsequently, the assessor reviewed the matched parcels and provided further information that assisted our screening process.

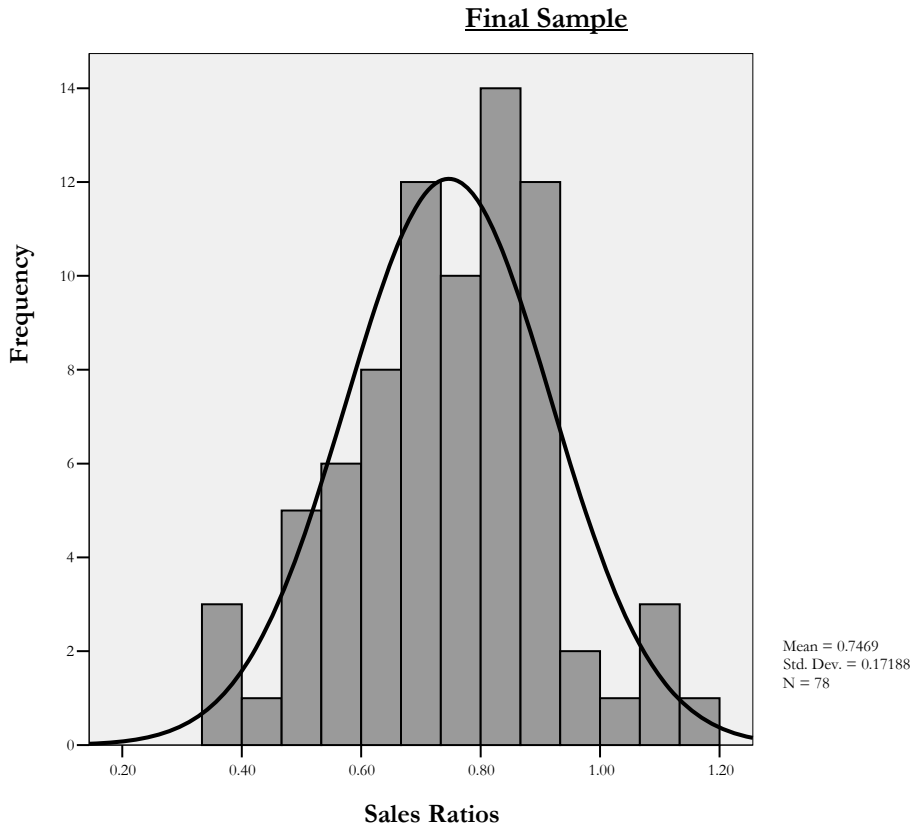
2.2 Sales and Ratio Data: The distribution of sale prices used is reflected in the following histogram.



The next table reports results of the data screening and trimming process. The "screened sales" represent the initial screened sample. The screened sales that were excluded from the final analysis because their ratios were deemed unrepresentative are identified as high or low trims. The "remaining ratios" represent the sample on which all the study's results are based.

| Trimming of Outliers | | | | |
|---|---|---|---|---|
| | | Improved Properties <=$43,200 | Improved Properties >$43,200 | Total |
| **Screened Sales** | | 45 | 43 | 88 |
| Excluded | High Trims | 4 | 4 | 8 |
| | Low Trims | 1 | 1 | 2 |
| **Remaining Ratios** | | **40** | **38** | **78** |

The histogram below shows the distribution of the ratios for the sample.




2.3 Population: A copy of the assessment data in electronic form was unavailable, so we used the best available alternative as a pseudo-population (hereinafter, "the population"), i.e. four random samples that were drawn and used by the STC.

## 3. Ratio Study Results

3.1 The Sample: The following table shows that none of the strata vary by more than 3 percent from the population. Upon initial examination, we conclude that the un-stratified sample is sufficiently representative of the population.

| Comparing Representivity | | | | | | |
|---|---|---|---|---|---|---|
| | Population Distribution | | | PPRC 2003 Sale Sample | | |
| Strata | N | $ | $ Weight | N | $ | $ Weight |
| Single-Family Properties <=$43,200 | 80 | 1,801,895 | 29.7% | 40 | 1,202,600 | 32.3% |
| Single-Family Properties >$43,200 | 51 | 4,129,789 | 68.1% | 38 | 2,523,800 | 67.7% |
| Unimproved Properties | 14 | 83,358 | 1.4% | 0 | 0 | 0% |
| Multi-family | 1 | 46,105 | 0.8% | 0 | 0 | 0% |
| Total | 146 | 6,061,147 | | 78 | 3,726,400 | |

3.2 Representing the Population with the Sample: Since the un-stratified sample is sufficiently representative of the population (Section 3.1), the use of stratification and weighting is not essential. Nevertheless, we used stratification because it produces additional analytical benefits and further optimizes representivity.

3.3 Sales Chasing: There was no indication of sales chasing.

3.4 Study Validity: The sample meets the requirements for producing valid inferences about the county's population of residential properties.

3.5 Assessment Level: Measures of the assessment level are summarized below. For the purposes of this study, the weighted mean from combined stratification is the preferred measure as long as both of the requirements for using the weighted mean are met. In this case, the distributions are approximately normal (Figure 3) and weighting is not severely compromised by the use of seriously undersized samples. Since both requirements are met, we focus on the weighted mean, though taking notice of the median, to conclude that the County's assessments for 2003 reflect approximately 75% of market value.

| Assessment Level (Based on Percent of Market Value) | | | | |
|---|---|---|---|---|
| | Stratification and Weighting | Reference | Weighted Mean | Median |
| **Overall Un-weighted** | None | Table 3 | 74.3% | 75.6% |
| **Combined** | By Property Use and Value Range | Table 4 | 74.6% | 77.2% |

3.6 Equity Measures and Evaluation:

i. Uniformity within Strata: Tables 2, 3 and 5 show results for individual strata of sufficient sample size for evaluation. The following strata represent problem areas for internal uniformity.

| Strata with Inadequate Uniformity | |
|---|---|
| **Property Strata** | **COD** |
| Single-Family <= $43,200 | 23.5% |

ii. Uniformity between Strata: Another form of inequity exists when different strata are assessed at different levels. The IAAO has established guidelines for identifying such inequity, but compliance can be heavily affected by sample size and uniformity. Therefore, we confine our remarks to identifying where assessment levels differ markedly from the norm. The difference in assessment level (medians) between the lower and higher valued strata (69.6% versus 81.1% respectively, Table 3) is substantial.

iii. Vertical Equity: The final form of potential inequity examined is vertical equity. The PRD for the overall sample of 1.005 complies with the IAAO standard.

## 4. STC Study

4.1 Comparative Results: The following table contrasts our results with those from the STC study. The STC found the level of assessment adequate, while ours does not. The STC reports substandard measures for horizontal and vertical equity, while our analysis finds otherwise. We have already demonstrated that the PPRC study meets the criteria for achieving valid results. The rest of Section 4 examines the validity of the STC's study.

| Comparison of Study Results | | | |
|---|---|---|---|
| **Measure** | **STC Study*** | **PPRC Study*** | **PPRC Study Combined**** |
| Assessment Level – median | 96.4% | 75.6% | 77.2% |
| Assessment Level - weighted mean | 92.7% | 74.3% | 74.6% |
| COD | 27.0% | 17.7% | |
| PRD | 1.11 | 1.01 | |
| Sample Size | 35 | 78 | |
| Relative Precision | 1.00 | 1.49 | |
| * Overall sample (un-stratified and un-weighted) | | | |
| ** Stratification and weighting by Property Use and Value Range | | | |

4.2 Representing the Population with the Sample: The STC does not examine the representivity of its sample, nor does it have the necessary sample size or information to do so. Therefore, in the following table, we provide that missing analysis. In this case, the table shows that one of the strata in the STC sample, the unimproved property stratum, varies by more than 3 percent from the population. However, upon closer examination, this variance has no material effect on the overall level of assessment and thus we conclude that the STC sample is sufficiently representative of the population.

| Comparing Representivity | | | | | | |
|---|---|---|---|---|---|---|
| | **Population** | | | **STC 2003 Appraisals** | | |
| **Strata** | **N** | **$** | **%** | **N** | **$** | **%** |
| Single family <=$43,200 | 80 | 1,801,895 | 29.7% | 17 | 419,211 | 28.7% |
| Single family >$43,200 | 51 | 4,129,789 | 68.1% | 13 | 974,158 | 66.7% |
| Unimproved | 14 | 83,358 | 1.4% | 5 | 68,053 | 4.7% |
| Multi-family | 1 | 46,105 | 0.8% | 0 | 0 | 0% |
| Total | 146 | 6,061,147 | | 35 | 1,461,421 | |

4.3 Market Value: The final requirement for producing a valid appraisal study is that appraisals must represent market values. As discussed in the introduction for this Section II, and in greater depth in the Procedure Manual (Section III), we use 4 tests to make this determination. The results of each test are reported in the following tables.

| Mann-Whitney Test | | | | |
|---|---|---|---|---|
| For the Entire Sample | | | | |
| Study | Observations | Rank sum | Expected | Ho: Ratios (35 STC Appraisals)=Ratios (78 Sales)<br>z = 4.812<br>Prob > \|z\| = 0.0000 |
| 0 | 35 | 2770 | 1995 | |
| 1 | 78 | 3671 | 4446 | |
| Combined | 113 | 6441 | 6441 | |
| For Single Family Properties Only | | | | |
| Study | Observations | Rank sum | Expected | Ho : Ratios (30 STC Appraisals)=Ratios (78 Sales)<br>z = 4.891<br>Prob > \|z\| = 0.0000 |
| 0 | 30 | 2348 | 1635 | |
| 1 | 78 | 3538 | 4251 | |
| Combined | 108 | 5886 | 5886 | |

| K-Sample Test | | | | |
|---|---|---|---|---|
| For the Entire Sample | | | | |
| Study | Not Greater than the median | Greater than the median | Total | Ho: Ratios (35 STC Appraisals)=Ratios (78 Sales)<br>Pearson chi2(1) = 18.7978 Pr = 0.000<br>Continuity corrected:<br>Pearson chi2(1) = 17.0749 Pr = 0.000 |
| 0 | 7 | 28 | 35 | |
| 1 | 50 | 28 | 78 | |
| Total | 57 | 56 | 113 | |
| For Single Family Properties Only | | | | |
| Study | Not Greater than the median | Greater than the median | Total | Ho: Ratios (30 STC Appraisals)=Ratios (78 Sales)<br>Pearson chi2(1) = 18.4615 Pr = 0.000<br>Continuity corrected:<br>Pearson chi2(1) = 16.6615 Pr = 0.000 |
| 0 | 5 | 25 | 30 | |
| 1 | 49 | 29 | 78 | |
| Total | 54 | 54 | 108 | |

All four tests lead to the conclusion that the STC appraisals do not represent market values (all with 99% statistical confidence). Therefore, the STC study is invalid and its reported results are unreliable.

## 5. Additional Analysis and Findings

5.1 Analysis of Reassessment History: The following table provides a comparison of actual assessment changes (net of new construction) to those that might have been expected for each of the last four reassessments as well as the six-year period leading up to 2003. None of the reassessments produced changes in line with the market indicator.

| Actual Value Changes from Reassessment vs. Expected Value Change | | | | | |
|---|---|---|---|---|---|
| Biennial Year | % Net Assessment Change | Missouri OFHEO Index | % Value Change: Actual vs. Expected | KC MSA OFHEO Index | % Value Change: Actual vs. Expected |
| 1999 | 0.9 | 8.4 | 11% | 12.3 | 7% |
| 2001 | 5.0 | 11.4 | 44% | 13.0 | 38% |
| 2003 | 6.6 | 11.8 | 56% | 9.9 | 67% |
| 2005 | 2.7 | 12.4 | 22% | 10.5 | 26% |
| Cumulative 1997 - 2003 | 12.9 | 35.0 | 37% | 39.5 | 33% |

## 6. Figures and Tables

**Table 1. STC's Appraisal Ratio Studies**

| | | Group | | | |
|---|---|---|---|---|---|
| | | 1999 | 2001 | 2003 | 2005* |
| Number of Appraisals | | 36 | 40 | 35 | 35 |
| Median | | .951 | .975 | .964 | .983 |
| 95% Confidence Interval | Lower Bound | .802 | .821 | .884 | .891 |
| for Median | Upper Bound | 1.025 | 1.055 | .994 | 1.015 |
| Weighted Mean | | .927 | .916 | .927 | .971 |
| 95% Confidence Interval | Lower Bound | .868 | .843 | .837 | .871 |
| for Weighted Mean | Upper Bound | .985 | .988 | 1.018 | 1.070 |
| Minimum | | .461 | .489 | .216 | .590 |
| Maximum | | 1.400 | 3.789 | 2.446 | 2.215 |
| Std. Deviation | | .223 | .526 | .423 | .374 |
| Price Related Differential | | 1.020 | 1.145 | 1.114 | 1.097 |
| Coefficient of Dispersion | | .188 | .278 | .270 | .236 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 30.6% | 42.5% | 34.3% | 37.1% |
| *The STC has not completed its studies for the 2005 reassessment cycle. These results may not represent final values. | | | | | |

**Figure 1. Ratios before Outlier Trimming**

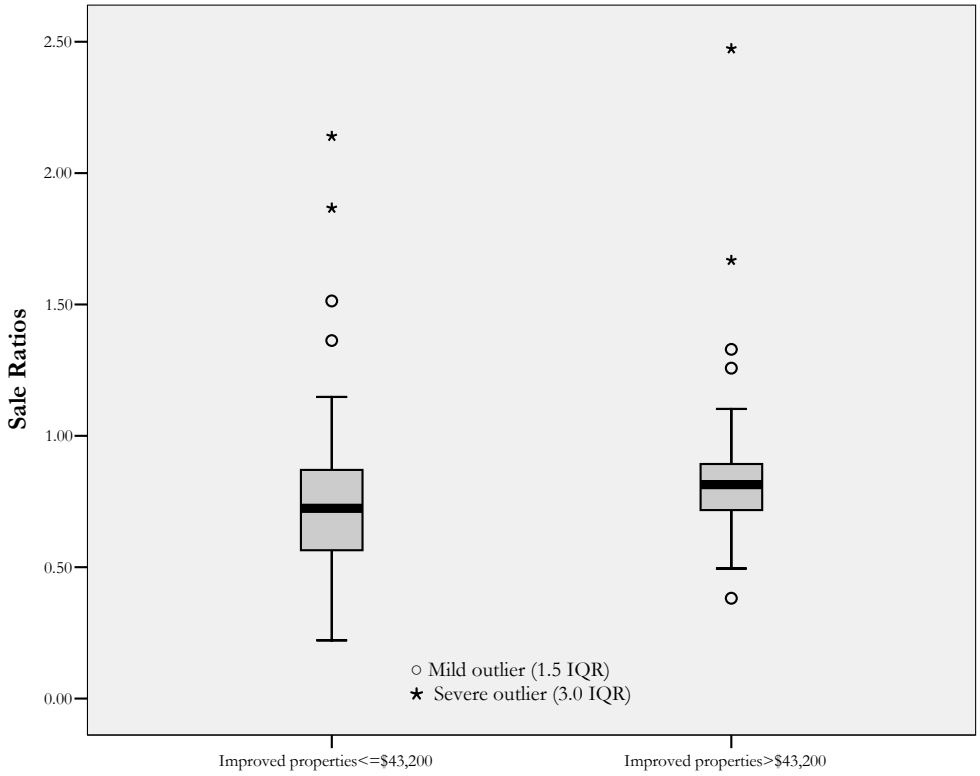
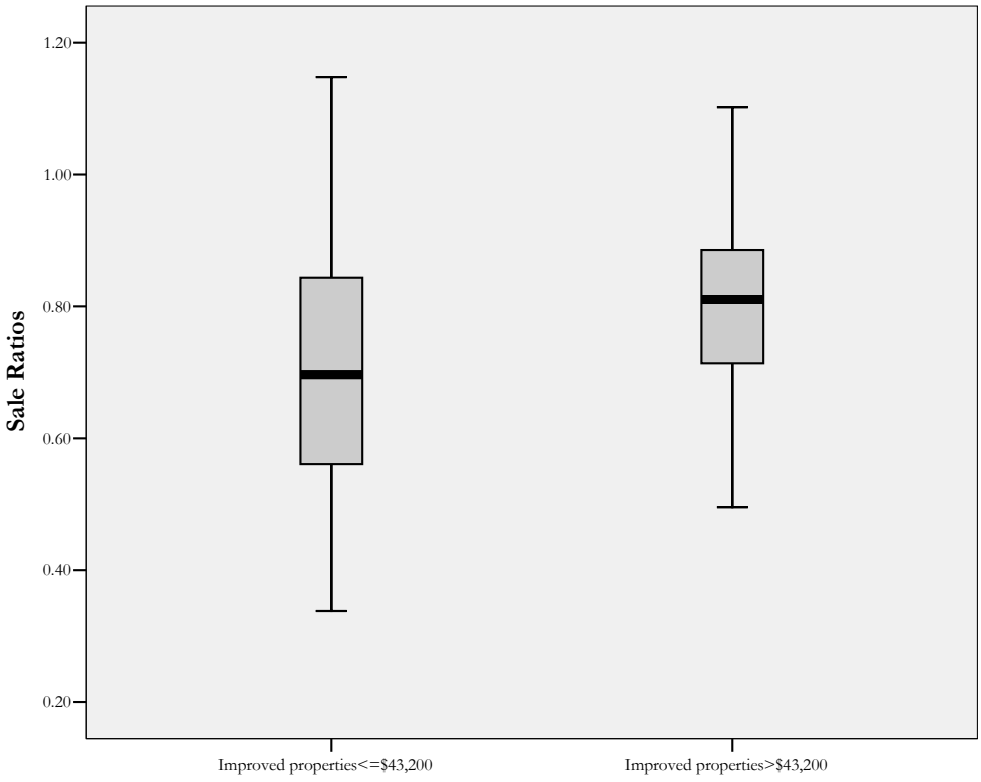
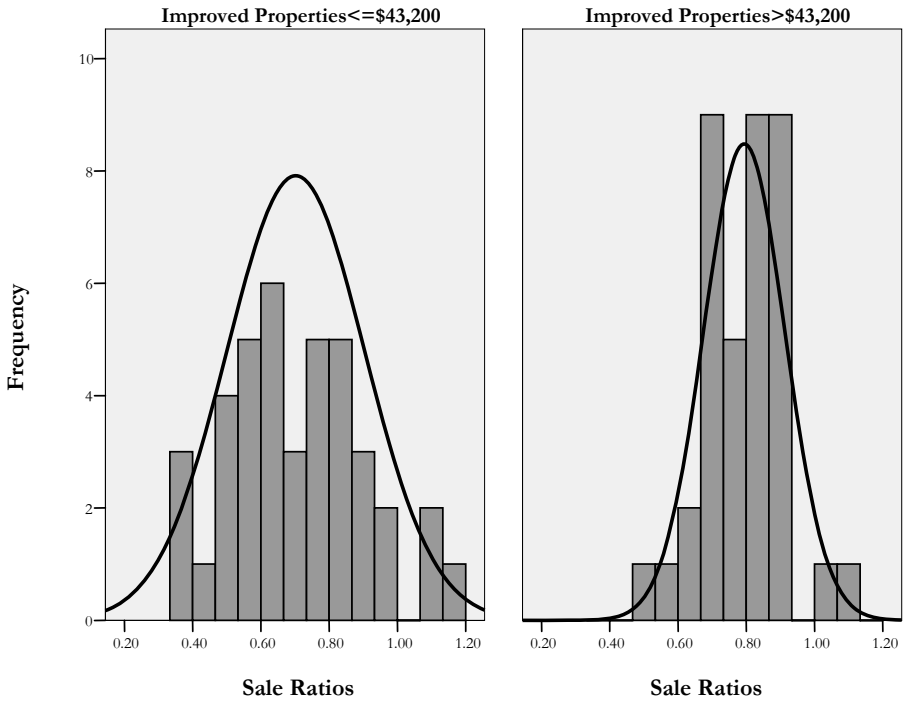



**Figure 2. Ratios after Outlier Trimming**



## Figure 3. Distribution of Final Sale Ratios




## Shapiro-Francia W' Tests for Normality for Various Strata

| Strata | Observations | W' | V' | z | Prob* |
|---|---|---|---|---|---|
| Single Family | 78 | 0.98886 | 0.823 | -0.395 | 0.65351 |
| Improved Properties | 78 | 0.98886 | 0.823 | -0.395 | 0.65351 |
| Improved Properties<=$43,200 | 40 | 0.98806 | 0.521 | -1.262 | 0.89658 |
| Improved Properties>$43,200 | 38 | 0.98087 | 0.803 | -0.419 | 0.66250 |
| Overall Un-weighted | 78 | 0.98886 | 0.823 | -0.395 | 0.65351 |
| *This value represents the indicated probability that the underlying population is normally distributed. A value of less than .05 indicates a distribution that is not normal. | | | | | |

## Table 2. Sales Ratio Analysis: Stratified by Property Use

| | | Strata | |
|---|---|---|---|
| | | Single Family | Overall Un-weighted |
| Number of Sales | | 78 | 78 |
| Median | | .756 | .756 |
| 95% Confidence Interval for Median | Lower Bound | .704 | .704 |
| | Upper Bound | .813 | .813 |
| Weighted Mean | | .743 | .743 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .709 | .709 |
| | Upper Bound | .777 | .777 |
| Minimum | | .338 | .338 |
| Maximum | | 1.148 | 1.148 |
| Std. Deviation | | .172 | .172 |
| Price Related Differential | | 1.005 | 1.005 |
| Coefficient of Dispersion | | .177 | .177 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 12.8% | 12.8% |

## Table 3. Sales Ratio Analysis: Stratified by Use and Value

| | | Strata | | |
|---|---|---|---|---|
| | | Improved Properties <=$43,200 | Improved Properties >$43,200 | Overall Un-weighted |
| Number of Sales | | 40 | 38 | 78 |
| Median | | .696 | .811 | .756 |
| 95% Confidence Interval for Median | Lower Bound | .605 | .729 | .704 |
| | Upper Bound | .768 | .859 | .813 |
| Weighted Mean | | .669 | .785 | .743 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .608 | .749 | .709 |
| | Upper Bound | .729 | .820 | .777 |
| Minimum | | .338 | .496 | .338 |
| Maximum | | 1.148 | 1.102 | 1.148 |
| Std. Deviation | | .202 | .119 | .172 |
| Price Related Differential | | 1.050 | 1.012 | 1.005 |
| Coefficient of Dispersion | | .235 | .116 | .177 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 12.5% | 13.2% | 12.8% |

## Table 4. Combined Results – Post Stratification and Weighting

| | Population Assessor's Value | Median | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Improved Properties <=$43,200 | 1,801,895 | 0.696 | 2,588,930 | 33.7% | 0.235 |
| Improved Properties >$43,200 | 4,129,789 | 0.811 | 5,092,218 | 66.3% | 0.538 |
| Total | 5,931,684 | | 7,681,148 | 100% | 77.2% |

| | Population Assessor's Value | Weighted Mean | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Improved Properties <=$43,200 | 1,801,895 | 0.669 | 2,693,416 | 33.9% | 0.227 |
| Improved Properties >$43,200 | 4,129,789 | 0.785 | 5,260,878 | 66.1% | 0.519 |
| Total | 5,931,684 | | 7,954,293 | 100.0% | 74.6% |

## Table 5. Sales Ratio Analysis: Stratified by Location

| | | Strata | | | |
|---|---|---|---|---|---|
| | | Adrian Area | Butler Area | All Other Areas | Overall Un-weighted |
| Number of Sales | | 30 | 35 | 13 | 78 |
| Median | | .759 | .768 | .691 | .756 |
| 95% Confidence Interval for Median | Lower Bound | .670 | .721 | .503 | .704 |
| | Upper Bound | .859 | .814 | .870 | .813 |
| Weighted Mean | | .749 | .766 | .651 | .743 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .686 | .725 | .551 | .709 |
| | Upper Bound | .811 | .807 | .750 | .777 |
| Minimum | | .349 | .379 | .338 | .338 |
| Maximum | | 1.102 | 1.148 | 1.095 | 1.148 |
| Std. Deviation | | .178 | .154 | .196 | .172 |
| Price Related Differential | | 1.014 | .998 | 1.033 | 1.005 |
| Coefficient of Dispersion | | .188 | .144 | .211 | .177 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 20.0% | 8.6% | 7.7% | 12.8% |

# Chapter 3. Cass County

## 1. Significant Findings

1.1 Assessment Level: Cass County's 2003 residential property assessments were approximately 82% of market value (Section 3.5). The results from the corresponding STC study are invalid because the STC's appraisals did not meet the requirement that they reflect market values (Section 4.3). Furthermore, the STC's sample is not representative of residential property for the county (Section 4.2).

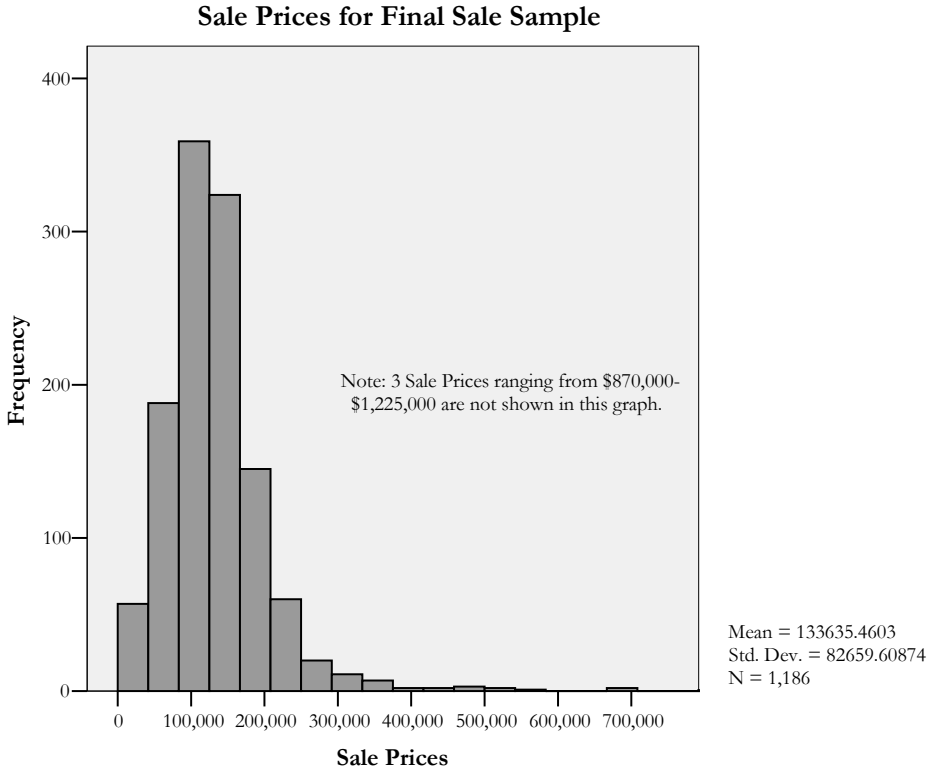
1.2 Assessment Equity: Unimproved properties and lower-valued properties are assessed less uniformly and at lower levels than other properties (Section 3.6 and Tables 2 & 3).

1.3 Reassessment History: Two indicators of market value changes suggest that three of the past four biennial reassessments have produced lower value increases than the market. Cumulatively, the reassessments from 1997 through 2003 produced only 68% of the expected rise in assessments (Section 5.1).

## 2. Data and Related Issues

2.1 Assessment Data: Assessment information was gathered from the county's website and matched electronically with sales.

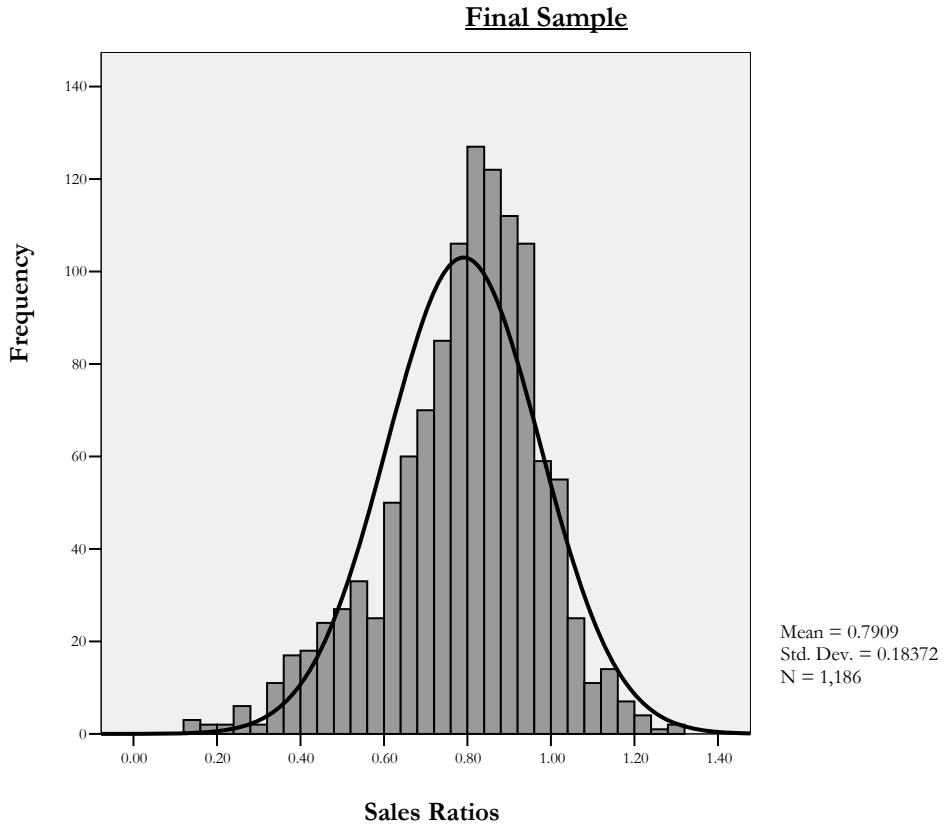
2.2 Sales and Ratio Data: The distribution of sale prices used is reflected in the following histogram.



The next table reports results of the data screening and trimming process. The "screened sales" represent the initial screened sample. The screened sales that were excluded from the final analysis because their ratios were deemed unrepresentative are identified as high or low trims. The "remaining ratios" represent the sample on which all the study's results are based.

| Trimming of Outliers | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Single Family <=$58,000 | Single Family $58,001 - $83,000 | Single Family $83,001 $110,000 | Single Family $110,001 - $135,000 | Single Family >$135,000 | Unimproved Properties | Multi-family | Total |
| **Screened Sales** | | 158 | 233 | 270 | 218 | 246 | 90 | 39 | 1,254 |
| Excluded | High Trims | 9 | 5 | 6 | 1 | 5 | 14 | 2 | 42 |
| | Low Trims | 12 | 2 | 4 | 1 | 3 | 2 | 2 | 26 |
| **Remaining Ratios** | | **137** | **226** | **260** | **216** | **238** | **74** | **35** | **1,186** |

The histogram below shows the distribution of the ratios for the sample.




2.3 Population: A copy of the assessment data in electronic form was unavailable, so we used the best available alternative as a pseudo-population (hereinafter, "the population"), i.e. four random samples that were drawn and used by the STC.

## 3. Ratio Study Results

3.1 The Sample: The following table shows that three of the strata, the three highest single family groups, vary from 4.7 to 11.7% from the population. Initially, this exhibits excessive variability from

the sample to the population. However, upon closer examination, this variation has no material effect and thus we conclude that the un-stratified sample is sufficiently representative of the population.

| Comparing Representivity | | | | | | |
|---|---|---|---|---|---|---|
| | Population Distribution | | | PPRC 2003 Sale Sample | | |
| Strata | N | $ | $ Weight | N | $ | $ Weight |
| Single Family <=$58,000 | 29 | 991,632 | 6.9% | 137 | 6,307,421 | 5.0% |
| Single Family $58,001-$83,000 | 22 | 1,561,105 | 10.9% | 226 | 16,182,316 | 12.9% |
| Single Family $83,001-$110,000 | 23 | 2,199,684 | 15.3% | 260 | 25,130,210 | 20.0% |
| Single Family $110,001-$135,000 | 18 | 2,212,526 | 15.4% | 216 | 26,070,684 | 20.7% |
| Single Family >$135,000 | 37 | 6,793,368 | 47.2% | 238 | 45,959,421 | 36.5% |
| Unimproved Properties | 16 | 146,368 | 1.0% | 74 | 1,682,474 | 1.3% |
| Multi-family | 4 | 483,105 | 3.4% | 35 | 4,464,684 | 3.5% |
| Total | 149 | 14,387,789 | | 1186 | 125,797,211 | |

3.2 Representing the Population with the Sample: Since the un-stratified sample is sufficiently representative of the population (Section 3.1), the use of stratification and weighting is not essential. Nevertheless, we used stratification because it produces additional analytical benefits and further optimizes representivity.

3.3 Sales Chasing: There was no indication of sales chasing.

3.4 Study Validity: The sample meets the requirements for producing valid inferences about the county's population of residential properties.

3.5 Assessment Level: Measures of the assessment level are summarized below. For the purposes of this study, the weighted mean from combined stratification is the preferred measure as long as the both of the requirements from using the weighted mean are met. In this case, weighting is not compromised by the use of seriously undersized samples but the distributions are not sufficiently normal (Figure 3). Since both requirements are not met, we focus on the median, though taking notice of the weighted mean, to conclude that the County's assessments for 2003 reflect approximately 82% of market value.

| Assessment Level (Based on Percent of Market Value) | | | | |
|---|---|---|---|---|
| | Stratification and Weighting | Reference | Weighted Mean | Median |
| **Overall Un-weighted** | None | Table 2 | 79.4% | 81.4% |
| **Combined** | By Property Use and Value Range | Table 4 | 79.9% | 83.5% |

3.6 Equity Measures and Evaluation:

i. Uniformity within Strata: Tables 2, 3 and 5 show results for individual strata of sufficient sample size for evaluation. The following strata represent problem areas for internal uniformity.

| Strata with Inadequate Uniformity | |
|---|---|
| **Property Strata** | **COD** |
| Unimproved Properties | 40.6% |
| SF <=$58,000 | 25.0% |

ii. Uniformity between Strata: Another form of inequity exists when different strata are assessed at different levels. The IAAO has established guidelines for identifying such inequity, but compliance can be heavily affected by sample size and uniformity. Therefore, we confine our remarks to identifying where assessment levels differ markedly from the norm. The difference in assessment level (medians) between unimproved properties and single family properties (47% versus 82% and 89% respectively, Table 2) and between lower-valued and higher-valued properties (68% versus 76-89% respectively, Table 3) is substantial.

iii. Vertical Equity: The final form of potential inequity examined is vertical equity. The PRD for the overall sample of 0.996 complies with the IAAO standard.

## 4. STC Study

4.1 Comparative Results: The following table contrasts our results with those from the STC study. The STC found the level of assessment adequate, while ours does not. The STC reports substandard measures for horizontal and vertical equity, while our analysis finds otherwise. We have already demonstrated that the PPRC study meets the criteria for achieving valid results. The rest of Section 4 examines the validity of the STC's study.

| Comparison of Study Results | | | |
|---|---|---|---|
| **Measure** | **STC Study*** | **PPRC Study*** | **PPRC Study Combined**** |
| Assessment Level - median | 102.8% | 81.4% | 83.5% |
| Assessment Level - wtd. mean | 97.2% | 79.4% | 79.9% |
| COD | 20.3% | 17.2% | |
| PRD | 1.14 | 1.00 | |
| Sample Size | 37 | 1,186 | |
| Relative Precision | 1.00 | 5.66 | |
| * Overall sample (un-stratified and un-weighted) | | | |
| ** Stratification and weighting by Property Use and Value Range | | | |

4.2 Representing the Population with the Sample: The STC does not examine the representivity of its sample, nor does it have the necessary sample size or information to do so. Therefore, in the following table, we provide that missing analysis. In this case, the table shows that four of the strata in the STC sample, the four highest single family strata, vary from 6.5 to 17.1%. Initially, this exhibits excessive variability from the sample to the population. Upon closer examination, this variation has a cumulative material effect on the overall assessment level and thus we conclude that the STC sample is insufficiently representative of the population.

| Comparing Representivity | | | | | | |
|---|---|---|---|---|---|---|
| | **Population** | | | **STC 2003 Appraisals** | | |
| **Strata** | **N** | **$** | **%** | **N** | **$** | **%** |
| Single Family <=$58,000 | 29 | 991,632 | 6.9% | 9 | 326,684 | 7.2% |
| Single Family $58,001-$83,000 | 22 | 1,561,105 | 10.9% | 3 | 197,737 | 4.4% |
| Single Family $83,001-$110,000 | 23 | 2,199,684 | 15.3% | 4 | 390,105 | 8.6% |
| Single Family $110,001-$135,000 | 18 | 2,212,526 | 15.4% | 3 | 368,211 | 8.2% |
| Single Family >$135,000 | 37 | 6,793,368 | 47.2% | 15 | 2,948,368 | 65.3% |
| Unimproved Properties | 16 | 146,368 | 1.0% | 1 | 15,421 | 0.3% |
| Multi-family | 4 | 483,105 | 3.4% | 2 | 266,211 | 5.9% |
| Total | 149 | 14,387,789 | | 37 | 4,512,737 | |

4.3 Market Value: The final requirement for producing a valid appraisal study is that appraisals must represent market values. As discussed in the introduction for this Section II, and in greater depth in the Procedure Manual (Section III), we use 4 tests to make this determination. The results of each test are reported in the following tables.

| Mann-Whitney Test | | | | |
|---|---|---|---|---|
| **For the Entire Sample** | | | | |
| Study | Observations | Rank sum | Expected | Ho: Ratios (37 STC Appraisals)=Ratios (1186 Sales)<br>z = 6.857<br>Prob > \|z\| = 0.0000 |
| 0 | 37 | 37152 | 22644 | |
| 1 | 1186 | 711324 | 725832 | |
| Combined | 1223 | 748476 | 748476 | |
| **For Single Family Properties Only** | | | | |
| Study | Observations | Rank sum | Expected | Ho : Ratios (34 STC Appraisals)=Ratios (1077 Sales)<br>z = 6.204<br>Prob > \|z\| = 0.0000 |
| 0 | 34 | 30332 | 18904 | |
| 1 | 1077 | 587384 | 598812 | |
| Combined | 1111 | 617716 | 617716 | |

| K-Sample Test | | | | |
|---|---|---|---|---|
| **For the Entire Sample** | | | | |
| Study | Not Greater than the median | Greater than the median | Total | Ho: Ratios (37 STC Appraisals)=Ratios(1186 Sales)<br>Pearson chi2(1) = 20.3629 Pr = 0.000<br>Continuity corrected:<br>Pearson chi2(1) = 18.8841 Pr = 0.000 |
| 0 | 5 | 32 | 37 | |
| 1 | 607 | 579 | 1186 | |
| Total | 612 | 611 | 1223 | |
| **For Single Family Properties Only** | | | | |
| Study | Not Greater than the median | Greater than the median | Total | Ho: Ratios (34 STC Appraisals)=Ratios(1077 Sales)<br>Pearson chi2(1) = 17.5206 Pr = 0.000<br>Continuity corrected:<br>Pearson chi2(1) = 16.0928 Pr = 0.000 |
| 0 | 5 | 29 | 34 | |
| 1 | 551 | 526 | 1077 | |
| Total | 556 | 555 | 1111 | |

All four tests lead to the conclusion that the STC appraisals do not represent market values (all with 99% statistical confidence). Therefore, the STC study is invalid and its reported results are unreliable.

## 5. Additional Analysis and Findings

5.1 Analysis of Reassessment History: The following table provides a comparison of actual assessment changes (net of new construction) to those that might have been expected for each of the last four reassessments as well as the six-year period leading up to 2003. Only one of the reassessments produced changes in line with the market indicator.

| Actual Value Changes from Reassessment vs. Expected Value Change | | | | | |
|---|---|---|---|---|---|
| Biennial Year | % Net Assessment Change | Missouri OFHEO Index | % Value Change: Actual vs. Expected | KC MSA OFHEO Index | % Value Change: Actual vs. Expected |
| 1999 | 4.7% | 8.4 | 56% | 12.3 | 38% |
| 2001 | 11.6% | 11.4 | 102% | 13.0 | 89% |
| 2003 | 6.0% | 11.8 | 51% | 9.9 | 61% |
| 2005 | 6.3% | 12.4 | 51% | 10.5 | 60% |
| Cumulative 1997 - 2003 | 23.9% | 35.0 | 68% | 39.5 | 61% |

## 6. Figures and Tables

**Table 1. STC's Appraisal Ratio Studies**

| | | Group | | | |
|---|---|---|---|---|---|
| | | 1999 | 2001 | 2003 | 2005* |
| Number of Appraisals | | 38 | 39 | 37 | 35 |
| Median | | .990 | .986 | 1.028 | .925 |
| 95% Confidence Interval | Lower Bound | .924 | .944 | .972 | .853 |
| for Median | Upper Bound | 1.058 | 1.035 | 1.046 | 1.013 |
| Weighted Mean | | 1.000 | .995 | .972 | .917 |
| 95% Confidence Interval | Lower Bound | .938 | .956 | .922 | .868 |
| for Weighted Mean | Upper Bound | 1.063 | 1.033 | 1.022 | .966 |
| Minimum | | .175 | .579 | .649 | .222 |
| Maximum | | 2.132 | 1.962 | 3.019 | 3.658 |
| Std. Deviation | | .403 | .224 | .414 | .694 |
| Price Related Differential | | 1.051 | 1.026 | 1.136 | 1.180 |
| Coefficient of Dispersion | | .247 | .141 | .203 | .343 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 50.0% | 56.4% | 51.4% | 40.0% |

*The STC has not completed its studies for the 2005 reassessment cycle. These results may not represent final values.

**Figure 1. Ratios before Outlier Trimming**

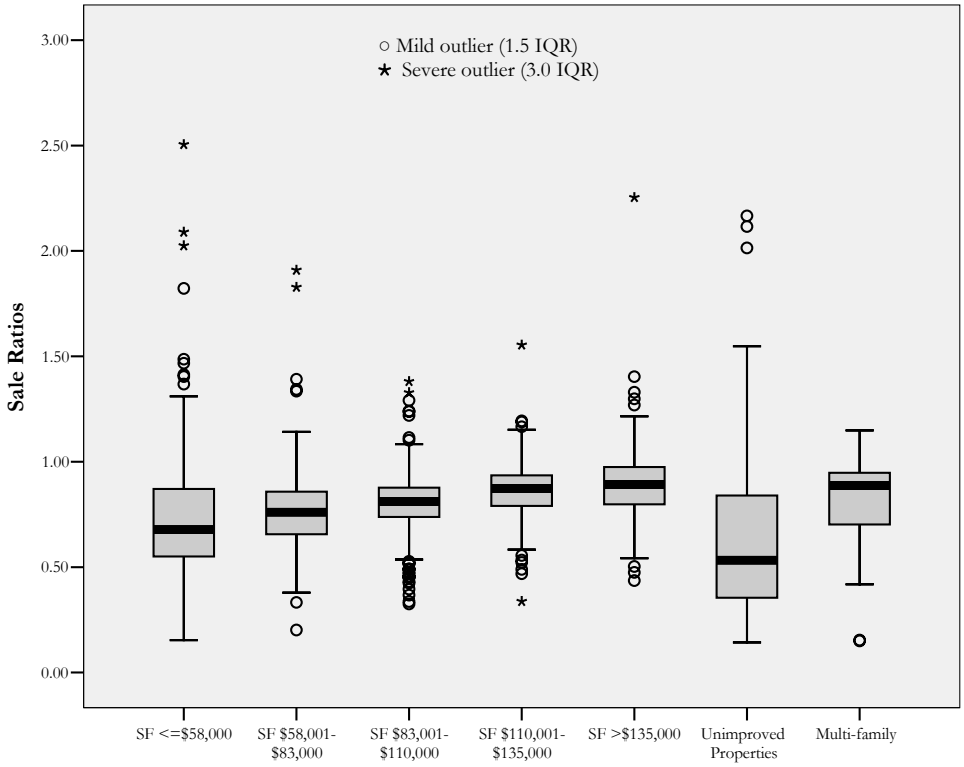
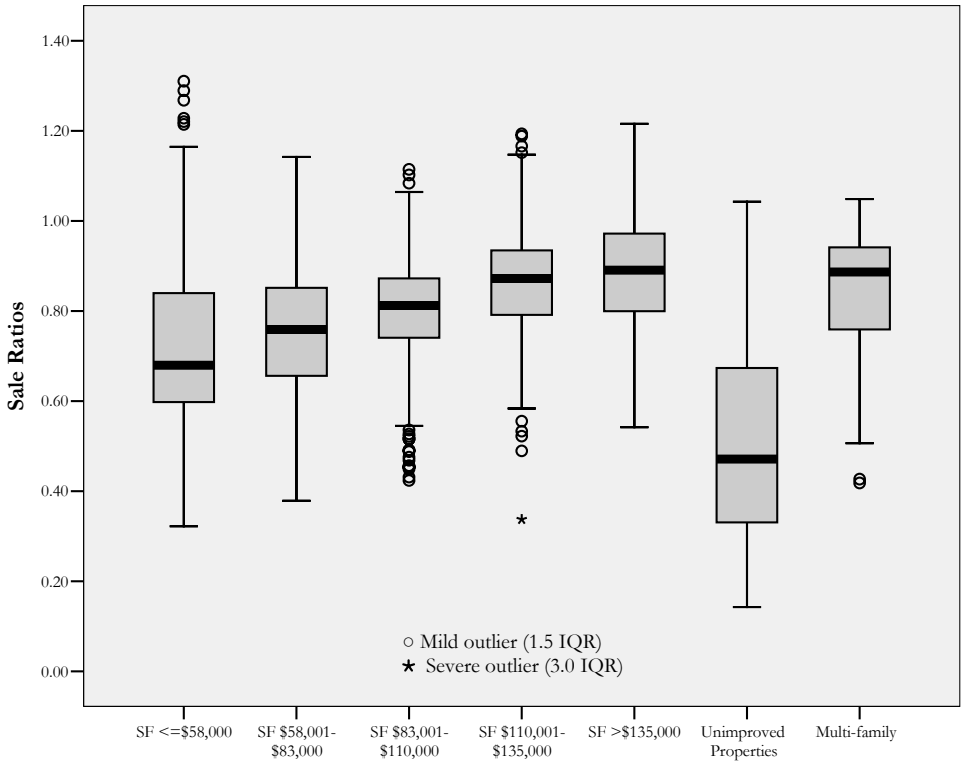
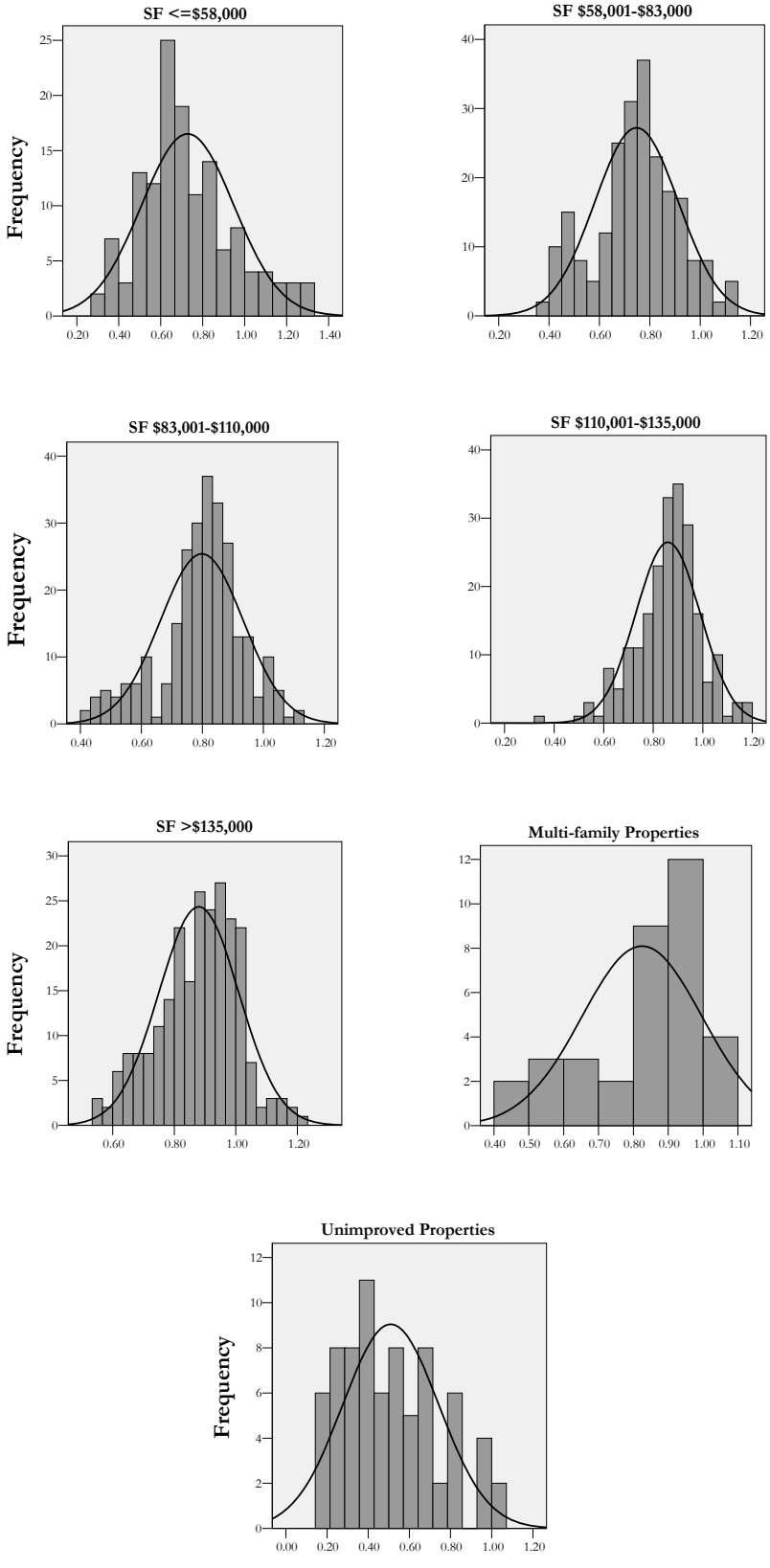



**Figure 2. Ratios after Outlier Trimming**



## Figure 3. Distribution of Final Sale Ratios



## Figure 3 (cont.). Distribution of Final Sale Ratios

### Shapiro-Francia W' Tests for Normality for Various Strata

| Strata | Observations | W' | V' | z | Prob* |
|---|---|---|---|---|---|
| Single Family | 1,077 | 0.98843 | 8.219 | 4.551 | 0.00001 |
| Multi-family | 35 | 0.89473 | 4.149 | 2.602 | 0.00463 |
| Unimproved Properties | 74 | 0.96498 | 2.478 | 1.772 | 0.03816 |
| Single Family <=$58,000 | 137 | 0.96935 | 3.591 | 2.590 | 0.00479 |
| Single Family $58,001-$83,000 | 226 | 0.98258 | 3.111 | 2.389 | 0.00846 |
| Single Family $83,001-$110,000 | 260 | 0.96448 | 7.154 | 4.110 | 0.00002 |
| Single Family $110,001-$135,000 | 216 | 0.97533 | 4.239 | 3.011 | 0.00130 |
| Single Family >$135,000 | 238 | 0.98779 | 2.279 | 1.750 | 0.04007 |
| Overall Un-weighted | 1,186 | 0.97360 | 20.259 | 6.176 | 0.00001 |

*This value represents the indicated probability that the underlying population is normally distributed. A value of less than .05 indicates a distribution that is not normal.

## Table 2. Sales Ratio Analysis: Stratified by Property Use

| | | Strata | | | |
|---|---|---|---|---|---|
| | | Single Family | Unimproved Properties | Multi-family | Overall Un-weighted |
| Number of Sales | | 1,077 | 74 | 35 | 1,186 |
| Median | | .822 | .472 | .887 | .814 |
| 95% Confidence Interval for Median | Lower Bound | .811 | .386 | .808 | .805 |
| | Upper Bound | .833 | .557 | .920 | .827 |
| Weighted Mean | | .799 | .492 | .835 | .794 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .788 | .430 | .768 | .783 |
| | Upper Bound | .810 | .553 | .901 | .804 |
| Minimum | | .322 | .143 | .418 | .143 |
| Maximum | | 1.310 | 1.043 | 1.049 | 1.310 |
| Std. Deviation | | .164 | .233 | .172 | .184 |
| Price Related Differential | | 1.012 | 1.037 | .988 | .996 |
| Coefficient of Dispersion | | .154 | .406 | .144 | .172 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 25.6% | 8.1% | 45.7% | 25.1% |

## Table 3. Sales Ratio Analysis: Stratified by Use and Value

| | | Strata | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | SF <=$58,000 | SF $58,001 - $83,000 | SF $83,001 - $110,000 | SF $110,001 - $ 135,000 | SF >$135,000 | Unimproved Properties | Multi-family | Overall Un-weighted |
| Number of Sales | | 137 | 226 | 260 | 216 | 238 | 74 | 35 | 1,186 |
| Median | | .680 | .759 | .812 | .872 | .891 | .472 | .887 | .814 |
| 95% Confidence Interval for Median | Lower Bound | .656 | .739 | .797 | .857 | .877 | .386 | .808 | .805 |
| | Upper Bound | .733 | .785 | .830 | .889 | .917 | .557 | .920 | .827 |
| Weighted Mean | | .674 | .707 | .773 | .837 | .854 | .492 | .835 | .794 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .640 | .682 | .753 | .815 | .835 | .430 | .768 | .783 |
| | Upper Bound | .708 | .731 | .793 | .859 | .874 | .553 | .901 | .804 |
| Minimum | | .322 | .379 | .424 | .338 | .542 | .143 | .418 | .143 |
| Maximum | | 1.310 | 1.142 | 1.114 | 1.193 | 1.215 | 1.043 | 1.049 | 1.310 |
| Std. Deviation | | .221 | .166 | .136 | .130 | .130 | .233 | .172 | .184 |
| Price Related Differential | | 1.081 | 1.058 | 1.033 | 1.027 | 1.030 | 1.037 | .988 | .996 |
| Coefficient of Dispersion | | .250 | .169 | .124 | .111 | .116 | .406 | .144 | .172 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 10.9% | 15.5% | 17.7% | 34.7% | 44.1% | 8.1% | 45.7% | 25.1% |

## Table 4. Combined Results – Post Stratification and Weighting

| | Population Assessor's Value | Median | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Single Family <=$58,000 | 991,632 | 0.68 | 1,458,282 | 8.5% | 0.058 |
| Single Family $58,001-$83,000 | 1,561,105 | 0.759 | 2,056,792 | 11.9% | 0.091 |
| Single Family $83,001-$110,000 | 2,199,684 | 0.812 | 2,708,971 | 15.7% | 0.128 |
| Single Family $110,001-$135,000 | 2,212,526 | 0.872 | 2,537,301 | 14.7% | 0.128 |
| Single Family >$135,000 | 6,793,368 | 0.891 | 7,624,431 | 44.2% | 0.394 |
| Unimproved Properties | 146,368 | 0.472 | 310,103 | 1.8% | 0.008 |
| Multi-family | 483,105 | 0.887 | 544,651 | 3.2% | 0.028 |
| Total | 14,387,789 | | 17,240,530 | 100.0% | 83.5% |

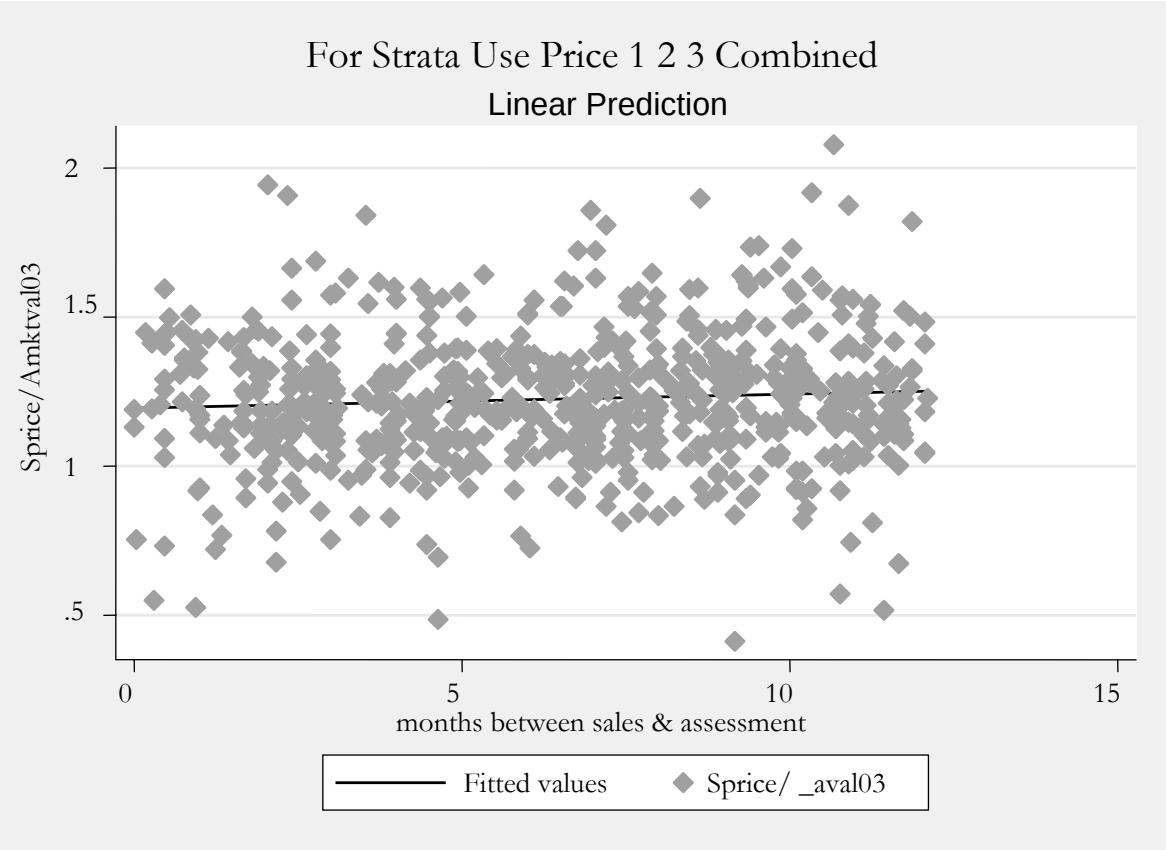
| | Population Assessor's Value | Weighted Mean | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Single Family <=$58,000 | 991,632 | 0.674 | 1,471,263 | 8.2% | 0.055 |
| Single Family $58,001-$83,000 | 1,561,105 | 0.707 | 2,208,070 | 12.3% | 0.087 |
| Single Family $83,001-$110,000 | 2,199,684 | 0.773 | 2,845,646 | 15.8% | 0.122 |
| Single Family $110,001-$135,000 | 2,212,526 | 0.837 | 2,643,401 | 14.7% | 0.123 |
| Single Family >$135,000 | 6,793,368 | 0.854 | 7,954,764 | 44.2% | 0.377 |
| Unimproved Properties | 146,368 | 0.492 | 297,497 | 1.7% | 0.008 |
| Multi-family | 483,105 | 0.835 | 578,569 | 3.2% | 0.027 |
| Total | 14,387,789 | | 17,999,210 | 100.0% | 79.9% |

## Table 5. Sales Ratio Analysis: Stratified by Location

| | | Strata | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Belton Area | Peculiar Area | Pleasant Hill Area | Raymore Area | Harrisonville Area | Garden City Area | All Other Areas | Overall Un-weighted |
| Number of Sales | | 335 | 82 | 164 | 309 | 151 | 39 | 106 | 1,186 |
| Median | | .792 | .748 | .808 | .863 | .832 | .807 | .770 | .814 |
| 95% Confidence Interval for Median | Lower Bound | .780 | .704 | .761 | .847 | .807 | .679 | .695 | .805 |
| | Upper Bound | .808 | .801 | .851 | .880 | .865 | .852 | .808 | .827 |
| Weighted Mean | | .799 | .757 | .781 | .811 | .826 | .754 | .741 | .794 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .782 | .723 | .749 | .790 | .801 | .694 | .696 | .783 |
| | Upper Bound | .817 | .790 | .812 | .833 | .850 | .815 | .786 | .804 |
| Minimum | | .254 | .143 | .191 | .158 | .253 | .485 | .220 | .143 |
| Maximum | | 1.310 | 1.188 | 1.268 | 1.199 | 1.228 | 1.147 | 1.220 | 1.310 |
| Std. Deviation | | .150 | .222 | .207 | .180 | .164 | .174 | .226 | .184 |
| Price Related Differential | | .990 | .956 | 1.000 | 1.006 | .998 | 1.026 | 1.001 | .996 |
| Coefficient of Dispersion | | .140 | .220 | .203 | .152 | .150 | .172 | .238 | .172 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 19.7% | 17.1% | 26.8% | 35.6% | 24.5% | 12.8% | 20.8% | 25.1% |

**Graph 1. Single Family Property Price Trend**

A thorough analysis of price-time trends by price strata determined that adjusting reported prices was desirable for the three lowest valued single family property strata. The prices for these strata ranged from $15,500 - $142,000. The resultant trend and statistical analysis is shown below.



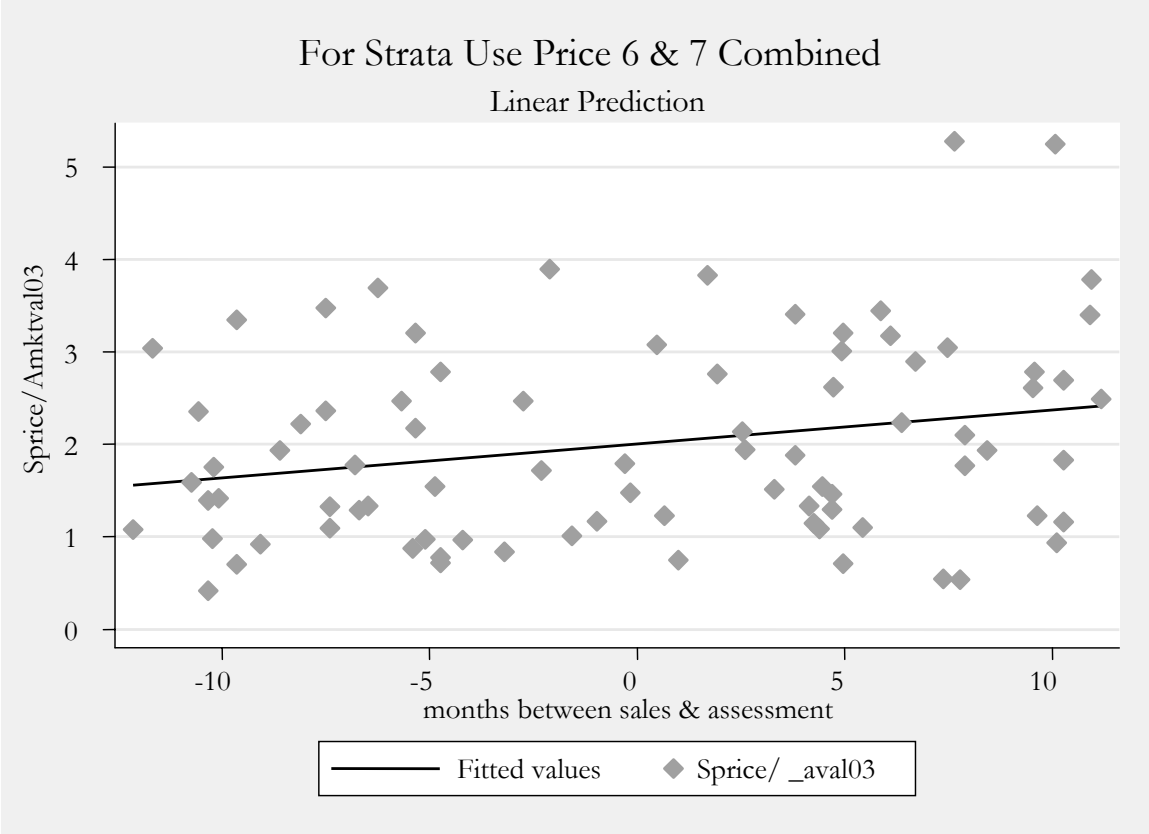

**Price Trend Regression Statistics**

| Source | SS | df | MS | | |
|---|---|---|---|---|---|
| Model | .159005914 | 1 | .159005914 | Number of obs = 671 | R-squared = 0. 0048 |
| Residual | 32.9410569 | 669 | .049239248 | F( 1, 669) = 3.23 | Adj R-squared= 0. 0033 |
| Total | 33.1000628 | 670 | .049403079 | Prob > F = 0. 0728 | Root MSE = .2219 |

| _aratio | Coef. | Std. Err. | t | P> t | [80% Conf. Interval] | |
|---|---|---|---|---|---|---|
| _adjperiod | .0047237 | .0026286 | 1.80 | 0.073 | .0013516 | .0080957 |
| _cons | 1.193735 | .0189515 | 62.99 | 0.000 | 1.169424 | 1.218046 |
| Monthly adjustment rate=.00395708 | | | | Annualized adjustment rate=.04748496 | | |

**Graph 2. Unimproved Property Price Trend**

A thorough analysis of price-time trends by price strata determined that adjusting reported prices was desirable for the unimproved property strata. The prices for these strata ranged from $5,000 - $262,500. The resultant trend and statistical analysis is shown below.




**Price Trend Regression Statistics**

| Source | SS | df | MS | | |
|---|---|---|---|---|---|
| Model | 5.608388 | 1 | 5.608388 | Number of obs = 83 | R-squared = 0. 0603 |
| Residual | 87.4180444 | 81 | 1.07923512 | F( 1, 81) = 5.20 | Adj R-squared= 0. 0487 |
| Total | 93.0264324 | 82 | 1.13446869 | Prob > F = 0. 0253 | Root MSE = 1.0389 |

| _aratio | Coef. | Std. Err. | t | P> t | [80% Conf. Interval] | |
|---|---|---|---|---|---|---|
| _adjperiod | .0367025 | .0161003 | 2.28 | 0.025 | .0158994 | .0575055 |
| _cons | 2.003617 | .114034 | 17.57 | 0.000 | 1.856274 | 2.150959 |
| Monthly adjustment rate=.01831812 | | | | Annualized adjustment rate=.21981744 | | |

# Chapter 4. Clay County

## 1. Significant Findings

1.1 Assessment Level: Clay County's 2003 residential property assessments were approximately 91% of market value (Section 3.5). The results from the corresponding STC study are invalid because the STC's appraisals did not meet the requirement that they reflect market values (Section 4.3). Furthermore, the STC's sample is not representative of residential property for the county (Section 4.2).

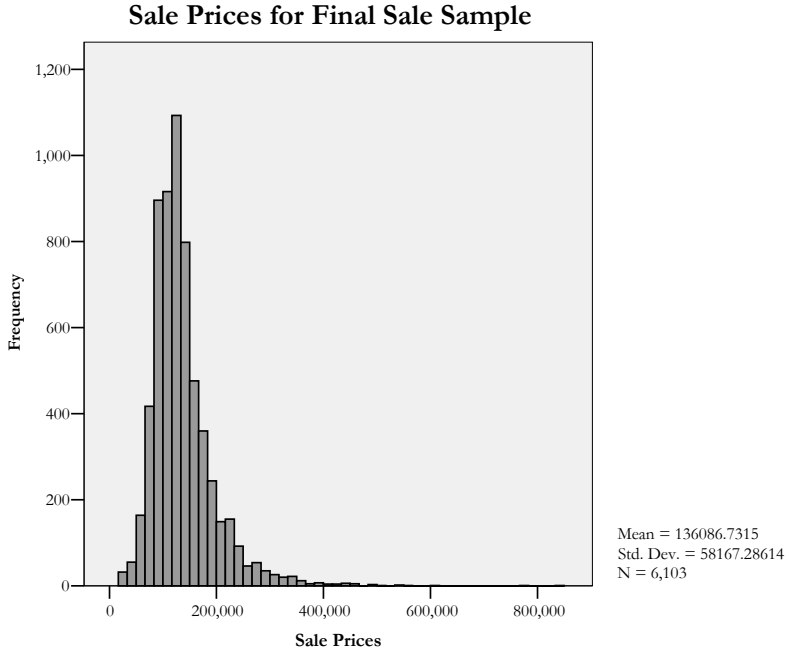
1.2 Assessment Equity: Unimproved properties are assessed less uniformly and at a lower level than other properties, and lower-valued and older properties are also assessed at lower levels than higher-valued and newer properties respectively (Section 3.6 and Tables 2, 4 & 8).

1.3 Reassessment History: Two indicators of market value changes suggest that two of the past four biennial reassessments have produced lower value increases than the market. However, the reassessments from 1997 through 2003 produced 95% of the expected rise in assessments, in part due to the larger assessment increase in 1999 (Section 5.1).

## 2. Data and Related Issues

2.1 Assessment Data: Sales and assessment information was available in electronic format. Sales were matched using a combination of computer techniques and software and then screened. The assessor answered all questions regarding the contents and coding of data when requested. The files received contained information allowing us to identify properties affected by new construction and to screen as appropriate.

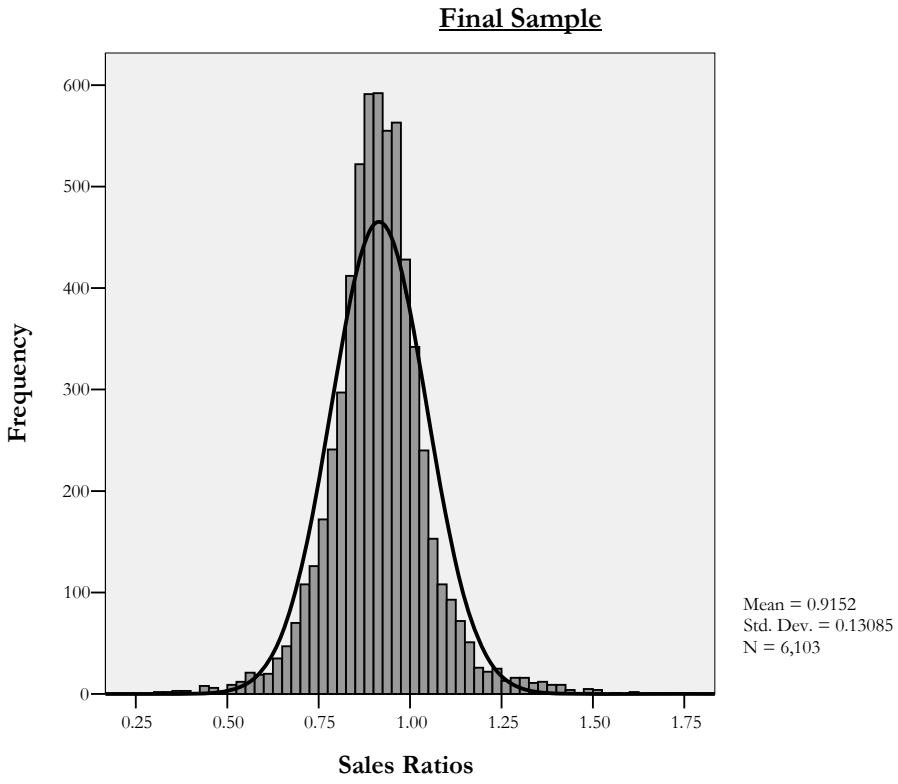
2.2 Sales and Ratio Data: The distribution of sale prices used is reflected in the following histogram.



The next table reports results of the data screening and trimming process. The "screened sales" represent the initial screened sample. The screened sales that were excluded from the final analysis because their ratios were deemed unrepresentative are identified as high or low trims. The "remaining ratios" represent the sample on which all the study's results are based.

| Trimming of Outliers | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Single Family <=$90,000 | Single Family $90,001 - $120,000 | Single Family $120,001 - $150,000 | Single Family $150,001 - $200,000 | Single Family >$200,000 | Unimproved Properties | Multi-family | Total |
| **Screened Sales** | | 1,390 | 1,731 | 1,301 | 834 | 490 | 30 | 384 | 6160 |
| Excluded | Value Outliers | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 |
| | High Trims | 18 | 9 | 4 | 3 | 5 | 2 | 4 | 45 |
| | Low Trims | 4 | 3 | 0 | 1 | 2 | 0 | 1 | 11 |
| **Remaining Ratios** | | **1,368** | **1,719** | **1,297** | **830** | **483** | **27** | **379** | **6103** |

The histogram below shows the distribution of the ratios for the sample.




2.3 Population: Since a complete copy of the 2003 assessment rolls in electronic form was available, we were able to analyze the county's population in detail. This allowed us to stratify and weight sales on a variety of property and location characteristics.

## 3. Ratio Study Results

3.1 The Sample: The following table shows that one of the strata, the multi-family stratum, varies by more than 3 percent from the population. However, upon closer examination, this variance has no material effect on the overall level of assessment and thus we conclude that the un-stratified sample is sufficiently representative of the population.

| Comparing Representivity | | | | | | |
|---|---|---|---|---|---|---|
| | Population Distribution | | | PPRC 2003 Sale Sample | | |
| Strata | N | $ | $ Weight | N | $ | $ Weight |
| Single Family <=$90,000 | 14,689 | 1,013,091,600 | 12.4% | 1368 | 97,097,800 | 12.8% |
| Single Family $90,001-$120,000 | 15,997 | 1,680,484,900 | 20.6% | 1719 | 181,388,700 | 23.9% |
| Single Family $120,001-$150,000 | 11,717 | 1,561,911,800 | 19.1% | 1297 | 172,430,100 | 22.7% |
| Single Family $150,001-$200,000 | 8,692 | 1,494,075,100 | 18.3% | 830 | 142,810,000 | 18.8% |
| Single Family >$200,000 | 5,938 | 1,566,179,600 | 19.2% | 483 | 123,934,300 | 16.3% |
| Unimproved Properties | 6,460 | 124,460,840 | 1.5% | 27 | 735,300 | 0.1% |
| Multi-family | 3,937 | 723,948,100 | 8.9% | 379 | 41,158,200 | 5.4% |
| Total | 67430 | 8,164,151,940 | | 6103 | 759,554,400 | |

3.2 Representing the Population with the Sample: Since the un-stratified sample is sufficiently representative of the population (Section 3.1), the use of stratification and weighting is not essential. Nevertheless, we used stratification because it produces additional analytical benefits and further optimizes representivity.

3.3 Sales Chasing: There was no indication of sales chasing.

3.4 Study Validity: The sample meets the requirements for producing valid inferences about the county's population of residential properties.

3.5 Assessment Level: Measures of the assessment level are summarized below. For the purposes of this study, the weighted mean from combined stratification is the preferred measure as long as both of the requirements from using the weighted mean are met. In this case, the distributions are not normal (Figure 3) and weighting is compromised by the use of seriously undersized samples. Since both requirements are not met, we focus on the median, though taking notice of the weighted mean, to conclude that the County's assessments for 2003 reflect approximately 91% of market value.

| Assessment Level (Based on Percent of Market Value) | | | | |
|---|---|---|---|---|
| | Stratification and Weighting | Reference | Weighted Mean | Median |
| **Overall Un-weighted** | None | Table 2 | 91.5% | 91.4% |
| **Combined** | By Property Use | Table 3 | 91.0% | 90.9% |
| **Combined** | By Property Use and Value Range | Table 5 | 91.1% | 91.6% |
| **Combined** | By Property Location | Table 7 | 91.5% | 91.2% |
| **Combined** | By Property Age | Table 9 | 90.8% | 90.7% |
| **Combined** | By Town and Rural Lots | Table 11 | 91.4% | 91.2% |

3.6 Equity Measures and Evaluation:

i. Uniformity within Strata: Tables 2, 4, 6, 8 & 10 show results for individual strata of sufficient sample size for evaluation. The following strata represent problem areas for internal uniformity.

| Strata with Inadequate Uniformity | |
|---|---|
| **Property Strata** | **COD** |
| Unimproved Properties | 34.1% |

ii. Uniformity between Strata: Another form of inequity exists when different strata are assessed at different levels. The IAAO has established guidelines for this evaluation, but compliance is heavily affected by sample size and uniformity within the strata. Therefore, we confine our remarks to identifying where assessment levels differ markedly from the norm. The differences in assessment level (medians) between unimproved properties and other properties (65.9% versus 91.2% and 94.2% respectively, Table 2), between lower and higher valued properties (83.3% versus 96.0% respectively, Table 4), and between older and newer properties (82.9% versus 92.3% respectively, Table 8) are notable.

iii. Vertical Equity: The final form of potential inequity examined is vertical equity. The PRD for the overall sample of 1.001 complies with the IAAO standard.

## 4. STC Study

4.1 Comparative Results: The following table contrasts our results with those from the STC study. The STC found the level of assessment adequate, as does ours. The STC reports a similar horizontal equity measure and vertical equity measure. We have already demonstrated that the PPRC study meets the criteria for achieving valid results. The rest of Section 4 examines the validity of the STC's study.

| Comparison of Study Results | | | |
|---|---|---|---|
| **Measure** | **STC Study*** | **PPRC Study*** | **PPRC Study Combined**** |
| Assessment Level - median | 99.2% | 91.4% | 91.6% |
| Assessment Level - wtd. mean | 100.6% | 91.5% | 91.1% |
| COD | 13.4% | 10.3% | |
| PRD | 1.00 | 1.00 | |
| Sample Size | 40 | 6,103 | |
| Relative Precision | 1.00 | 12.35 | |
| * Overall sample (un-stratified and un-weighted) | | | |
| ** Stratification and weighting by Property Use and Value Range | | | |

4.2 Representing the Population with the Sample: The STC does not examine the representivity of its sample, nor does it have the necessary sample size or information to do so. Therefore, in the following table, we provide that missing analysis. In this case, the table shows that four of the strata in the STC sample, the two lowest single family strata as well as the second highest single family stratum and multi-family stratum, vary from 4% to 10.6%. Initially, this exhibits excessive variability from the sample to the population. Upon closer examination, this variation has a cumulative material effect on the overall assessment level and thus we conclude that the STC sample is insufficiently representative of the population.

| Comparing Representivity | | | | | | |
|---|---|---|---|---|---|---|
| | Population | | | STC 2003 Appraisals | | |
| Strata | N | $ | % | N | $ | % |
| Single Family <=$90,000 | 14,689 | 1,013,091,600 | 12.4% | 2 | 112,737 | 2.4% |
| Single Family $90,001-$120,000 | 15,997 | 1,680,484,900 | 20.6% | 12 | 1,280,579 | 26.8% |
| Single Family $120,001-$150,000 | 11,717 | 1,561,911,800 | 19.1% | 7 | 933,684 | 19.5% |
| Single Family $150,001-$200,000 | 8,692 | 1,494,075,100 | 18.3% | 8 | 1,380,579 | 28.9% |
| Single Family >$200,000 | 5,938 | 1,566,179,600 | 19.2% | 3 | 736,263 | 15.4% |
| Unimproved Properties | 6,460 | 124,460,840 | 1.5% | 6 | 101,474 | 2.1% |
| Multi-family | 3,937 | 723,948,100 | 8.9% | 2 | 233,789 | 4.9% |
| Total | 67430 | 8,164,151,940 | | 40 | 4,779,105 | |

4.3 Market Value: The final requirement for producing a valid appraisal study is that appraisals must represent market values. As discussed in the introduction for this Section II, and in greater depth in the Procedure Manual (Section III), we use 4 tests to make this determination. The results of each test are reported in the following tables.

| Mann-Whitney Test | | | | |
|---|---|---|---|---|
| For the Entire Sample | | | | |
| Study | Observations | Rank sum | Expected | Ho: Ratios (40 STC Appraisals)=Ratios (6103 Sales)<br>z = 4.153<br>Prob > \|z\| = 0.0000 |
| 0 | 40 | 169308 | 122880 | |
| 1 | 6103 | 18701988 | 18748416 | |
| Combined | 6143 | 18871296 | 18871296 | |
| For Single Family Properties Only | | | | |
| Study | Observations | Rank sum | Expected | Ho : Ratios (32 STC Appraisals)=Ratios (5697 Sales)<br>z = 4.602<br>Prob > \|z\| = 0.0000 |
| 0 | 32 | 134613 | 91680 | |
| 1 | 5697 | 16278972 | 16321905 | |
| Combined | 5729 | 16413585 | 16413585 | |

| K-Sample Test | | | | |
|---|---|---|---|---|
| For the Entire Sample | | | | |
| Study | Not Greater than the median | Greater than the median | Total | Ho: Ratios (40 STC Appraisals)=Ratios(6103 Sales)<br>Pearson chi2(1) = 8.1590 Pr = 0.004<br>Continuity corrected:<br>Pearson chi2(1) = 7.2779 Pr = 0.007 |
| 0 | 11 | 29 | 40 | |
| 1 | 3061 | 3042 | 6103 | |
| Total | 3072 | 3071 | 6143 | |
| For Single Family Properties Only | | | | |
| Study | Not Greater than the median | Greater than the median | Total | Ho: Ratios (32 STC Appraisals)=Ratios(5697 Sales)<br>Pearson chi2(1) = 10.1882 Pr = 0.001<br>Continuity corrected:<br>Pearson chi2(1) = 9.0879 Pr = 0.003 |
| 0 | 7 | 25 | 32 | |
| 1 | 2858 | 2839 | 5697 | |
| Total | 2865 | 2864 | 5729 | |

All four tests lead to the conclusion that the STC appraisals do not represent market values (all with 99% statistical confidence). Therefore, the STC study is invalid and its reported results are unreliable.

## 5. Additional Analysis and Findings

5.1 Analysis of Reassessment History: The following table provides a comparison of actual assessment changes (net of new construction) to those that might have been expected for each of the last four reassessments as well as the six-year period leading up to 2003. Two of the reassessments produced changes in line with the market indicator.

| Actual Value Changes from Reassessment vs. Expected Value Change | | | | | |
|---|---|---|---|---|---|
| Biennial Year | % Net Assessment Change | Missouri OFHEO Index | % Value Change: Actual vs. Expected | KC MSA OFHEO Index | % Value Change: Actual vs. Expected |
| 1999 | 14.5 | 8.4 | 172% | 12.3 | 118% |
| 2001 | 6.1 | 11.4 | 53% | 13.0 | 47% |
| 2003 | 9.8 | 11.8 | 83% | 9.9 | 99% |
| 2005 | 6.7 | 12.4 | 54% | 10.5 | 64% |
| Cumulative 1997 - 2003 | 33.3 | 35.0 | 95% | 39.5 | 84% |

## 6. Figures and Tables

**Table 1. STC's Appraisal Ratio Studies**

| | | Group | | | |
|---|---|---|---|---|---|
| | | 1999 | 2001 | 2003 | 2005* |
| Number of Appraisals | | 37 | 41 | 40 | 35 |
| Median | | .983 | .989 | .992 | .948 |
| 95% Confidence Interval | Lower Bound | .923 | .954 | .945 | .893 |
| for Median | Upper Bound | 1.000 | 1.076 | 1.076 | 1.027 |
| Weighted Mean | | .962 | 1.053 | 1.006 | .968 |
| 95% Confidence Interval | Lower Bound | .926 | .971 | .952 | .905 |
| for Weighted Mean | Upper Bound | .998 | 1.135 | 1.061 | 1.031 |
| Minimum | | .562 | .579 | .455 | .222 |
| Maximum | | 1.195 | 3.150 | 1.712 | 1.371 |
| Std. Deviation | | .132 | .374 | .200 | .222 |
| Price Related Differential | | .981 | 1.022 | 1.000 | .962 |
| Coefficient of Dispersion | | .098 | .176 | .134 | .150 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 59.5% | 56.1% | 50.0% | 51.4% |
| *The STC has not completed its studies for the 2005 reassessment cycle. These results may not represent final values. | | | | | |

**Figure 1. Ratios before Outlier Trimming**

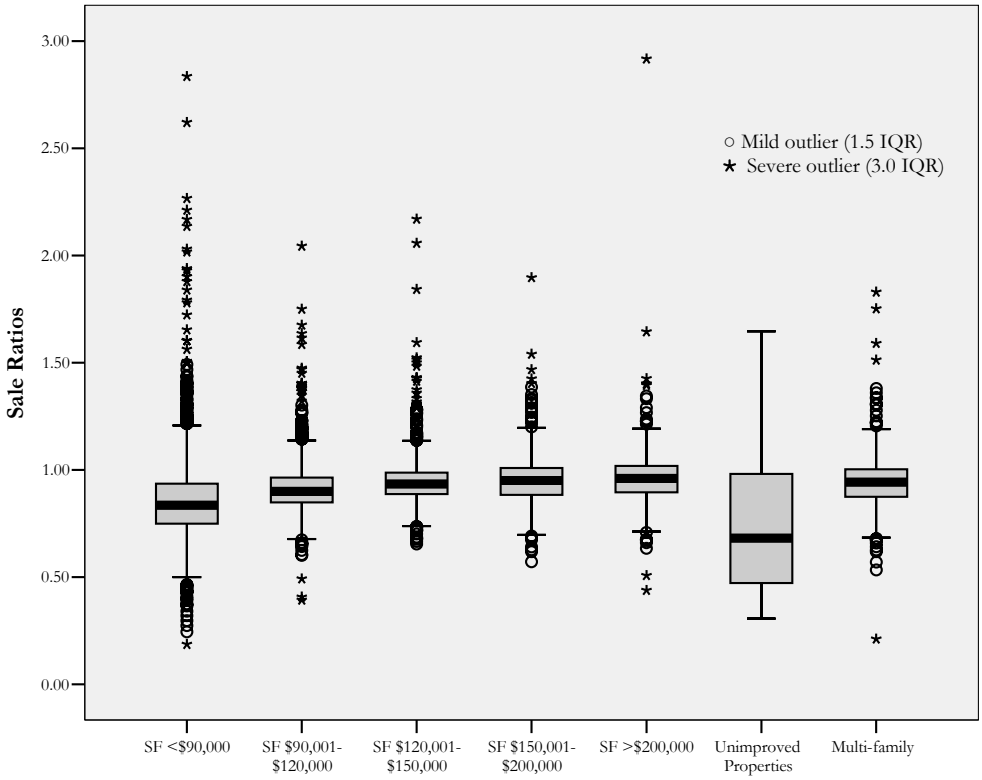
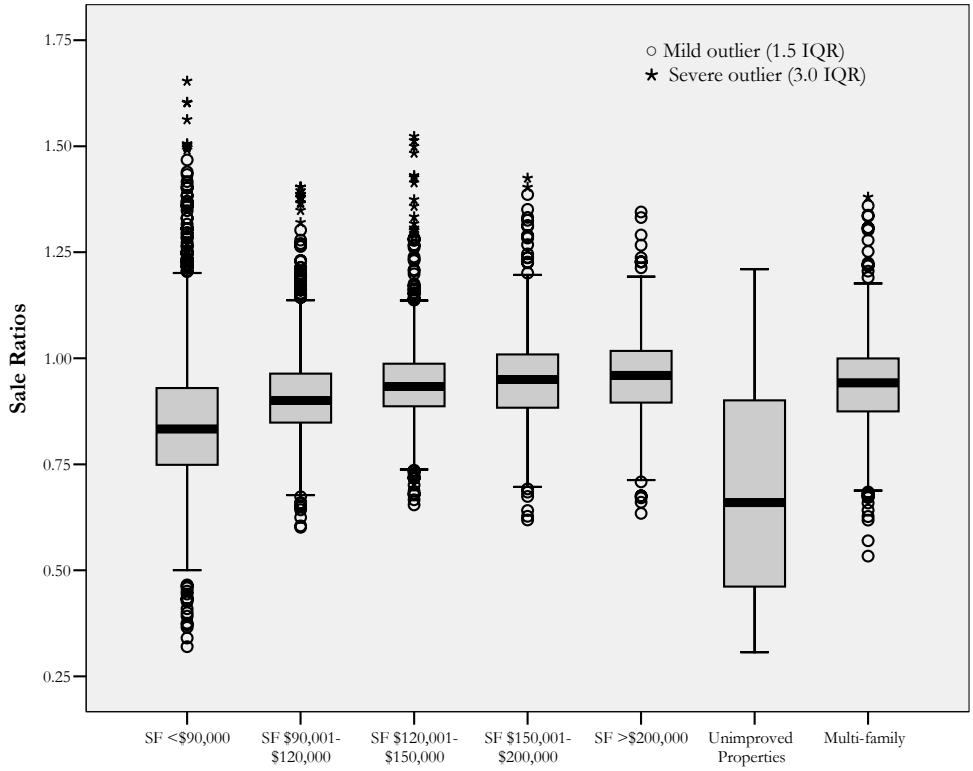
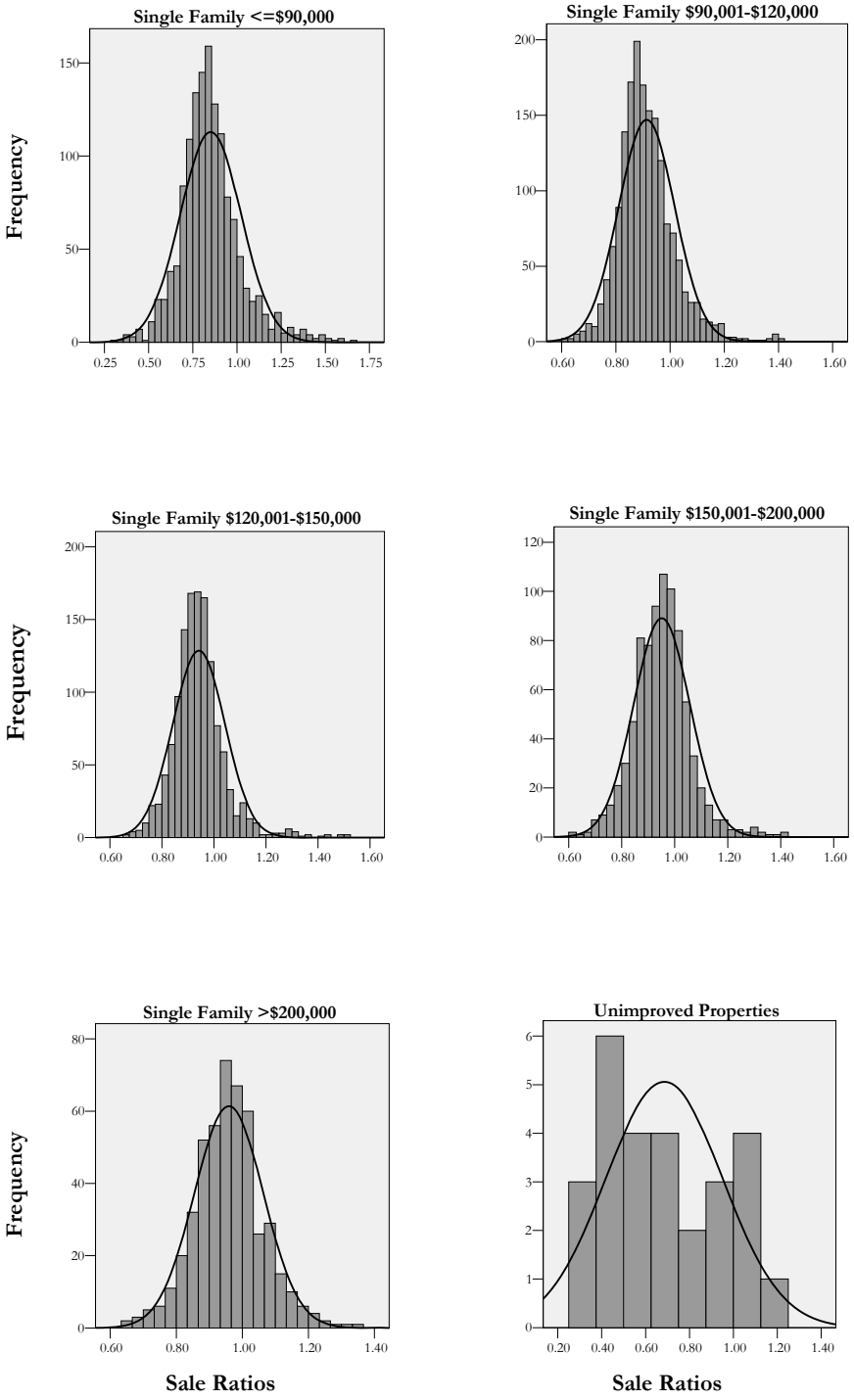


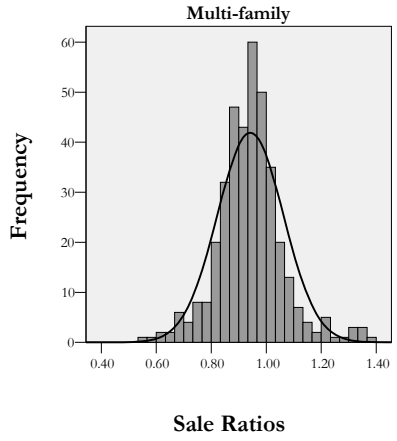

**Figure 2. Ratios after Outlier Trimming**



## Figure 3. Distribution of Final Sale Ratios



## Figure 3 (cont.). Distribution of Final Sale Ratios




## Shapiro-Francia W' Tests for Normality for Various Strata

| Strata | Observations | W' | V' | z | Prob* |
|---|---|---|---|---|---|
| Single Family | 5697 | 0.96385 | 41.072 | 3.267 | 0.00054 |
| Multi-family | 379 | 0.96043 | 11.083 | 5.085 | 0.00001 |
| Unimproved Properties | 27 | 0.94688 | 1.725 | 0.994 | 0.16003 |
| Single Family <=$90,000 | 1368 | 0.95363 | 39.580 | 7.142 | 0.00001 |
| Single Family $90,001-$120,000 | 1719 | 0.95352 | 45.841 | 7.032 | 0.00001 |
| Single Family $120,001-$150,000 | 1297 | 0.91849 | 66.950 | 7.981 | 0.00001 |
| Single Family $150,001-$200,000 | 830 | 0.97139 | 16.260 | 5.890 | 0.00001 |
| Single Family >$200,000 | 483 | 0.98957 | 3.630 | 2.816 | 0.00243 |
| Overall Un-weighted | 6103 | 0.96298 | 41.434 | 3.003 | 0.00134 |
| *This value represents the indicated probability that the underlying population is normally distributed. A value of less than .05 indicates a distribution that is not normal. | | | | | |

## Skewness and Kurtosis Test for Normality for Strata with more than 5,000 Observations

| Strata | Pr(Skewness) | Pr(Kurtosis) | Chi2(2) | Prob>chi2* |
|---|---|---|---|---|
| Single Family | 0.000 | 0.000 | 492.71 | 0.0000 |
| Overall Un-weighted | 0.000 | 0.000 | 516.73 | 0.0000 |
| *This value represents the indicated probability that the underlying population is normally distributed. A value of less than .05 indicates a distribution that is not normal. | | | | |

## Table 2. Sales Ratio Analysis: Stratified by Property Use

| | | Group | | | |
|---|---|---|---|---|---|
| | | Single Family | Unimproved Properties | Multi-family | Overall Un-weighted |
| Number of Sales | | 5697 | 27 | 379 | 6103 |
| Median | | .912 | .659 | .942 | .914 |
| 95% Confidence Interval for Median | Lower Bound | .909 | .473 | .928 | .911 |
| | Upper Bound | .915 | .891 | .956 | .917 |
| Weighted Mean | | .914 | .644 | .933 | .915 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .911 | .540 | .920 | .911 |
| | Upper Bound | .917 | .747 | .947 | .918 |
| Minimum | | .320 | .307 | .534 | .307 |
| Maximum | | 1.653 | 1.210 | 1.380 | 1.653 |
| Std. Deviation | | .129 | .266 | .120 | .131 |
| Price Related Differential | | 1.001 | 1.064 | 1.010 | 1.001 |
| Coefficient of Dispersion | | .103 | .341 | .092 | .103 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 48.4% | 18.5% | 58.3% | 48.8% |

## Table 3. Combined Results – Post Stratification and Weighting

| | **Population Assessor's Value** | **Median** | **Estimated Actual Value** | **% of Total Est. Mkt. Value** | **Subtotal** |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Single Family | 7,315,743,000 | 0.912 | 8,021,648,026 | 89.3% | 0.815 |
| Unimproved Properties | 124,460,840 | 0.659 | 188,863,187 | 2.1% | 0.014 |
| Multi-family | 723,948,100 | 0.942 | 768,522,399 | 8.6% | 0.081 |
| Total | 8,164,151,940 | | 8,979,033,612 | 100.0% | 90.9% |

| | **Population Assessor's Value** | **Weighted Mean** | **Estimated Actual Value** | **% of Total Est. Mkt. Value** | **Subtotal** |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Single Family | 7,315,743,000 | 0.914 | 8,004,095,186 | 89.2% | 0.815 |
| Unimproved Properties | 124,460,840 | 0.644 | 193,262,174 | 2.2% | 0.014 |
| Multi-family | 723,948,100 | 0.933 | 775,935,798 | 8.6% | 0.081 |
| Total | 8,164,151,940 | | 8,973,293,158 | 100.0% | 91.0% |

## Table 4. Sales Ratio Analysis: Stratified by Use and Value

| | | Strata | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | SF < $90,000 | SF $90,001-$120,000 | SF $120,001 - $150,000 | SF $150,001 - $200,000 | SF > $200,000 | Un-improved Property | Multi-family | Overall Un-weighted |
| Number of Sales | | 1368 | 1719 | 1297 | 830 | 483 | 27 | 379 | 6103 |
| Median | | .833 | .901 | .934 | .950 | .960 | .659 | .942 | .914 |
| 95% Confidence Interval for Median | Lower Bound | .826 | .896 | .929 | .943 | .951 | .473 | .928 | .911 |
| | Upper Bound | .843 | .906 | .939 | .959 | .967 | .891 | .956 | .917 |
| Weighted Mean | | .831 | .904 | .932 | .940 | .948 | .644 | .933 | .915 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .823 | .899 | .927 | .932 | .937 | .540 | .920 | .911 |
| | Upper Bound | .839 | .908 | .938 | .947 | .958 | .747 | .947 | .918 |
| Minimum | | .320 | .601 | .654 | .619 | .634 | .307 | .534 | .307 |
| Maximum | | 1.653 | 1.404 | 1.523 | 1.425 | 1.345 | 1.210 | 1.380 | 1.653 |
| Std. Deviation | | .173 | .104 | .101 | .106 | .105 | .266 | .120 | .131 |
| Price Related Differential | | 1.025 | 1.011 | 1.010 | 1.012 | 1.012 | 1.064 | 1.010 | 1.001 |
| Coefficient of Dispersion | | .149 | .085 | .075 | .083 | .083 | .341 | .092 | .103 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 24.3% | 45.1% | 62.2% | 63.5% | 64.6% | 18.5% | 58.3% | 48.8% |

## Table 5. Combined Results – Post Stratification and Weighting

| | Population Assessor's Value | Median | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Single Family <=$90,000 | 1,013,091,600 | 0.833 | 1,216,196,399 | 13.6% | 0.114 |
| Single Family $90,001 - $120,000 | 1,680,484,900 | 0.901 | 1,865,133,074 | 20.9% | 0.188 |
| Single Family $120,001 - $150,000 | 1,561,911,800 | 0.934 | 1,672,282,441 | 18.8% | 0.175 |
| Single Family $150,001 - $200,000 | 1,494,075,100 | 0.95 | 1,572,710,632 | 17.6% | 0.168 |
| Single Family >$200,000 | 1,566,179,600 | 0.96 | 1,631,437,083 | 18.3% | 0.176 |
| Unimproved Properties | 124,460,840 | 0.659 | 188,863,187 | 2.1% | 0.014 |
| Multi-family | 723,948,100 | 0.942 | 768,522,399 | 8.6% | 0.081 |
| Total | 8,164,151,940 | | 8,915,145,215 | 100.0% | 91.6% |

| | Population Assessor's Value | Weighted Mean | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Single Family <=$90,000 | 1,013,091,600 | 0.831 | 1,219,123,466 | 13.6% | 0.113 |
| Single Family $90,001 - $120,000 | 1,680,484,900 | 0.904 | 1,858,943,473 | 20.7% | 0.187 |
| Single Family $120,001 - $150,000 | 1,561,911,800 | 0.932 | 1,675,871,030 | 18.7% | 0.174 |
| Single Family $150,001 - $200,000 | 1,494,075,100 | 0.94 | 1,589,441,596 | 17.7% | 0.167 |
| Single Family >$200,000 | 1,566,179,600 | 0.948 | 1,652,088,186 | 18.4% | 0.175 |
| Unimproved Properties | 124,460,840 | 0.644 | 193,262,174 | 2.2% | 0.014 |
| Multi-family | 723,948,100 | 0.933 | 775,935,798 | 8.7% | 0.081 |
| Total | 8,164,151,940 | | 8,964,665,723 | 100.0% | 91.1% |

## Table 6. Sales Ratio Analysis: Stratified by Location

| | | Strata | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Kearney R-1 | Smithville R-II | Excelsior Springs 40 | Liberty 53 | North Kansas City 74 | Other | Overall Un-weighted |
| Number of Sales | | 413 | 304 | 366 | 1368 | 3603 | 49 | 6103 |
| Median | | .904 | .917 | .865 | .918 | .915 | .906 | .914 |
| 95% Confidence Interval for Median | Lower Bound | .893 | .900 | .843 | .913 | .911 | .869 | .911 |
| | Upper Bound | .921 | .929 | .883 | .923 | .920 | .957 | .917 |
| Weighted Mean | | .898 | .915 | .882 | .913 | .921 | .896 | .915 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .886 | .903 | .864 | .907 | .917 | .854 | .911 |
| | Upper Bound | .909 | .927 | .899 | .919 | .925 | .939 | .918 |
| Minimum | | .435 | .307 | .341 | .463 | .320 | .360 | .307 |
| Maximum | | 1.604 | 1.357 | 1.563 | 1.403 | 1.653 | 1.213 | 1.653 |
| Std. Deviation | | .125 | .131 | .193 | .107 | .131 | .153 | .131 |
| Price Related Differential | | 1.009 | .991 | .992 | 1.001 | 1.001 | .987 | 1.001 |
| Coefficient of Dispersion | | .098 | .101 | .169 | .086 | .104 | .125 | .103 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 48.7% | 52.3% | 30.3% | 53.9% | 48.5% | 49.0% | 48.8% |

## Table 7. Combined Results – Post Stratification and Weighting

| | Population Assessor's Value | Median | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Kearney R-I | 726,463,300 | 0.904 | 803,609,845 | 9.0% | 0.081 |
| Smithville R-II | 415,913,300 | 0.917 | 453,558,670 | 5.1% | 0.046 |
| Excelsior Springs 40 | 370,841,900 | 0.865 | 428,718,960 | 4.8% | 0.041 |
| Liberty 53 | 1,864,624,300 | 0.918 | 2,031,181,155 | 22.7% | 0.208 |
| North Kansas City 74 | 4,671,442,340 | 0.915 | 5,105,401,464 | 57.0% | 0.522 |
| Other | 114,866,800 | 0.906 | 126,784,547 | 1.4% | 0.013 |
| Total | 8,164,151,940 | | 8,949,254,641 | 100.0% | 91.2% |

| | Population Assessor's Value | Weighted Mean | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Kearney R-I | 726,463,300 | 0.898 | 808,979,176 | 9.1% | 0.081 |
| Smithville R-II | 415,913,300 | 0.915 | 454,550,055 | 5.1% | 0.047 |
| Excelsior Springs 40 | 370,841,900 | 0.882 | 420,455,669 | 4.7% | 0.042 |
| Liberty 53 | 1,864,624,300 | 0.913 | 2,042,304,819 | 22.9% | 0.209 |
| North Kansas City 74 | 4,671,442,340 | 0.921 | 5,072,141,520 | 56.8% | 0.523 |
| Other | 114,866,800 | 0.896 | 128,199,554 | 1.4% | 0.013 |
| Total | 8,164,151,940 | | 8,926,630,792 | 100.0% | 91.5% |

## Table 8. Sales Ratio Analysis: Stratified by Age

| | | Strata | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Un-improved Prop-erties | Multi-family | Built before 1950 | Built 1950s | Built 1960s | Built 1970s | Built 1980s | Built 1990 thru 1995 | Built 1996 and newer | Overall Un-weighted |
| Number of Sales | | 27 | 379 | 619 | 892 | 875 | 633 | 580 | 822 | 1276 | 6103 |
| Median | | .659 | .942 | .829 | .900 | .907 | .916 | .922 | .922 | .923 | .914 |
| 95% Confidence Interval for Median | Lower Bound | .473 | .928 | .809 | .889 | .897 | .903 | .912 | .916 | .918 | .911 |
| | Upper Bound | .891 | .956 | .847 | .909 | .916 | .927 | .933 | .929 | .928 | .917 |
| Weighted Mean | | .644 | .933 | .831 | .901 | .911 | .920 | .931 | .929 | .922 | .915 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .540 | .920 | .815 | .892 | .903 | .910 | .923 | .922 | .916 | .911 |
| | Upper Bound | .747 | .947 | .847 | .910 | .920 | .929 | .939 | .936 | .928 | .918 |
| Minimum | | .307 | .534 | .320 | .366 | .577 | .451 | .684 | .658 | .619 | .307 |
| Maximum | | 1.210 | 1.380 | 1.653 | 1.523 | 1.416 | 1.484 | 1.374 | 1.313 | 1.289 | 1.653 |
| Std. Deviation | | .266 | .120 | .217 | .148 | .128 | .118 | .096 | .085 | .087 | .131 |
| Price Related Differential | | 1.064 | 1.010 | 1.029 | 1.005 | 1.009 | 1.007 | 1.000 | .995 | 1.006 | 1.001 |
| Coefficient of Dispersion | | .341 | .092 | .198 | .124 | .108 | .096 | .079 | .070 | .072 | .103 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 18.5% | 58.3% | 24.1% | 41.9% | 43.4% | 47.4% | 55.2% | 57.4% | 59.6% | 48.8% |

## Table 9. Combined Results – Post Stratification and Weighting

| | Population Assessor's Value | Median | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Unimproved Properties | 124,460,840 | 0.659 | 188,863,187 | 2.1% | 0.014 |
| Multi-family | 723,948,100 | 0.942 | 768,522,399 | 8.5% | 0.080 |
| Built before 1950 | 542,513,800 | 0.829 | 654,419,542 | 7.3% | 0.060 |
| Built 1950s | 926,484,800 | 0.9 | 1,029,427,556 | 11.4% | 0.103 |
| Built 1960s | 1,052,767,500 | 0.907 | 1,160,713,892 | 12.9% | 0.117 |
| Built 1970s | 909,361,800 | 0.916 | 992,753,057 | 11.0% | 0.101 |
| Built 1980s | 922,568,000 | 0.922 | 1,000,616,052 | 11.1% | 0.102 |
| Built 1990 thru 1995 | 1,041,566,000 | 0.922 | 1,129,681,128 | 12.5% | 0.116 |
| Built 1996 and newer | 1,920,341,500 | 0.923 | 2,080,543,337 | 23.1% | 0.213 |
| Total | 8,164,012,340 | | 9,005,540,149 | 100.0% | 90.7% |

| | Population Assessor's Value | Weighted Mean | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Unimproved Properties | 124,460,840 | 0.644 | 193,262,174 | 2.1% | 0.014 |
| Multi-family | 723,948,100 | 0.933 | 775,935,798 | 8.6% | 0.081 |
| Built before 1950 | 542,513,800 | 0.831 | 652,844,525 | 7.3% | 0.060 |
| Built 1950s | 926,484,800 | 0.901 | 1,028,285,017 | 11.4% | 0.103 |
| Built 1960s | 1,052,767,500 | 0.911 | 1,155,617,453 | 12.9% | 0.117 |
| Built 1970s | 909,361,800 | 0.92 | 988,436,739 | 11.0% | 0.101 |
| Built 1980s | 922,568,000 | 0.931 | 990,943,072 | 11.0% | 0.103 |
| Built 1990 thru 1995 | 1,041,566,000 | 0.929 | 1,121,168,999 | 12.5% | 0.116 |
| Built 1996 and newer | 1,920,341,500 | 0.922 | 2,082,799,892 | 23.2% | 0.214 |
| Total | 8,164,012,340 | | 8,989,293,669 | 100.0% | 90.8% |

**Table 10. Sales Ratio Analysis: Stratified by Town and Rural Lots**

| | | Strata | | |
|---|---|---|---|---|
| | | Rural Lots | Town Lots | Overall Un-weighted |
| Number of Sales | | 282 | 5821 | 6103 |
| Median | | .880 | .915 | .914 |
| 95% Confidence Interval for Median | Lower Bound | .867 | .912 | .911 |
| | Upper Bound | .895 | .918 | .917 |
| Weighted Mean | | .884 | .917 | .915 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .869 | .914 | .911 |
| | Upper Bound | .899 | .920 | .918 |
| Minimum | | .307 | .320 | .307 |
| Maximum | | 1.604 | 1.653 | 1.653 |
| Std. Deviation | | .161 | .129 | .131 |
| Price Related Differential | | 1.004 | 1.000 | 1.001 |
| Coefficient of Dispersion | | .131 | .102 | .103 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 35.1% | 49.5% | 48.8% |

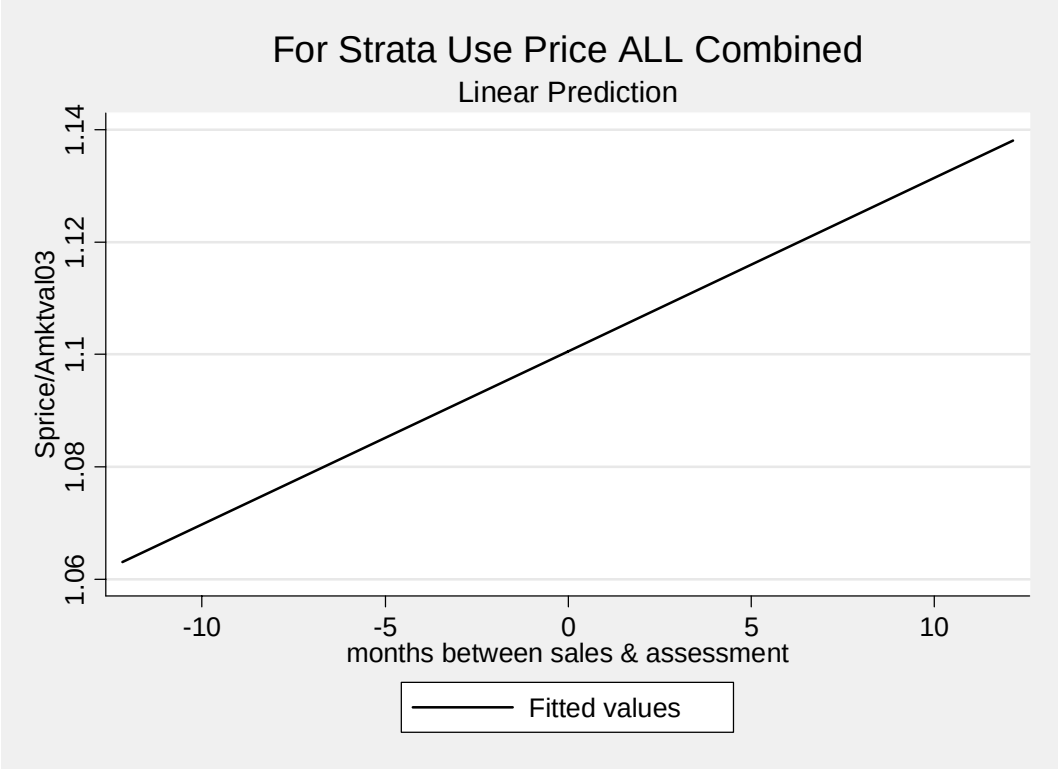
**Table 11. Combined Results – Post Stratification and Weighting**

| | **Population Assessor's Value** | **Median** | **Estimated Actual Value** | **% of Total Est. Mkt. Value** | **Subtotal** |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Town Lot | 7,396,088,640 | 0.915 | 8,083,156,984 | 90.3% | 0.826 |
| Rural Lot | 768,063,300 | 0.88 | 872,799,205 | 9.7% | 0.086 |
| Total | 8,164,151,940 | | 8,955,956,188 | 100.0% | 91.2% |

| | **Population Assessor's Value** | **Weighted Mean** | **Estimated Actual Value** | **% of Total Est. Mkt. Value** | **Subtotal** |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Town Lot | 7,396,088,640 | 0.917 | 8,065,527,415 | 90.3% | 0.828 |
| Rural Lot | 768,063,300 | 0.884 | 868,849,887 | 9.7% | 0.086 |
| Total | 8,164,151,940 | | 8,934,377,302 | 100.0% | 91.4% |

**Graph 1. Single Family Property Price Trend**

A thorough analysis of price-time trends by price strata determined that adjusting reported prices was desirable for all single family properties combined. The prices for these strata ranged from $12,000 - $850,000. The resultant trend and statistical analysis is shown below.




**Price Trend Regression Statistics**

| Source | SS | df | MS | | |
|---|---|---|---|---|---|
| Model | 2.44441269 | 1 | 2.44441269 | Number of obs = 5530 | R-squared = 0. 0224 |
| Residual | 106.682162 | 5528 | .01929851 | F( 1, 5528) = 126.66 | Adj R-squared= 0. 0222 |
| Total | 109.126575 | 5529 | .019737127 | Prob > F = 0. 0000 | Root MSE = .13892 |

| _aratio | Coef. | Std. Err. | T | P> t | [80% Conf. Interval] | |
|---|---|---|---|---|---|---|
| _adjperiod | .0030882 | .0002744 | 11.25 | 0.000 | .0027365 | .0034399 |
| _cons | 1.100584 | .0018697 | 588.64 | 0.000 | 1.098188 | 1.10298 |
| Monthly adjustment rate=.00280596 | | | | Annualized adjustment rate=.03367152 | | |

# Chapter 5. Cole County

## 1. Significant Findings

1.1 Assessment Level: Cole County's 2003 residential property assessments were approximately 95% of market value (Section 3.5). The results from the corresponding STC study are invalid because the STC's appraisals did not meet the requirement that they reflect market values (Section 4.3). Furthermore, the STC's sample is not representative of residential property for the county (Section 4.2).

1.2 Assessment Equity: Multi-family properties are assessed less uniformly and at a lower level than single-family properties (Section 3.6 and Table 2).

1.3 Reassessment History: Cumulatively, the reassessments from 1997 through 2003 produced 77% of the expected rise in assessments. The net change in assessments in 2001 raises questions regarding whether any serious revaluation occurred in 2001 while the high level of change in 2003 suggested that this was corrected in 2003 (Section 5.1).

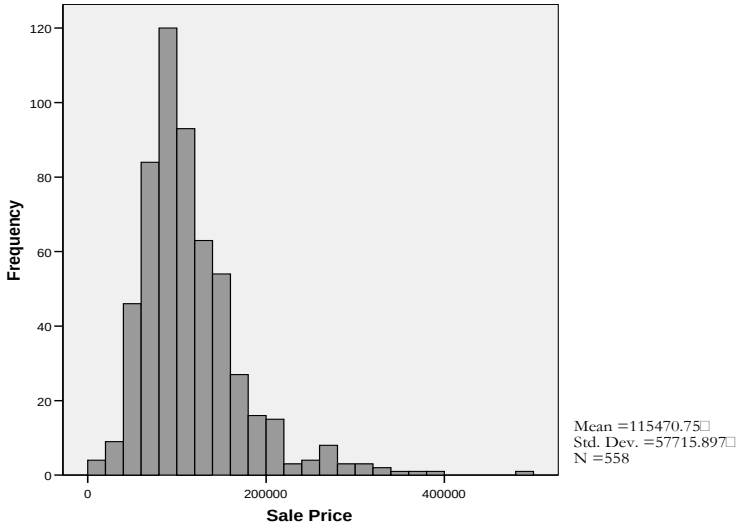
1.4 Sale Validation: The Cole County Assessor provided detailed results that suggested a portion of our sample included sales that Cole County did not use in their models. We tested whether the inclusion or exclusion of these sales would produce a material effect and found none. Therefore, we included these sales for reasons of procedural consistency

## 2. Data and Related Issues

2.1 Assessment Data: Sales and assessment information was available in electronic format. Sales were matched using a combination of computer techniques and software and then screened. The assessor answered all questions regarding the contents and coding of data when requested. The files received contained information allowing us to identify properties affected by new construction and to screen as appropriate.

2.2 Sales and Ratio Data: The distribution of sale prices used is reflected in the following histogram.

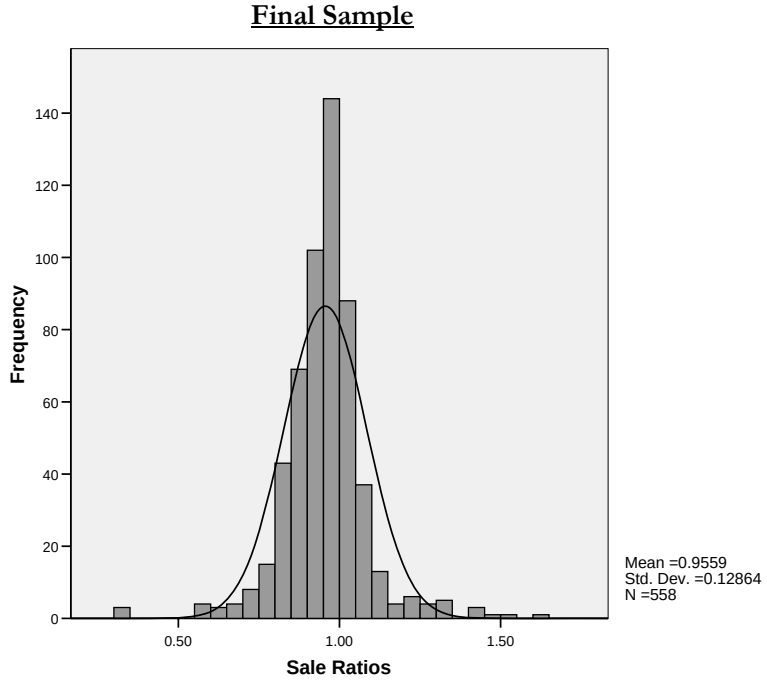
**Sale Prices for Final Sale Sample**



The next table reports results of the data screening and trimming process. The "screened sales" represent the initial screened sample. The screened sales that were excluded from the final analysis because their ratios were deemed unrepresentative are identified as high or low trims. The "remaining ratios" represent the sample on which all the study's results are based.

| Trimming of Outliers | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Single Family <=$79,000 | Single Family $79,001 - $95,000 | Single Family $95,001 - $116,000 | Single Family $116,001 - $158,000 | Single Family >$158,000 | Unimproved Properties | Multi-family | Total |
| **Screened Sales** | | 150 | 100 | 108 | 105 | 74 | 7 | 46 | 590 |
| Excluded | High Trims | 5 | 1 | 4 | 0 | 0 | 0 | 10 | 20 |
| | Low Trims | 5 | 1 | 1 | 0 | 0 | 0 | 5 | 12 |
| **Remaining Ratios** | | **140** | **98** | **103** | **105** | **74** | **7** | **31** | **558** |

The histogram below shows the distribution of the ratios for the sample.




2.3 Population: Since a complete copy of the 2003 assessment rolls in electronic form was available, we were able to analyze the county's population in detail. This allowed us to stratify and weight sales on a variety of property and location characteristics.

## 3. Ratio Study Results

3.1 The Sample: The following table shows that three of the strata, the two largest single-family strata and the multifamily stratum, vary by more than 3 percent from the population. However, upon closer examination, this variance has no material effect on the overall level of assessment and thus we conclude that the un-stratified sample is sufficiently representative of the population.

| Comparing Representivity | | | | | | |
|---|---|---|---|---|---|---|
| | Population Distribution | | | PPRC 2003 Sale Sample | | |
| Strata | N | $ | $ Weight | N | $ | $ Weight |
| Single Family <=$79,000 | 5,785 | 310,030,250 | 13.1% | 140 | 8,928,700 | 14.8% |
| Single Family $79,001-$95,000 | 3,358 | 292,303,600 | 12.3% | 98 | 8,479,100 | 14.1% |
| Single Family $95,001-$116,000 | 3,337 | 348,311,200 | 14.7% | 103 | 1,078,600 | 17.9% |
| Single Family $116,001-$158,000 | 3,502 | 471,086,600 | 19.9% | 105 | 14,142,700 | 23.5% |
| Single Family >$158,000 | 3,353 | 740,534,000 | 31.3% | 74 | 15,489,200 | 25.7% |
| Unimproved Properties | 2,916 | 29,459,400 | 1.2% | 7 | 176,000 | 0.3% |
| Multi-family | 1,419 | 176,873,800 | 7.5% | 31 | 2,209,200 | 3.7% |
| Total | 23,670 | 2,368,598,850 | | 558 | 60,210,900 | |

3.2 Representing the Population with the Sample: Since the un-stratified sample is sufficiently representative of the population (Section 3.1), the use of stratification and weighting is not essential. Nevertheless, we used stratification because it produces additional analytical benefits and further optimizes representivity.

3.3 Sold versus Unsold Properties: Examinations showed the effects of an assessment procedure that would have produced a biased result in the ratio study. This was avoided by the selection of a sales period where the effect was absent.

3.4 Study Validity: The sample meets the requirements for producing valid inferences about the county's population of residential properties.

3.5 Assessment Level: Measures of the assessment level are summarized below. For the purposes of this study, the weighted mean from combined stratification is the preferred measure as long as both of the requirements from using the weighted mean are met. In this case, the distributions are not normal (Figure 3) and weighting is compromised by the use of seriously undersized samples. Since both requirements are not met, we focus on the median, though taking notice of the weighted mean, to conclude that the County's assessments for 2003 reflect approximately 95% of market value.

| Assessment Level (Based on Percent of Market Value) | | | | |
|---|---|---|---|---|
| | Stratification and Weighting | Reference | Weighted Mean | Median |
| **Overall Un-weighted** | None | Table 2 | 94.2% | 96.2% |
| **Combined** | By Property Use | Table 3 | 93.3% | 95.4% |
| **Combined** | By Property Use and Value Range | Table 5 | 93.3% | 95.3% |
| **Combined** | By Property Location | Table 7 | 94.0% | 96.0% |
| **Combined** | By Property Age | Table 9 | 93.7% | 96.1% |
| **Combined** | By Town and Rural Lots | Table 11 | 93.9% | 96.0% |

3.6 Equity Measures and Evaluation:

i. Uniformity within Strata: Tables 2, 4, 6, 8 & 10 show results for individual strata of sufficient sample size for evaluation. The following strata represent problem areas for internal uniformity.

| Strata with Inadequate Uniformity | |
|---|---|
| **Property Strata** | **COD** |
| Multi-family | 25.1% |

ii. Uniformity between Strata: Another form of inequity exists when different strata are assessed at different levels. The IAAO has established guidelines for identifying such inequity, but compliance can be heavily affected by sample size and uniformity. Therefore, we confine our remarks to identifying where assessment levels differ markedly from the norm. The difference in assessment level (medians) between the multi-family and single-family strata (84.7% versus 96.4% respectively, Table 3) is substantial.

iii. Vertical Equity: The final form of potential inequity examined is vertical equity. The PRD for the overall sample of 1.014 complies with the IAAO standard.

## 4. STC Study

4.1 Comparative Results: The following table contrasts our results with those from the STC study. The STC found the level of assessment adequate, as does ours. The STC reports a similarly acceptable horizontal equity measure and vertical equity measure. We have already demonstrated that the PPRC study meets the criteria for achieving valid results. The rest of Section 4 examines the validity of the STC's study.

| Comparison of Study Results | | | |
|---|---|---|---|
| **Measure** | **STC Study*** | **PPRC Study*** | **PPRC Study Combined**** |
| Assessment Level - median | 104.1% | 96.2% | 95.3% |
| Assessment Level - wtd. mean | 104.9% | 94.2% | 93.3% |
| COD | 17.2% | 8.9% | |
| PRD | 0.97 | 1.01 | |
| Sample Size | 40 | 558 | |
| Relative Precision | 1.00 | 3.74 | |
| * Overall sample (un-stratified and un-weighted) | | | |
| ** Stratification and weighting by Property Use and Value Range | | | |

4.2 Representing the Population with the Sample: The STC does not examine the representivity of its sample, nor does it have the necessary sample size or information to do so. Therefore, in the following table, we provide that missing analysis. In this case, the table shows that two of the strata in the STC sample, the two lowest single-family value strata, vary by more than 3 percent from the population. Furthermore, the STC sample does not contain any multifamily properties. Upon closer examination, this variance has a material effect on the results and thus we conclude that the STC sample is insufficiently representative of the population.

| Comparing Representivity | | | | | | |
|---|---|---|---|---|---|---|
| | Population | | | STC 2003 Appraisals | | |
| Strata | N | $ | % | N | $ | % |
| Single Family <=$79,000 | 5,785 | 310,030,250 | 13.1% | 18 | 934,526 | 26.6% |
| Single Family $79,001-$95,000 | 3,358 | 292,303,600 | 12.3% | 2 | 175,474 | 5.0% |
| Single Family $95,001-$116,000 | 3,337 | 348,311,200 | 14.7% | 5 | 515,789 | 14.7% |
| Single Family $116,001-$158,000 | 3,502 | 471,086,600 | 19.9% | 5 | 698,316 | 19.9% |
| Single Family >$158,000 | 3,353 | 740,534,000 | 31.3% | 5 | 1,110,526 | 31.7% |
| Unimproved Properties | 2,916 | 29,459,400 | 1.2% | 5 | 72,947 | 2.1% |
| Multi-family | 1,419 | 176,873,800 | 7.5% | 0 | 0 | 0.0% |
| Total | 23,670 | 2,368,598,850 | | 40 | 3,507,579 | |

4.3 Market Value: The final requirement for producing a valid appraisal study is that appraisals must represent market values. As discussed in the introduction for this Section II, and in greater depth in the Procedure Manual (Section III), we use 4 tests to make this determination. The results of each test are reported in the following tables.

| Mann-Whitney Test | | | | |
|---|---|---|---|---|
| For the Entire Sample | | | | |
| Study | Observations | Rank sum | Expected | Ho: Ratios (40 STC Appraisals)=Ratios (558 Sales)<br>z = 3.161<br>Prob > \|z\| = 0.0016 |
| 0 | 40 | 15316 | 11980 | |
| 1 | 558 | 163785 | 167121 | |
| Combined | 598 | 179101 | 179101 | |
| For Single Family Properties Only | | | | |
| Study | Observations | Rank sum | Expected | Ho : Ratios (35 STC Appraisals)=Ratios (520 Sales)<br>z = 4.613<br>Prob > \|z\| = 0.0000 |
| 0 | 35 | 13966 | 9730 | |
| 1 | 520 | 140324 | 144560 | |
| Combined | 555 | 154290 | 154290 | |

| K-Sample Test | | | | |
|---|---|---|---|---|
| For the Entire Sample | | | | |
| Study | Not Greater than the median | Greater than the median | Total | Ho: Ratios (40 STC Appraisals)=Ratios(558 Sales)<br>Pearson chi2(1) = 6.8588 Pr = 0.009<br>Continuity corrected:<br>Pearson chi2(1) = 6.0282 Pr = 0.014 |
| 0 | 12 | 28 | 40 | |
| 1 | 287 | 271 | 558 | |
| Total | 299 | 299 | 598 | |
| For Single Family Properties Only | | | | |
| Study | Not Greater than the median | Greater than the median | Total | Ho: Ratios (35 STC Appraisals)=Ratios(520 Sales)<br>Pearson chi2(1) = 13.529 Pr = 0.000<br>Continuity corrected:<br>Pearson chi2(1) = 12.2749 Pr = 0.000 |
| 0 | 7 | 28 | 35 | |
| 1 | 271 | 249 | 520 | |
| Total | 278 | 279 | 555 | |

All four tests lead to the conclusion that the STC appraisals do not represent market values (all with 95% statistical confidence). Therefore, the STC study is invalid and its reported results are unreliable.

## 5. Additional Analysis and Findings

5.1 Analysis of Reassessment History: The following table provides a comparison of actual assessment changes (net of new construction) to those that might have been expected for each of the last four reassessments as well as the six-year period leading up to 2003. Two of the reassessments produced changes in line with the market indicator. The data shown raises questions about whether the reassessment of 2001 reflected changes in the market value. In our study, previous assessment information was available for Cole County, so we were able to test for the real reassessment rate. Using this information, we found evidence that a real reassessment took place in 2003.

**Actual Value Changes from Reassessment vs. Expected Value Change**

| Biennial Year | % Net Assessment Change | Missouri OFHEO Index | % Value Change: Actual vs. Expected | Jefferson City MSA OFHEO Index | % Value Change: Actual vs. Expected |
|---|---|---|---|---|---|
| 1999 | 8.0 | 8.4 | 95% | 9.1 | 87% |
| 2001 | -0.3 | 11.4 | -2% | 7.0 | -4% |
| 2003 | 10.8 | 11.8 | 91% | 7.2 | 150% |
| 2005 | 7.1 | 12.4 | 57% | 10.4 | 68% |
| Cumulative 1997 - 2003 | 19.3 | 35.0 | 55% | 25.1 | 77% |

## 6. Figures and Tables

**Table 1. STC's Appraisal Ratio Studies**

| | | Group | | | |
|---|---|---|---|---|---|
| | | 1999 | 2001 | 2003 | 2005* |
| Number of Appraisals | | 38 | 40 | 40 | 35 |
| Median | | .999 | 1.004 | 1.041 | .992 |
| 95% Confidence Interval | Lower Bound | .925 | .964 | .980 | .957 |
| for Median | Upper Bound | 1.036 | 1.050 | 1.102 | 1.014 |
| Weighted Mean | | .981 | .984 | 1.049 | 1.000 |
| 95% Confidence Interval | Lower Bound | .943 | .945 | .991 | .959 |
| for Weighted Mean | Upper Bound | 1.019 | 1.024 | 1.108 | 1.041 |
| Minimum | | .206 | .495 | .355 | .434 |
| Maximum | | 1.338 | 5.526 | 1.505 | 1.713 |
| Std. Deviation | | .202 | .758 | .251 | .207 |
| Price Related Differential | | .964 | 1.166 | .965 | .975 |
| Coefficient of Dispersion | | .132 | .245 | .172 | .123 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 57.9% | 52.5% | 40.0% | 62.9% |

* The STC has not completed its studies for the 2005 reassessment cycle. These results may not represent final values.

**Figure 1. Ratios before Outlier Trimming**

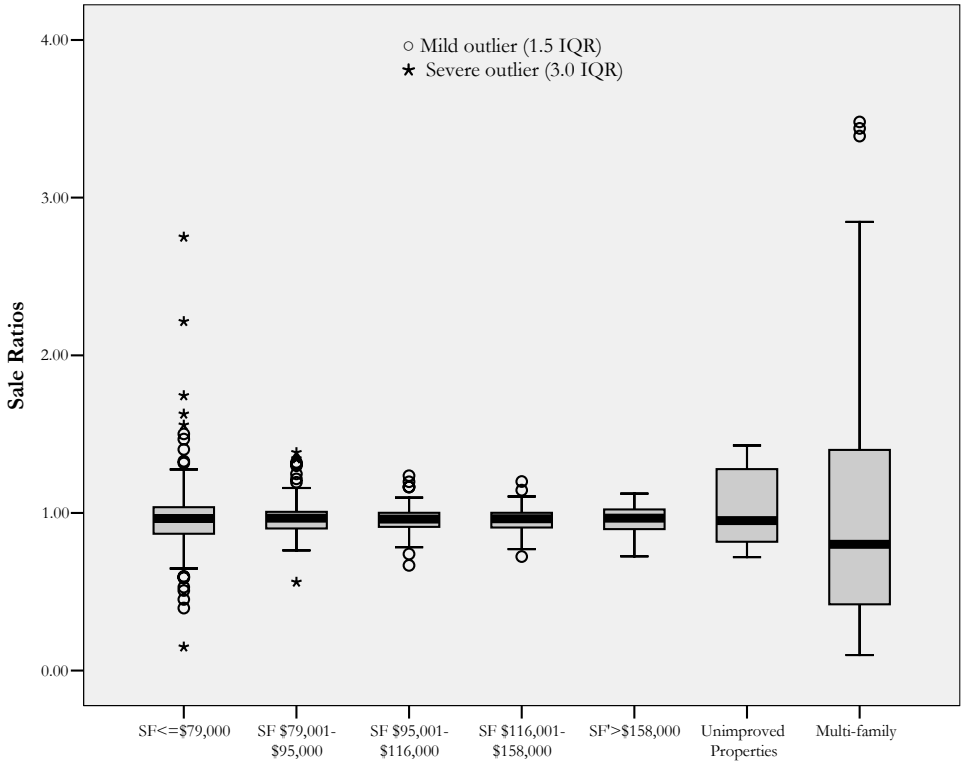
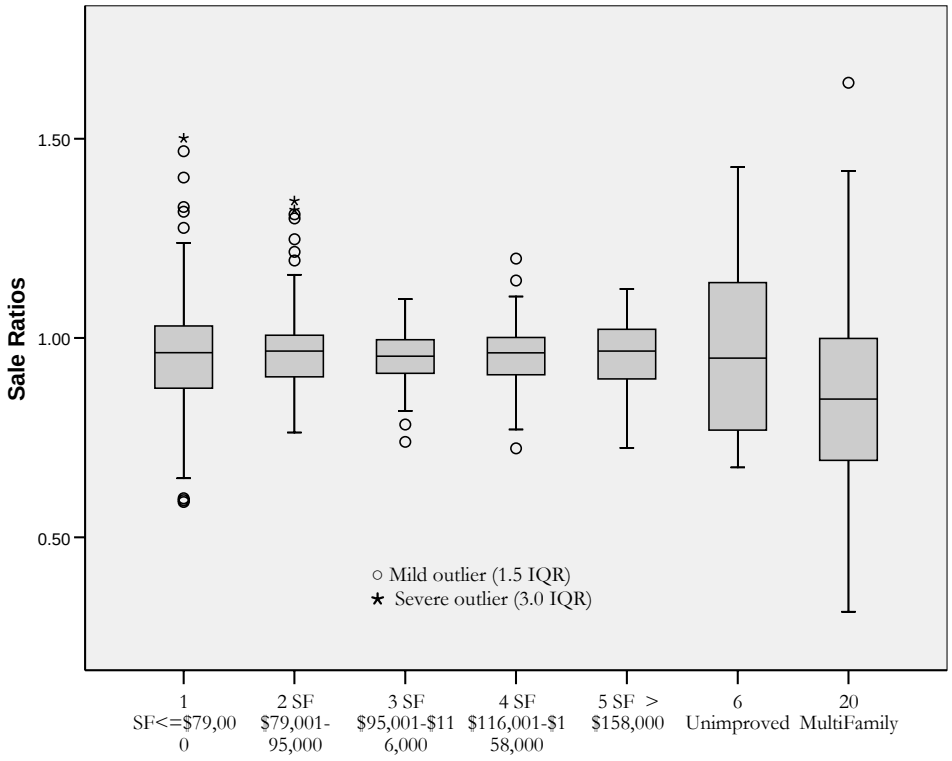
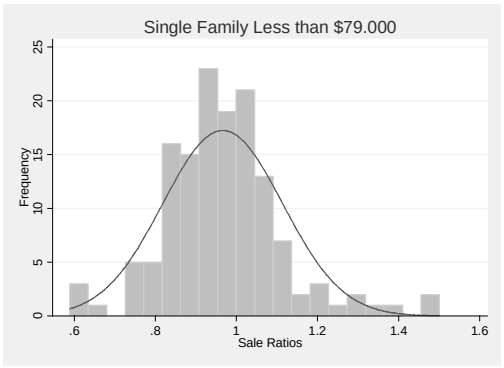
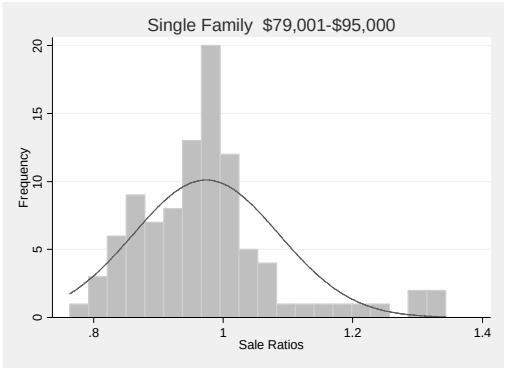


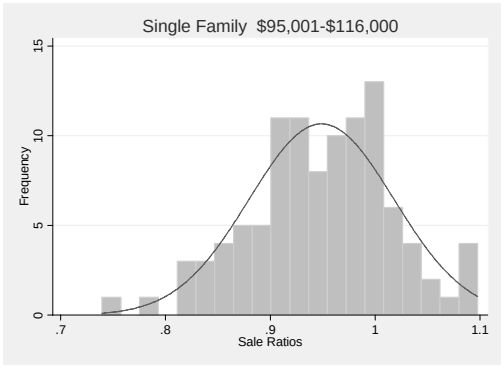

**Figure 2. Ratios after Outlier Trimming**

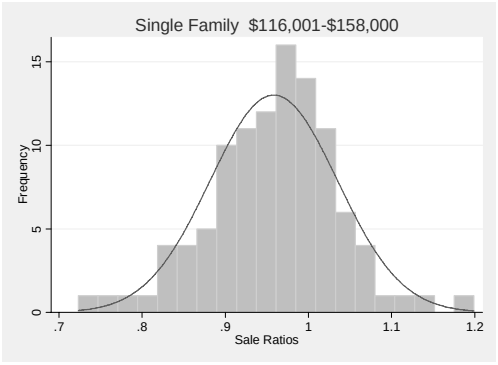


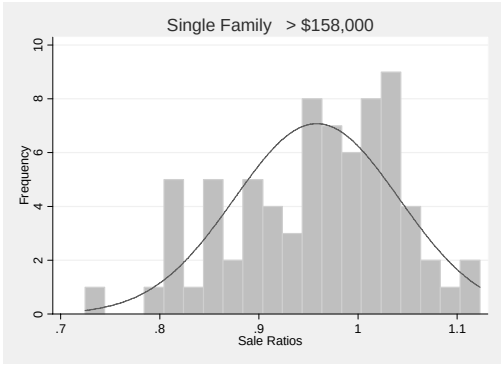
## Figure 3. Distribution of Final Sale Ratios

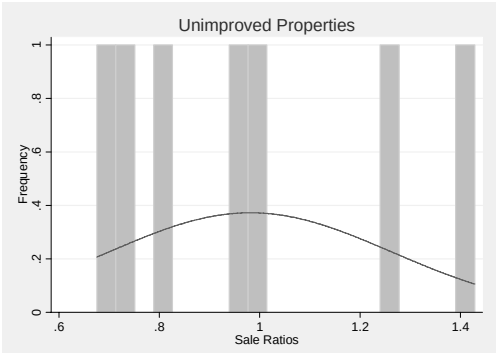


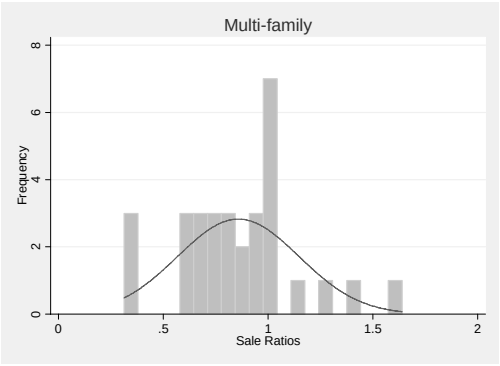



## Shapiro-Francia W' Tests for Normality for Various Strata

| Strata | Observations | W' | V' | z | Prob* |
|---|---|---|---|---|---|
| Single Family | 520 | 0.93412 | 24.514 | 6.710 | 0.00001 |
| Multi-family | 31 | 0.94770 | 1.881 | 1.163 | 0.12233 |
| Unimproved Properties | 7 | 0.3738 | 0.873 | -.200 | 0.57944 |
| Single Family <=$79,000 | 140 | 0.9787 | 6.218 | 3.660 | 0.00013 |
| Single Family $79,001-$95,000 | 98 | 0.89525 | 9.310 | 4.294 | 0.00001 |
| Single Family $95,001-$116,000 | 103 | 0.98931 | 0.990 | -0.021 | 0.50828 |
| Single Family $116,001-$158,000 | 105 | 0.97992 | 1.888 | 1.284 | 0.09954 |
| Single Family >$158,000 | 74 | 0.97839 | 1.529 | 0.841 | 0.20008 |
| Overall Un-weighted | 558 | 0.89810 | 40.425 | 7.669 | 0.00001 |

*This value represents the indicated probability that the underlying population is normally distributed. A value of less than .05 indicates a distribution that is not normal.

## Table 2. Sales Ratio Analysis: Stratified by Property Use

| | | Strata | | | |
|---|---|---|---|---|---|
| | | Single Family | Unimproved Properties | Multi-family | Overall Un-weighted |
| Number of Sales | | 520 | 7 | 31 | 558 |
| Median | | .964 | .950 | .847 | .962 |
| 95% Confidence Interval for Median | Lower Bound | .954 | .676 | .741 | .952 |
| | Upper Bound | .971 | 1.429 | .995 | .969 |
| Weighted Mean | | .952 | .937 | .751 | .942 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .943 | .742 | .627 | .932 |
| | Upper Bound | .960 | 1.132 | .876 | .953 |
| Minimum | | .589 | .676 | .314 | .314 |
| Maximum | | 1.501 | 1.429 | 1.640 | 1.640 |
| Std. Deviation | | .107 | .282 | .290 | .129 |
| Price Related Differential | | 1.010 | 1.047 | 1.142 | 1.014 |
| Coefficient of Dispersion | | .078 | .225 | .251 | .089 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 69.6% | 28.6% | 32.3% | 67.0% |

## Table 3. Combined Results – Post Stratification and Weighting

| | Population Assessed Value | Median | Estimated Market Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Single Family | 2,162,265,650 | 0.964 | 2,243,014,160 | 90.3% | 0.871 |
| Unimproved Properties | 29,459,400 | 0.95 | 31,009,895 | 1.2% | 0.012 |
| Multi-family | 176,873,800 | 0.847 | 208,823,849 | 8.4% | 0.071 |
| Total | 2,368,598,850 | | 2,482,847,903 | 100.0% | 95.4% |

| | Population Assessed Value | Weighted Mean | Estimated Market Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Single Family | 2,162,265,650 | 0.952 | 2,271,287,447 | 89.5% | 0.852 |
| Unimproved Properties | 29,459,400 | 0.937 | 31,440,128 | 1.2% | 0.012 |
| Multi-family | 176,873,800 | 0.751 | 235,517,710 | 9.3% | 0.070 |
| Total | 2,368,598,850 | | 2,538,245,285 | 100.0% | 93.3% |

## Table 4. Sales Ratio Analysis: Stratified by Use and Value

| | | Strata | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | SF <=$79,000 | SF $79,001-95,000 | SF $95,001-$116,000 | SF $116,001-$158,000 | SF > $158,000 | Un-improved | Multi-Family | Overall Un-weighted |
| Number of Sales | | 140 | 98 | 103 | 105 | 74 | 7 | 31 | 558 |
| Median | | .963 | .967 | .954 | .963 | .967 | .950 | 847 | .962 |
| 95% Confidence Interval for Median | Lower Bound | .935 | .946 | .929 | .947 | .950 | .676 | .741 | .952 |
| | Upper Bound | .995 | .979 | .972 | .980 | .993 | 1.429 | .995 | .969 |
| Weighted Mean | | .950 | .962 | .943 | .952 | .952 | .937 | .751 | .942 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .928 | .942 | .929 | .937 | .933 | .742 | .627 | .932 |
| | Upper Bound | .973 | .982 | .957 | .968 | .972 | 1.132 | .876 | .953 |
| Minimum | | .589 | .763 | .739 | .723 | .724 | .676 | .314 | .314 |
| Maximum | | 1.501 | 1.344 | 1.098 | 1.199 | 1.123 | 1.429 | 1.640 | 1.640 |
| Std. Deviation | | .148 | .112 | .069 | .077 | .083 | .282 | .290 | .129 |
| Price Related Differential | | 1.016 | 1.012 | 1.006 | 1.007 | 1.007 | 1.047 | 1.142 | 1.014 |
| Coefficient of Dispersion | | .111 | .080 | .057 | .060 | .069 | .225 | .251 | .089 |
| Coefficient of Concentration | Percent between 0.9 and 1.1 inclusive | 58.6% | 66.3% | 79.6% | 77.1% | 70.3% | 28.6% | 32.3% | 67.0% |

## Table 5. Combined Results – Post Stratification and Weighting

| | Population Assessed Value | Median | Estimated Market Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Single Family <=$79,000 | 310,030,250 | 0.963 | 321,942,108 | 13.0% | 0.125 |
| Single Family $79,001 - $95,000 | 292,303,600 | 0.967 | 302,278,800 | 12.2% | 0.118 |
| Single Family $95,001 - $116,000 | 348,311,200 | 0.954 | 365,106,080 | 14.7% | 0.140 |
| Single Family $116,001 - $158,000 | 471,086,600 | 0.963 | 489,186,501 | 19.7% | 0.190 |
| Single Family >$158,000 | 740,534,000 | 0.967 | 765,805,584 | 30.8% | 0.298 |
| Unimproved Properties | 29,459,400 | 0.95 | 31,009,895 | 1.2% | 0.012 |
| Multi-family | 176,873,800 | 0.847 | 208,823,849 | 8.4% | 0.071 |
| Total | 2,368,598,850 | | 2,484,152,816 | 100.0% | 95.3% |

| | Population Assessed Value | Weighted Mean | Estimated Market Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Single Family <=$79,000 | 310,030,250 | 0.95 | 326,347,632 | 12.9% | 0.122 |
| Single Family $79,001 - $95,000 | 292,303,600 | 0.962 | 303,849,896 | 12.0% | 0.115 |
| Single Family $95,001 - $116,000 | 348,311,200 | 0.943 | 369,365,005 | 14.5% | 0.137 |
| Single Family $116,001 - $158,000 | 471,086,600 | 0.952 | 494,838,866 | 19.5% | 0.186 |
| Single Family >$158,000 | 740,534,000 | 0.952 | 777,871,849 | 30.6% | 0.292 |
| Unimproved Properties | 29,459,400 | 0.937 | 31,440,128 | 1.2% | 0.012 |
| Multi-family | 176,873,800 | 0.751 | 235,517,710 | 9.3% | 0.070 |
| Total | 2,368,598,850 | | 2,539,231,085 | 100.0% | 93.3% |

## Table 6. Sales Ratio Analysis: Stratified by Location

| | | Strata | | | |
|---|---|---|---|---|---|
| | | JC School District 65101 | JC School District 65109 | Other School Districts | Overall Un-weighted |
| Number of Sales | | 150 | 352 | 56 | 558 |
| Median | | .973 | .962 | .937 | .962 |
| 95% Confidence Interval for Median | Lower Bound | .952 | .951 | .952 | .952 |
| | Upper Bound | .989 | .970 | .969 | .969 |
| Weighted Mean | | .936 | .948 | .920 | .942 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .901 | .938 | .932 | .932 |
| | Upper Bound | .970 | .958 | .953 | .953 |
| Minimum | | .314 | .614 | .598 | .314 |
| Maximum | | 1.640 | 1.402 | 1.429 | 1.640 |
| Std. Deviation | | .182 | .097 | .131 | .129 |
| Price Related Differential | | 1.032 | 1.008 | 1.013 | 1.014 |
| Coefficient of Dispersion | | .122 | .072 | .097 | .089 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 58.0% | 72.4% | 67.0% | 67.0% |

## Table 7. Combined Results – Post Stratification and Weighting

| | Population Assessed Value | Median | Estimated Market Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| JC School District 65101 | 601,277,450 | 0.973 | 617,962,436 | 25.0% | 0.244 |
| JC School District 65109 | 1,322,473,500 | 0.962 | 1,374,712,578 | 55.7% | 0.536 |
| Other school districts | 444,847,900 | 0.937 | 474,757,631 | 19.2% | 0.180 |
| Total | 2,368,598,850 | | 2,467,432,644 | 100.0% | 96.0% |

| | Population Assessed Value | Weighted Mean | Estimated Market Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| JC School District 65101 | 601,277,450 | 0.936 | 642,390,438 | 25.5% | 0.239 |
| JC School District 65109 | 1,322,473,500 | 0.948 | 1,395,014,241 | 55.3% | 0.525 |
| Other school districts | 444,847,900 | 0.92 | 483,530,326 | 19.2% | 0.176 |
| Total | 2,368,598,850 | | 2,520,935,005 | 100.0% | 94.0% |

## Table 8. Sales Ratio Analysis: Stratified by Age

| | | Strata | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Un-improved Property | Multi - family | Un-known Age | Built before 1950 | Built 1950s | Built 1960s | Built 1970s | Built 1980s | Built 1990 thru 1995 | Built 1996 and newer | Overall Un-weighted |
| Number of Sales | | 7 | 31 | 207 | 60 | 31 | 43 | 69 | 43 | 35 | 32 | 558 |
| Median | | .950 | .847 | .972 | .975 | .972 | .983 | .948 | .951 | .949 | .943 | .962 |
| 95% Confidence Interval for Median | Lower Bound | .676 | .741 | .957 | .931 | .923 | .921 | .927 | .918 | .913 | .919 | .952 |
| | Upper Bound | 1.429 | .995 | .982 | 1.010 | .999 | 1.006 | .968 | .977 | .974 | .987 | .969 |
| Weighted Mean | | .937 | .751 | .957 | .952 | .970 | .962 | .952 | .940 | .939 | .930 | .942 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .742 | .627 | .945 | .912 | .931 | .930 | .932 | .912 | .915 | .899 | .932 |
| | Upper Bound | 1.132 | .876 | .970 | .992 | 1.009 | .994 | .972 | .969 | .964 | .961 | .953 |
| Minimum | | .676 | .314 | .593 | .589 | .785 | .739 | .780 | .801 | .783 | .771 | .314 |
| Maximum | | 1.429 | 1.640 | 1.501 | 1.468 | 1.402 | 1.276 | 1.344 | 1.300 | 1.057 | 1.057 | 1.640 |
| Std. Deviation | | .282 | .290 | .104 | .158 | .124 | .109 | .088 | .086 | .068 | .074 | .129 |
| Price Related Differential | | 1.047 | 1.142 | 1.007 | 1.022 | 1.013 | 1.013 | 1.004 | 1.008 | 1.003 | 1.011 | 1.014 |
| Coefficient of Dispersion | | .225 | .251 | .075 | .119 | .086 | .083 | .065 | .062 | .058 | .062 | .089 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 28.6% | 32.3% | 72.9% | 55.0% | 61.3% | 65.1% | 76.8% | 69.8% | 71.4% | 71.9% | 67.0% |

## Table 9. Combined Results – Post Stratification and Weighting

| | Population Assessed Value | Median | Estimated Market Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Unimproved Properties | 29,459,400 | 0.95 | 31,009,895 | 1.3% | 0.012 |
| Multi-family | 176,873,800 | 0.847 | 208,823,849 | 8.5% | 0.072 |
| Unknown Age | 2,124,739,750 | 0.972 | 2,185,946,245 | 88.7% | 0.862 |
| Built before 1950 | 4,986,400 | 0.975 | 5,114,256 | 0.2% | 0.002 |
| Built 1950s | 2,463,700 | 0.972 | 2,534,671 | 0.1% | 0.001 |
| Built 1960s | 4,416,800 | 0.983 | 4,493,184 | 0.2% | 0.002 |
| Built 1970s | 7,474,700 | 0.948 | 7,884,705 | 0.3% | 0.003 |
| Built 1980s | 5,740,500 | 0.951 | 6,036,278 | 0.2% | 0.002 |
| Built 1990 thru 1995 | 5,335,900 | 0.949 | 5,622,655 | 0.2% | 0.002 |
| Built 1996 and newer | 7,107,900 | 0.943 | 7,537,540 | 0.3% | 0.003 |
| Total | 2,368,598,850 | | 2,465,003,277 | 100.0% | 96.1% |
| | **Population Assessed Value** | **Weighted Mean** | **Estimated Market Value** | **% of Total Est. Mkt. Value** | **Subtotal** |
| **Strata** | | | | | |
| Unimproved Properties | 29,459,400 | 0.937 | 31,440,128 | 1.2% | 0.012 |
| Multi-family | 176,873,800 | 0.751 | 235,517,710 | 9.3% | 0.070 |
| Unknown Age | 2,124,739,750 | 0.957 | 2,220,208,725 | 87.9% | 0.841 |
| Built before 1950 | 4,986,400 | 0.952 | 5,237,815 | 0.2% | 0.002 |
| Built 1950s | 2,463,700 | 0.97 | 2,539,897 | 0.1% | 0.001 |
| Built 1960s | 4,416,800 | 0.962 | 4,591,268 | 0.2% | 0.002 |
| Built 1970s | 7,474,700 | 0.952 | 7,851,576 | 0.3% | 0.003 |
| Built 1980s | 5,740,500 | 0.94 | 6,106,915 | 0.2% | 0.002 |
| Built 1990 thru 1995 | 5,335,900 | 0.939 | 5,682,535 | 0.2% | 0.002 |
| Built 1996 and newer | 7,107,900 | 0.93 | 7,642,903 | 0.3% | 0.003 |
| Total | 2,368,598,850 | | 2,526,819,472 | 100.0% | 93.7% |

## Table 10. Sales Ratio Analysis: Stratified by Town and Rural Lots

| | | Strata | | |
|---|---|---|---|---|
| | | Rural Lots | Town Lots | Overall Un-weighted |
| Number of Sales | | 171 | 387 | 558 |
| Median | | .951 | .965 | .962 |
| 95% Confidence Interval for Median | Lower Bound | .928 | .956 | .952 |
| | Upper Bound | .970 | .976 | .969 |
| Weighted Mean | | .941 | .943 | .942 |
| 95% Confidence Interval for | Lower Bound | .926 | .929 | .932 |
| Weighted Mean | Upper Bound | .956 | .957 | .953 |
| Minimum | | .640 | .314 | .314 |
| Maximum | | 1.429 | 1..640 | 1.640 |
| Std. Deviation | | .105 | .138 | .129 |
| Price Related Differential | | 1.007 | 1.018 | 1.014 |
| Coefficient of Dispersion | | .080 | .093 | .089 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 66.1% | 67.4% | 67.0% |

## Table 11. Combined Results – Post Stratification and Weighting

| | Population Assessed Value | Median | Estimated Market Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Town Lot | 1,488,273,350 | 0.965 | 1,542,252,176 | 62.5% | 0.603 |
| Rural Lot | 880,325,500 | 0.951 | 925,684,017 | 37.5% | 0.357 |
| Total | 2,368,598,850 | | 2,467,936,193 | 100.0% | 96.0% |

| | Population Assessed Value | Weighted Mean | Estimated Market Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Town Lot | 1,488,273,350 | 0.943 | 1,578,232,609 | 62.5% | 0.590 |
| Rural Lot | 880,325,500 | 0.931 | 945,569,817 | 37.5% | 0.349 |
| Total | 2,368,598,850 | | 2,523,802,426 | 100.0% | 93.9% |

# Chapter 6. Crawford County

## 1. Significant Findings

1.1 Assessment Level: Crawford County's 2003 residential property assessments were approximately 72% of market value (Section 3.5). The results from the corresponding STC study are invalid because the STC's appraisals did not meet the requirement that they reflect market values (Section 4.3). Furthermore, the STC's sample is not representative of residential property for the county (Section 4.2).

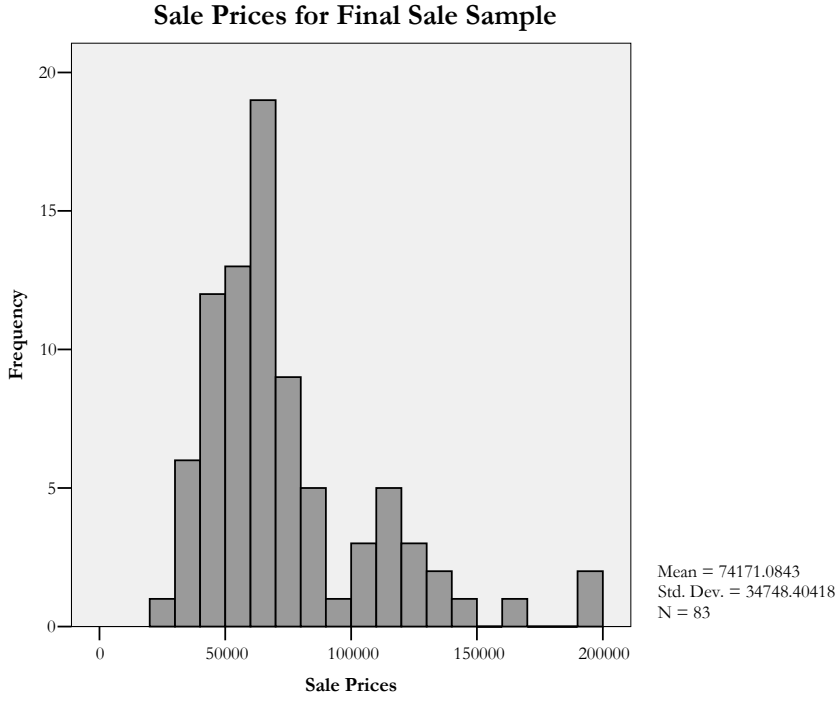
1.2 Assessment Equity: Lower-valued properties are assessed at a lower level than higher-valued properties (Section 3.6 and Table 3).

1.3 Reassessment History: One indicator of market value changes suggests that two of the past four biennial reassessments have produced lower value increases than the market. Cumulatively, the reassessments from 1997 through 2003 produced only 31% of the expected rise in assessments. The net change in assessments in 1999 and 2003 raises questions regarding whether any serious revaluation occurred (Section 5.1).

## 2. Data and Related Issues

2.1 Assessment Data: Sales and assessment information were matched at the county offices. Subsequently, the assessor reviewed the matched parcels and provided further information that assisted our screening process.

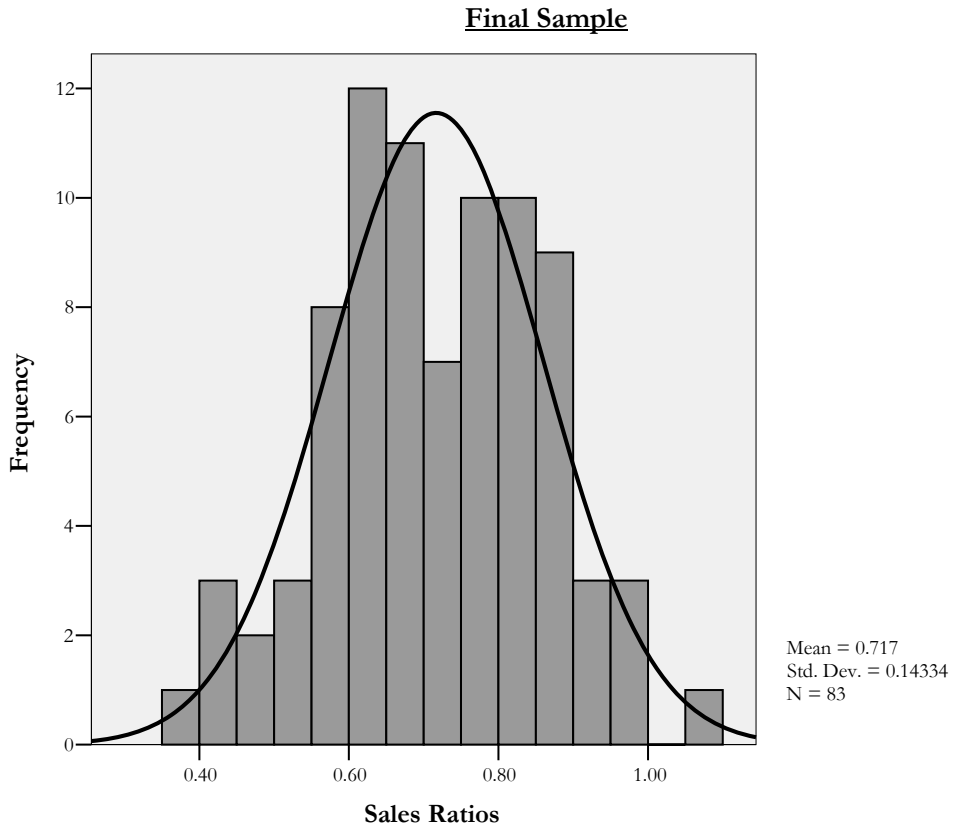
2.2 Sales and Ratio Data: The distribution of sale prices used is reflected in the following histogram.



The next table reports results of the data screening and trimming process. The "screened sales" represent the initial screened sample. The screened sales that were excluded from the final analysis because their ratios were deemed unrepresentative are identified as high or low trims. The "remaining ratios" represent the sample on which all the study's results are based.

| Trimming of Outliers | | | | |
|---|---|---|---|---|
| | | Improved Properties <=$50,500 | Improved Properties >$50,500 | Total |
| **Screened Sales** | | 47 | 39 | 86 |
| Excluded | High Trims | 0 | 1 | 1 |
| | Low Trims | 1 | 1 | 2 |
| **Remaining Ratios** | | **46** | **37** | **83** |

The histogram below shows the distribution of the ratios for the sample.




2.3 Population: Since a complete copy of the assessment rolls in electronic form was not available, we used the best available alternative as a pseudo-population (hereinafter, "the population"), i.e. four random samples that were drawn and used by the STC.

## 3. Ratio Study Results

3.1 The Sample: The following table shows that one of the strata, the lower single-family valued stratum, varies by more than 3 percent from the population. However, upon closer examination, this variance has no material effect on the overall level of assessment and thus we conclude that the un-stratified sample is sufficiently representative of the population.

| Comparing Representivity | | | | | | |
|---|---|---|---|---|---|---|
| | Population Distribution | | | PPRC 2003 Sale Sample | | |
| Strata | N | $ | $ Weight | N | $ | $ Weight |
| Improved Properties <=$50,500 | 69 | 1,860,247 | 32.4% | 46 | 1,631,579 | 37.2% |
| Improved Properties >$50,500 | 45 | 3,657,684 | 63.7% | 37 | 2,750,526 | 62.8% |
| Unimproved Properties | 33 | 222,558 | 3.9% | 0 | 0 | 0.0% |
| Total | 147 | 5,740,489 | | 83 | 4,382,105 | |

3.2 Representing the Population with the Sample: Since the un-stratified sample is sufficiently representative of the population (Section 3.1), the use of stratification and weighting is not essential. Nevertheless, we used stratification because it produces additional analytical benefits and further optimizes representivity.

3.3 Sales Chasing: There was no indication of sales chasing.

3.4 Study Validity: The sample meets the requirements for producing valid inferences about the county's population of residential properties.

3.5 Assessment Level: Measures of the assessment level are summarized below. For the purposes of this study, the weighted mean from combined stratification is the preferred measure as long as the requirements for using the weighted mean are met. The distribution of ratios is normal (Figure 3) and weighting is not compromised by the use of seriously undersized samples. Therefore, we focus on the weighted mean, though taking notice of the medians, to conclude that the County's assessments for 2003 reflect approximately 72% of market value.

| Assessment Level (Based on Percent of Market Value) | | | | |
|---|---|---|---|---|
| | Stratification and Weighting | Reference | Weighted Mean | Median |
| **Overall Un-weighted** | None | Table 3 | 71.2% | 70.2% |
| **Combined** | By Property Use and Value Range | Table 4 | 71.5% | 72.5% |

3.6 Equity Measures and Evaluation:

i. Uniformity within Strata: Results from Tables 2, 3, 5 & 6 for the strata with sufficient sample size for individual evaluation indicate no problem areas for internal uniformity.

ii. Uniformity between Strata: Another form of inequity exists when different strata are assessed at different levels. The IAAO has established guidelines for identifying such inequity, but compliance can be heavily affected by sample size and uniformity. Therefore, we confine our remarks to identifying where assessment levels differ markedly from the norm. The difference in assessment level (medians) between the lower and higher valued strata (65.0% versus 77.1% respectively, Table 3) is substantial.

iii. Vertical Equity: The final form of potential inequity examined is vertical equity. The PRD for the overall sample of 1.007 complies with the IAAO standard.

## 4. STC Study

4.1 Comparative Results: The following table contrasts our results with those from the STC study. The STC found the level of assessment adequate, while ours does not. The STC reports a substandard horizontal equity measure and a poor measure for vertical equity, while our results find no such problems. We have already demonstrated that the PPRC study meets the criteria for achieving valid results. The rest of Section 4 examines the validity of the STC's study.

| Comparison of Study Results | | | |
|---|---|---|---|
| **Measure** | **STC Study*** | **PPRC Study*** | **PPRC Study Combined**** |
| Assessment Level - median | 97.9% | 70.2% | 72.5% |
| Assessment Level - wtd. mean | 96.8% | 71.2% | 71.5% |
| COD | 30.1% | 16.7% | |
| PRD | 1.06 | 1.01 | |
| Sample Size | 34 | 83 | |
| Relative Precision | 1.00 | 1.56 | |
| * Overall sample (un-stratified and un-weighted) | | | |
| ** Stratification and weighting by Property Use and Value Range | | | |

4.2 Representing the Population with the Sample: The STC does not examine the representivity of its sample, nor does it have the necessary sample size or information to do so. Therefore, in the following table, we provide that missing analysis. In this case, the table shows that two of the strata in the STC sample, the two improved property value strata, vary from 8.3% to 9.9%. Initially, this exhibits excessive variability from the sample to the population. Upon closer examination, this variation has a cumulative material effect on the overall assessment level and thus we conclude that the STC sample is insufficiently representative of the population.

| Comparing Representivity | | | | | | |
|---|---|---|---|---|---|---|
| | **Population** | | | **STC 2003 Appraisals** | | |
| **Strata** | **N** | **$** | **%** | **N** | **$** | **%** |
| Improved Properties <=$50,500 | 69 | 1,860,247 | 32.4% | 18 | 532,895 | 42.3% |
| Improved Properties >$50,500 | 45 | 3,657,684 | 63.7% | 8 | 704,789 | 56.0% |
| Unimproved Properties | 33 | 222,558 | 3.9% | 8 | 21,316 | 1.7% |
| Total | 147 | 5,740,489 | | 34 | 1,259,000 | |

4.3 Market Value: The final requirement for producing a valid appraisal study is that appraisals must represent market values. As discussed in the introduction for this Section II, and in greater depth in the Procedure Manual (Section III), we use 4 tests to make this determination. The results of each test are reported in the following tables.

| Mann-Whitney Test | | | | |
|---|---|---|---|---|
| For the Entire Sample | | | | |
| Study | Observations | Rank sum | Expected | Ho: Ratios (34 STC Appraisals)=Ratios (83 Sales)<br>z = 4.544<br>Prob > \|z\| = 0.0000 |
| 0 | 34 | 2763 | 2006 | |
| 1 | 83 | 4140 | 4897 | |
| Combined | 117 | 6903 | 6903 | |
| For Single Family Properties Only | | | | |
| Study | Observations | Rank sum | Expected | Ho : Ratios (26 STC Appraisals)=Ratios (82 Sales)<br>z = 4.901<br>Prob > \|z\| = 0.0000 |
| 0 | 26 | 2099 | 1417 | |
| 1 | 82 | 3787 | 4469 | |
| Combined | 108 | 5886 | 5886 | |

| K-Sample Test | | | | |
|---|---|---|---|---|
| For the Entire Sample | | | | |
| Study | Not Greater than the median | Greater than the median | Total | Ho: Ratios (34 STC Appraisals)=Ratios (83 Sales)<br>Pearson chi2(1) = 13.8713 Pr = 0.000<br>Continuity corrected:<br>Pearson chi2(1) = 12.3960 Pr = 0.000 |
| 0 | 8 | 26 | 34 | |
| 1 | 51 | 32 | 83 | |
| Total | 59 | 58 | 117 | |
| For Single Family Properties Only | | | | |
| Study | Not Greater than the median | Greater than the median | Total | Ho: Ratios (26 STC Appraisals)=Ratios (82 Sales)<br>Pearson chi2(1) = 12.9681 Pr = 0.000<br>Continuity corrected:<br>Pearson chi2(1) = 11.3977 Pr = 0.001 |
| 0 | 5 | 21 | 26 | |
| 1 | 49 | 33 | 82 | |
| Total | 54 | 54 | 108 | |

All four tests lead to the conclusion that the STC appraisals do not represent market values (all with 99% statistical confidence). Therefore, the STC study is invalid and its reported results are unreliable.

## 5. Additional Analysis and Findings

5.1 Analysis of Reassessment History: Without the necessary data, it was impractical to conduct a complete audit of the degree of revaluation that occurred during the 2003 reassessment. The table that follows, however, provides a comparison of actual assessment changes (net of new construction) to those that might have been expected for each two-year cycle as well as the six-year period leading up to 2003. Only two of the reassessments produced changes in line with the indicator.

| Actual Value Changes from Reassessment vs. Expected Value Change | | | |
|---|---|---|---|
| Biennial Year | % Net Assessment Change | Missouri OFHEO Index | % Value Change: Actual vs. Expected |
| 1999 | -0.6 | 8.4 | -7% |
| 2001 | 11.3 | 11.4 | 99% |
| 2003 | 0.0 | 11.8 | 0% |
| 2005 | 17.5 | 12.4 | 141% |
| Cumulative 1997 - 2003 | 10.7 | 35.0 | 31% |

## 6. Figures and Tables

**Table 1. STC's Appraisal Ratio Studies**

| | | Group | | | |
|---|---|---|---|---|---|
| | | 1999 | 2001 | 2003 | 2005* |
| Number of Appraisals | | 38 | 40 | 34 | 35 |
| Median | | 1.002 | 1.061 | .979 | 1.000 |
| 95% Confidence Interval | Lower Bound | .992 | 1.012 | .833 | .945 |
| for Median | Upper Bound | 1.071 | 1.148 | 1.125 | 1.090 |
| Weighted Mean | | 1.045 | .998 | .968 | 1.042 |
| 95% Confidence Interval | Lower Bound | .970 | .911 | .823 | .954 |
| for Weighted Mean | Upper Bound | 1.120 | 1.085 | 1.112 | 1.130 |
| Minimum | | .501 | .211 | .385 | .285 |
| Maximum | | 18.526 | 3.158 | 2.365 | 3.202 |
| Std. Deviation | | 3.097 | .633 | .439 | .498 |
| Price Related Differential | | 1.648 | 1.216 | 1.059 | 1.048 |
| Coefficient of Dispersion | | .811 | .340 | .301 | .276 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 52.6% | 37.5% | 26.5% | 42.9% |

*The STC has not completed its studies for the 2005 reassessment cycle. These results may not represent final values.

**Figure 1. Ratios before Outlier Trimming**

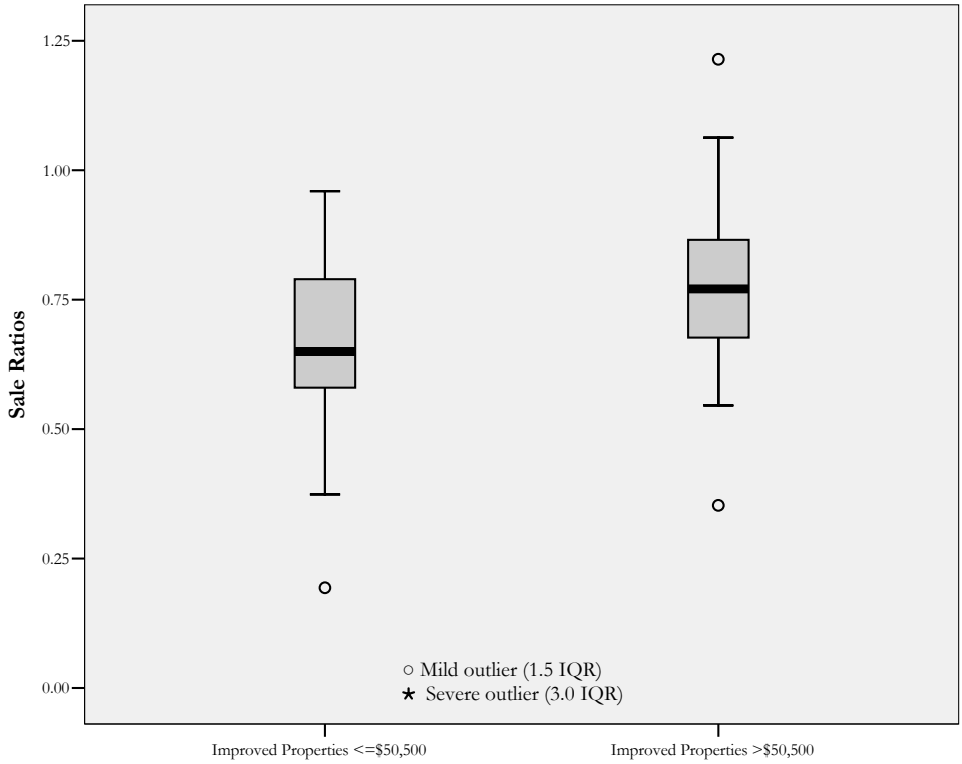
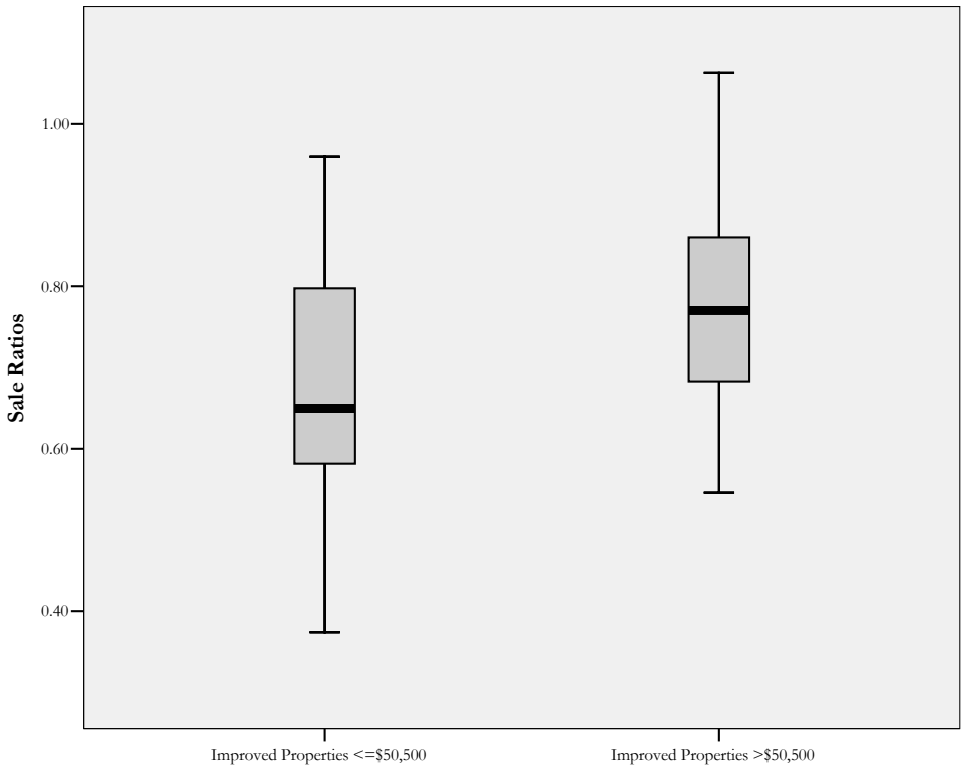
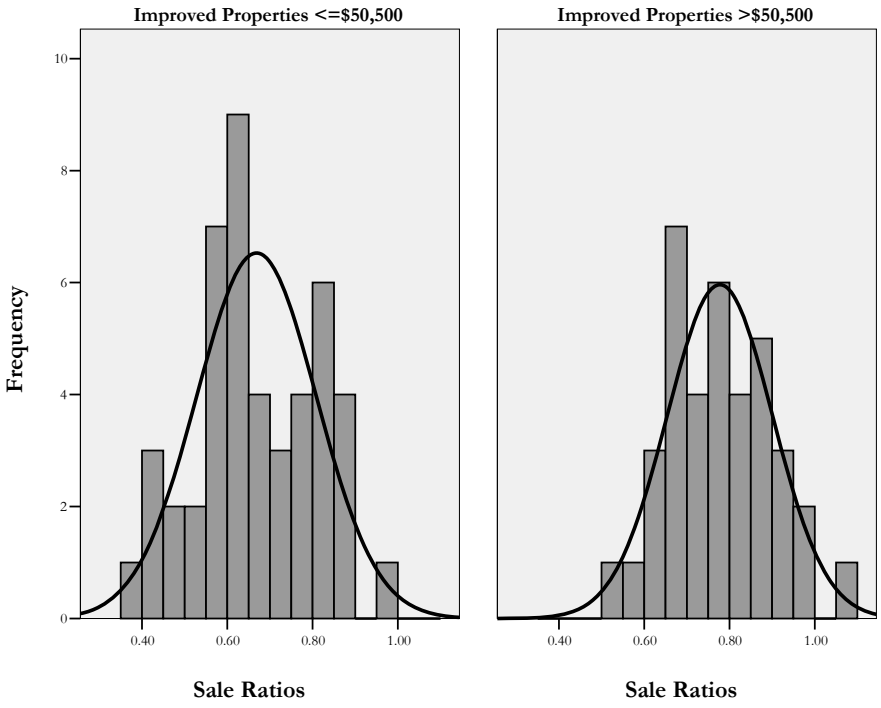



**Figure 2. Ratios after Outlier Trimming**



## Figure 3. Distribution of Final Sale Ratios




## Shapiro-Francia W' Tests for Normality for Various Strata

| Strata | Observations | W' | V' | z | Prob* |
|---|---|---|---|---|---|
| Single Family | 82 | 0.99335 | 0.511 | -1.381 | 0.91641 |
| Multi-family | 1 | . | . | . | . |
| Improved Properties | 83 | 0.99371 | 0.488 | -1.479 | 0.93043 |
| Improved Properties<=$50,500 | 46 | 0.98501 | 0.728 | -0.617 | 0.73132 |
| Improved Properties>$50,500 | 37 | 0.98475 | 0.627 | -0.892 | 0.81389 |
| Overall Un-weighted | 83 | 0.99371 | 0.488 | -1.479 | 0.93043 |
| *This value represents the indicated probability that the underlying population is normally distributed. A value of less than .05 indicates a distribution that is not normal. | | | | | |

## Table 2. Sales Ratio Analysis: Stratified by Property Use

| | | Strata | | |
|---|---|---|---|---|
| | | Single Family | Multi-family | Overall Un-weighted |
| Number of Sales | | 82 | 1 | 83 |
| Median | | .701 | .787 | .702 |
| 95% Confidence Interval for Median | Lower Bound | .666 | . | .667 |
| | Upper Bound | .761 | . | .761 |
| Weighted Mean | | .711 | .787 | .712 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .683 | . | .684 |
| | Upper Bound | .739 | . | .739 |
| Minimum | | .374 | .787 | .374 |
| Maximum | | 1.063 | .787 | 1.063 |
| Std. Deviation | | .144 | . | .143 |
| Price Related Differential | | 1.007 | 1.000 | 1.007 |
| Coefficient of Dispersion | | .167 | .000 | .167 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 8.5% | .0% | 8.4% |

## Table 3. Sales Ratio Analysis: Stratified by Use and Value

| | | Strata | | |
|---|---|---|---|---|
| | | Improved Properties <=$50,500 | Improved Properties >$50,500 | Overall Un-weighted |
| Number of Sales | | 46 | 37 | 83 |
| Median | | .650 | .771 | .702 |
| 95% Confidence Interval for Median | Lower Bound | .612 | .701 | .667 |
| | Upper Bound | .736 | .843 | .761 |
| Weighted Mean | | .656 | .750 | .712 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .614 | .714 | .684 |
| | Upper Bound | .697 | .786 | .739 |
| Minimum | | .374 | .546 | .374 |
| Maximum | | .960 | 1.063 | 1.063 |
| Std. Deviation | | .141 | .124 | .143 |
| Price Related Differential | | 1.020 | 1.037 | 1.007 |
| Coefficient of Dispersion | | .175 | .133 | .167 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 2.2% | 16.2% | 8.4% |

## Table 4. Combined Results – Post Stratification and Weighting

| | Population Assessor's Value | Median | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Improved Properties <=$50,500 | 1,860,247 | 0.65 | 2,861,918 | 37.6% | 0.245 |
| Improved Properties >$50,500 | 3,657,684 | 0.771 | 4,744,078 | 62.4% | 0.481 |
| Total | 5,517,931 | | 7,605,996 | 100.0% | 72.5% |

| | Population Assessor's Value | Weighted Mean | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Improved Properties <=$50,500 | 1,860,247 | 0.656 | 2,835,742 | 36.8% | 0.241 |
| Improved Properties >$50,500 | 3,657,684 | 0.75 | 4,876,912 | 63.2% | 0.474 |
| Total | 5,517,931 | | 7,712,654 | 100.0% | 71.5% |

## Table 5. Sales Ratio Analysis: Stratified by Location

| | | Strata | | | |
|---|---|---|---|---|---|
| | | Bourbon Area | Cuba Area | All other cities | Overall Un-weighted |
| Number of Sales | | 40 | 36 | 7 | 83 |
| Median | | .669 | .758 | .755 | .702 |
| 95% Confidence Interval for Median | Lower Bound | .645 | .679 | .546 | .667 |
| | Upper Bound | .701 | .832 | .965 | .761 |
| Weighted Mean | | .682 | .742 | .753 | .712 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .648 | .695 | .625 | .684 |
| | Upper Bound | .717 | .789 | .881 | .739 |
| Minimum | | .374 | .426 | .546 | .374 |
| Maximum | | .942 | 1.063 | .965 | 1.063 |
| Std. Deviation | | .129 | .150 | .163 | .143 |
| Price Related Differential | | 1.002 | 1.003 | 1.017 | 1.007 |
| Coefficient of Dispersion | | .145 | .156 | .164 | .167 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 2.5% | 11.1% | 28.6% | 8.4% |

## Table 6. Sales Ratio Analysis: Stratified by Age

| | | Strata | | |
|---|---|---|---|---|
| | | 1950's through 1970's | 1980's and Newer | Overall Un-weighted |
| Number of Sales | | 36 | 24 | 60 |
| Median | | .702 | .692 | .701 |
| 95% Confidence Interval for Median | Lower Bound | .637 | .656 | .662 |
| | Upper Bound | .797 | .819 | .771 |
| Weighted Mean | | .711 | .703 | .707 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .664 | .662 | .677 |
| | Upper Bound | .757 | .745 | .737 |
| Minimum | | .374 | .410 | .374 |
| Maximum | | 1.063 | .949 | 1.063 |
| Std. Deviation | | .143 | .134 | .138 |
| Price Related Differential | | 1.011 | 1.009 | 1.012 |
| Coefficient of Dispersion | | .162 | .151 | .157 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 8.3% | 4.2% | 6.7% |

# Chapter 7. Dent County

## 1. Significant Findings

1.1 Assessment Level: Dent County's 2003 residential property assessments were approximately 72% of market value (Section 3.5). The results from the corresponding STC study are invalid because the STC's appraisals did not meet the requirement that they reflect market values (Section 4.3).

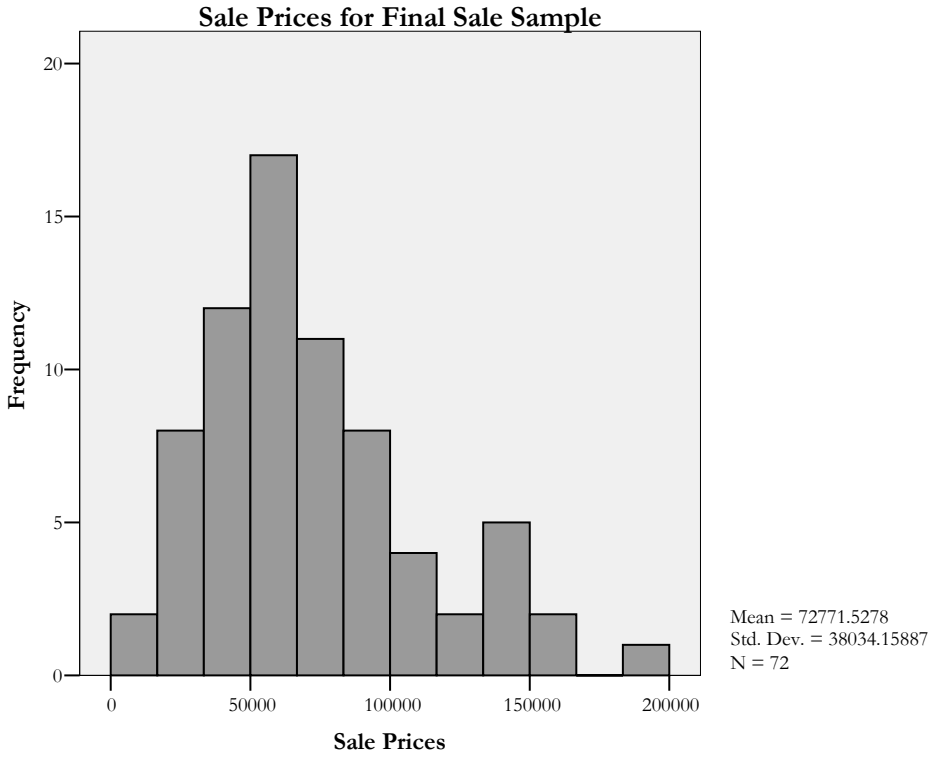
1.2 Assessment Equity: Lower-valued properties and older properties are assessed less uniformly and at lower levels than higher-valued and newer properties respectively (Section 3.6 and Tables 3 & 5).

1.3 Reassessment History: One indicator of market value changes suggests that three of the past four biennial reassessments have produced lower value increases than the market. Cumulatively, the reassessments from 1997 through 2003 produced -8% of the expected rise in assessments. The net change in assessments in 1999, 2001, and 2003 raises questions regarding whether any serious revaluation occurred (Section 5.1).

## 2. Data and Related Issues

2.1 Assessment Data: Sales and assessment information were matched at the county offices. Subsequently, the assessor reviewed the matched parcels and provided further information that assisted our screening process.

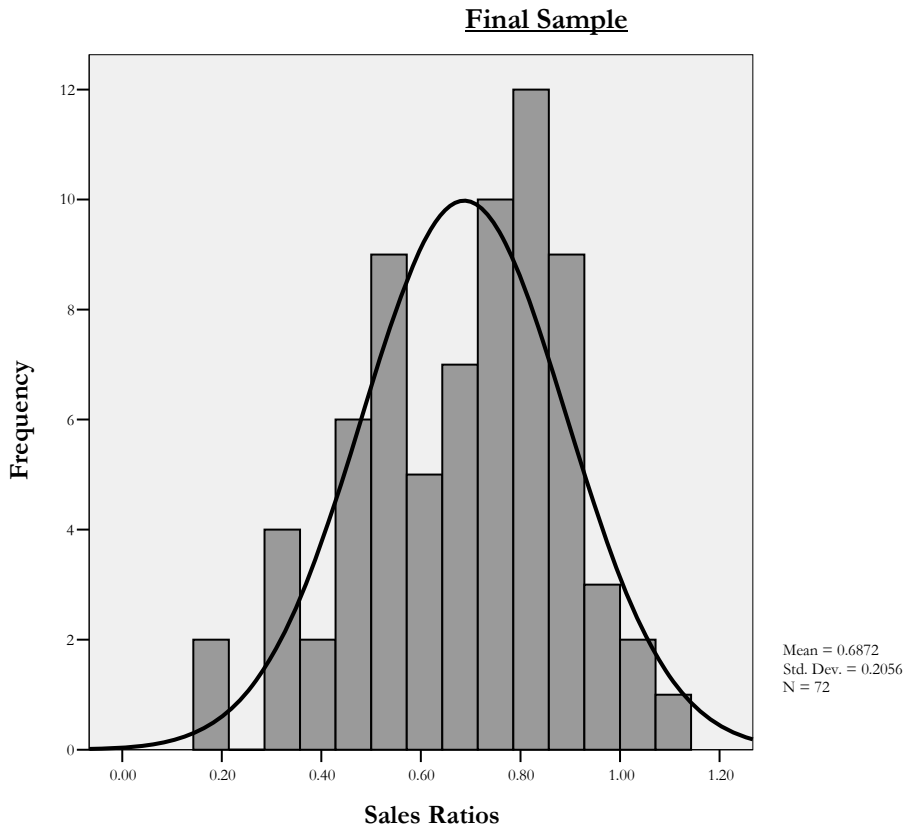
2.2 Sales and Ratio Data: The distribution of sale prices used is reflected in the following histogram.



The next table reports results of the data screening and trimming process. The "screened sales" represent the initial screened sample. The screened sales that were excluded from the final analysis because their ratios were deemed unrepresentative are identified as high or low trims. The "remaining ratios" represent the sample on which all the study's results are based.

| Trimming of Outliers | | | | | |
|---|---|---|---|---|---|
| | | Improved Properties <=$51,000 | Improved Properties >$51,000 | Unimproved Properties | Total |
| **Screened Sales** | | 38 | 34 | 8 | 80 |
| Excluded | High Trims | 2 | 1 | 2 | 5 |
| | Low Trims | 1 | 0 | 2 | 3 |
| **Remaining Ratios** | | **35** | **33** | **4** | **72** |

The histogram below shows the distribution of the ratios for the sample.




2.3 Population: Since a complete copy of the assessment rolls in electronic form was not available, we used the best available alternative as a pseudo-population (hereinafter, "the population"), i.e. four random samples that were drawn and used by the STC.

## 3. Ratio Study Results

3.1 The Sample: The following table shows that none of the strata vary by more than 3 percent from the population. Upon initial examination, we conclude that the un-stratified sample is sufficiently representative of the population.

| Comparing Representivity | | | | | | |
|---|---|---|---|---|---|---|
| | Population Distribution | | | PPRC 2003 Sale Sample | | |
| Strata | N | $ | $ Weight | N | $ | $ Weight |
| Single-Family Properties <=$51,000 | 70 | 1,582,789 | 27.0% | 35 | 1,054,789 | 28.7% |
| Single-Family Properties >$51,000 | 60 | 4,160,947 | 70.9% | 33 | 2,548,300 | 69.3% |
| Unimproved Properties | 18 | 127,368 | 2.2% | 4 | 72,947 | 2.0% |
| Total | 148 | 5,871,105 | | 72 | 3,676,037 | |

3.2 Representing the Population with the Sample: Since the un-stratified sample is sufficiently representative of the population (Section 3.1), the use of stratification and weighting is not essential. Nevertheless, we used stratification because it produces additional analytical benefits and further optimizes representivity.

3.3 Sales Chasing: There was no indication of sales chasing.

3.4 Study Validity: The sample meets the requirements for producing valid inferences about the county's population of residential properties.

3.5 Assessment Level: Measures of the assessment level are summarized below. For the purposes of this study, the weighted mean from combined stratification is the preferred measure as long as both of the requirements for using the weighted mean are met. In this case, the distributions are approximately normal (Figure 3) and weighting is not severely compromised by the use of seriously undersized samples. Since both requirements are met, we focus on the weighted mean, though taking notice of the median, to conclude that the County's assessments for 2003 reflect approximately 72% of market value.

| Assessment Level (Based on Percent of Market Value) | | | | |
|---|---|---|---|---|
| | Stratification and Weighting | Reference | Weighted Mean | Median |
| **Overall Un-weighted** | None | Table 3 | 71.3% | 75.6% |
| **Combined** | By Property Use and Value Range | Table 4 | 71.5% | 73.8% |

3.6 Equity Measures and Evaluation:

i. Uniformity within Strata: Tables 2, 3 and 5 show results for individual strata of sufficient sample size for evaluation. The following strata represent problem areas for internal uniformity.

| Strata with Inadequate Uniformity | |
|---|---|
| **Property Strata** | **COD** |
| Improved Properties <= $51,000 | 27.2% |
| Built 1975 and Earlier | 23.3% |

ii. Uniformity between Strata: Another form of inequity exists when different strata are assessed at different levels. The IAAO has established guidelines for identifying such inequity, but compliance can be heavily affected by sample size and uniformity. Therefore, we confine our remarks to identifying where assessment levels differ markedly from the norm. The difference in assessment level (medians) between lower and higher valued strata (64% versus 79% respectively, Table 3) and between older and newer properties (65% and 79% respectively, Table 5) is substantial.

iii. Vertical Equity: The final form of potential inequity examined is vertical equity. The PRD for the overall sample of 0.979 is slightly progressive according to the IAAO standard (Table 2).

## 4. STC Study

4.1 Comparative Results: The following table contrasts our results with those from the STC study. The STC found the level of assessment adequate, while ours does not. The STC reports an almost equivalent horizontal equity measure but a poor measure for vertical equity while our results find no such problem. We have already demonstrated that the PPRC study meets the criteria for achieving valid results. The rest of Section 4 examines the validity of the STC's study.

| Comparison of Study Results | | | |
|---|---|---|---|
| **Measure** | **STC Study*** | **PPRC Study*** | **PPRC Study Combined**** |
| Assessment Level - median | 101.3% | 75.6% | 73.8% |
| Assessment Level - wtd. mean | 98.5% | 71.3% | 71.5% |
| COD | 18.6% | 19.9% | |
| PRD | 1.07 | 1.00 | |
| Sample Size | 35 | 72 | |
| Relative Precision | 1.00 | 1.43 | |
| * Overall sample (un-stratified and un-weighted) | | | |
| ** Stratification and weighting by Property Use and Value Range | | | |

4.2 Representing the Population with the Sample: The STC does not examine the representivity of its sample, nor does it have the necessary sample size or information to do so. Therefore, in the following table, we provide that missing analysis. In this case, the table shows that none of the strata in the STC sample vary by more than 3 percent from the population. Upon initial examination, we conclude that the STC sample is sufficiently representative of the population.

| Comparing Representivity | | | | | | |
|---|---|---|---|---|---|---|
| | **Population** | | | **STC 2003 Appraisals** | | |
| **Strata** | **N** | **$** | **%** | **N** | **$** | **%** |
| Single family <=$51,000 | 70 | 1,582,789 | 27.0% | 16 | 401,158 | 28.7% |
| Single family >$51,000 | 60 | 4,160,947 | 70.9% | 15 | 984,211 | 70.3% |
| Unimproved | 18 | 127,368 | 2.2% | 4 | 14,211 | 1.0% |
| Total | 148 | 5,871,105 | | 35 | 1,399,579 | |

4.3 Market Value: The final requirement for producing a valid appraisal study is that appraisals must represent market values. As discussed in the introduction for this Section II, and in greater depth in the Procedure Manual (Section III), we use 4 tests to make this determination. The results of each test are reported in the following tables.

| Mann-Whitney Test | | | | |
|---|---|---|---|---|
| For the Entire Sample | | | | |
| Study | Observations | Rank sum | Expected | Ho: Ratios (35 STC Appraisals)=Ratios (72 Sales)<br>z = 6.408<br>Prob > \|z\| = 0.0000 |
| 0 | 35 | 2855 | 1890 | |
| 1 | 72 | 2923 | 3888 | |
| Combined | 107 | 5778 | 5778 | |
| For Single Family Properties Only | | | | |
| Study | Observations | Rank sum | Expected | Ho : Ratios (31 STC Appraisals)=Ratios (67 Sales)<br>z = 6.215<br>Prob > \|z\| = 0.0000 |
| 0 | 31 | 2348 | 1534.5 | |
| 1 | 67 | 2503 | 3316.5 | |
| Combined | 98 | 4851 | 4851 | |

| K-Sample Test | | | | |
|---|---|---|---|---|
| For the Entire Sample | | | | |
| Study | Not Greater than the median | Greater than the median | Total | Ho: Ratios (35 STC Appraisals)=Ratios (72 Sales)<br>Pearson chi2(1) = 27.2391 Pr = 0.000<br>Continuity corrected:<br>Pearson chi2(1) = 25.1305 Pr = 0.000 |
| 0 | 5 | 30 | 35 | |
| 1 | 49 | 23 | 72 | |
| Total | 54 | 53 | 107 | |
| For Single Family Properties Only | | | | |
| Study | Not Greater than the median | Greater than the median | Total | Ho: Ratios (31 STC Appraisals)=Ratios (67 Sales)<br>Pearson chi2(1) = 24.9600 Pr = 0.000<br>Continuity corrected:<br>Pearson chi2(1) = 22.8368 Pr = 0.000 |
| 0 | 4 | 27 | 31 | |
| 1 | 45 | 22 | 67 | |
| Total | 49 | 49 | 98 | |

All four tests lead to the conclusion that the STC appraisals do not represent market values (all with 99% statistical confidence). Therefore, the STC study is invalid and its reported results are unreliable.

## 5. Additional Analysis and Findings

5.1 Analysis of Reassessment History: The following table provides a comparison of actual assessment changes (net of new construction) to those that might have been expected for each of the last four reassessments as well as the six-year period leading up to 2003. None of the reassessments produced changes in line with the market indicator.

| Actual Value Changes from Reassessment vs. Expected Value Change | | | |
|---|---|---|---|
| Biennial Year | % Net Assessment Change | Missouri OFHEO Index | % Value Change: Actual vs. Expected |
| 1999 | -0.2% | 8.4 | -3% |
| 2001 | -1.8% | 11.4 | -16% |
| 2003 | -0.6% | 11.8 | -5% |
| 2005 | 25.5% | 12.4 | 206% |
| Cumulative 1997 - 2003 | -2.7% | 35.0 | -8% |

## 6. Figures and Tables

**Table 1. STC's Appraisal Ratio Studies**

| | | Group | | | |
|---|---|---|---|---|---|
| | | 1999 | 2001 | 2003 | 2005* |
| Number of Appraisals | | 39 | 39 | 35 | 35 |
| Median | | .991 | .990 | 1.013 | .954 |
| 95% Confidence Interval | Lower Bound | .968 | .875 | .965 | .885 |
| for Median | Upper Bound | 1.011 | 1.049 | 1.096 | 1.067 |
| Weighted Mean | | .900 | .947 | .985 | .899 |
| 95% Confidence Interval | Lower Bound | .819 | .883 | .910 | .828 |
| for Weighted Mean | Upper Bound | .981 | 1.012 | 1.061 | .970 |
| Minimum | | .271 | .157 | .385 | .544 |
| Maximum | | 1.210 | 3.158 | 1.883 | 1.741 |
| Std. Deviation | | .183 | .522 | .275 | .285 |
| Price Related Differential | | 1.046 | 1.146 | 1.067 | 1.106 |
| Coefficient of Dispersion | | .110 | .313 | .186 | .227 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 69.2% | 30.8% | 51.4% | 37.1% |
| *The STC has not completed its studies for the 2005 reassessment cycle. These results may not represent final values. | | | | | |

**Figure 1. Ratios before Outlier Trimming**

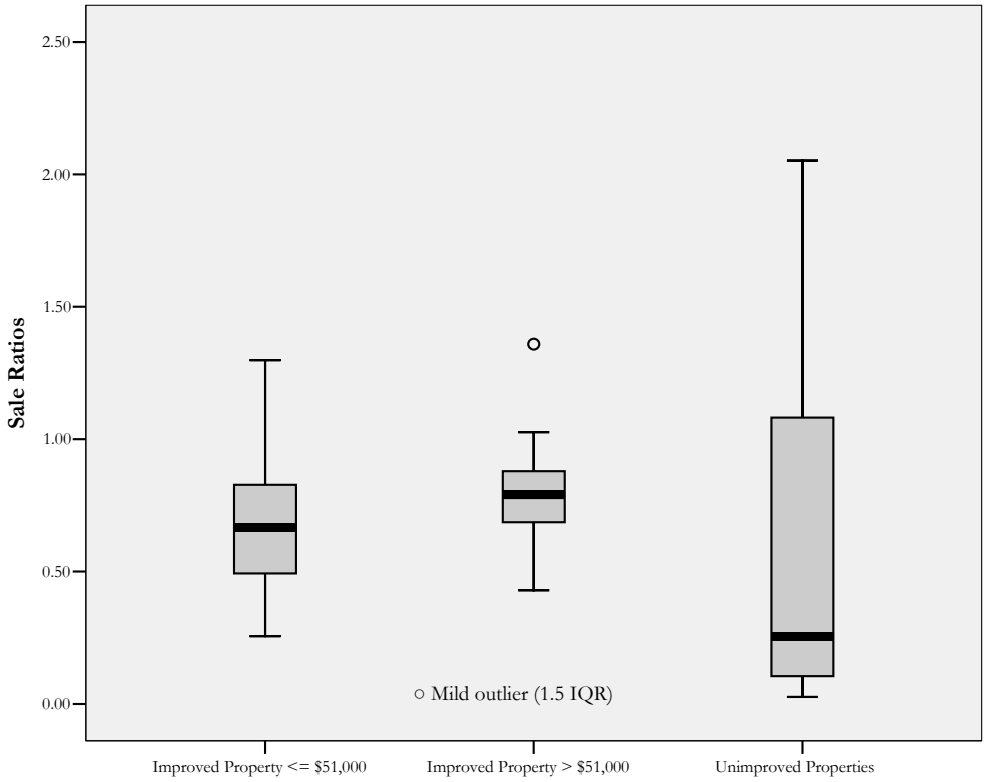
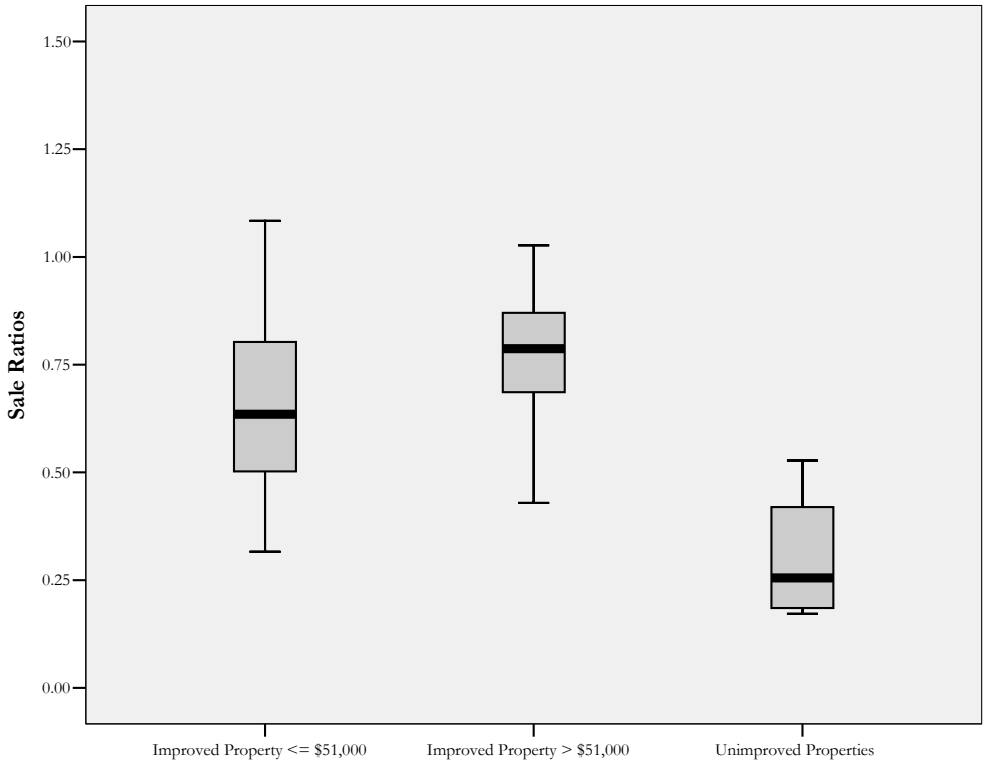
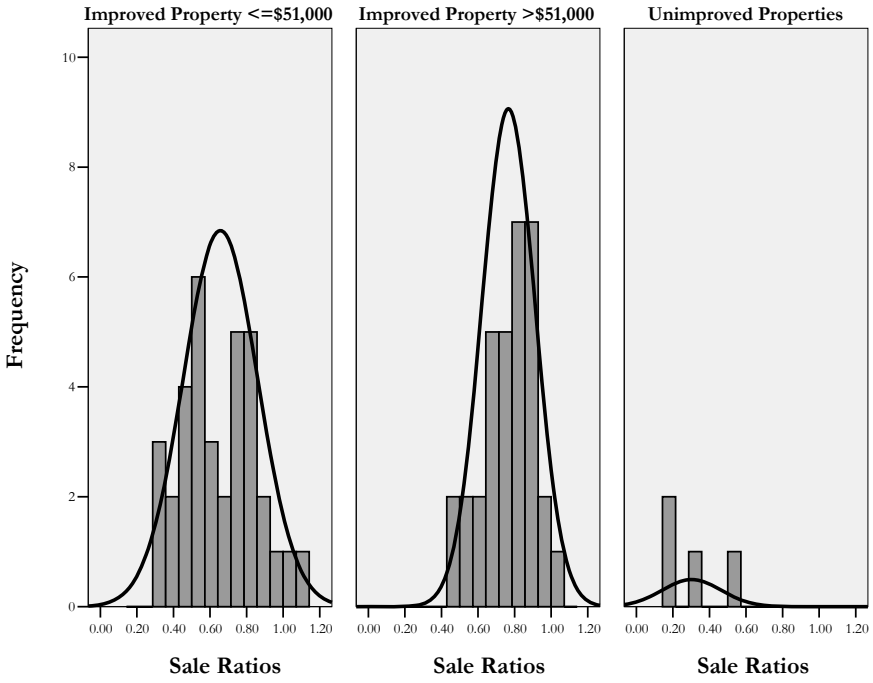



**Figure 2. Ratios after Outlier Trimming**



## Figure 3. Distribution of Final Sale Ratios




## Shapiro-Francia W' Tests for Normality for Various Strata

| Strata | Observations | W' | V' | z | Prob* |
|---|---|---|---|---|---|
| Single Family | 67 | 0.97352 | 1.730 | 1.074 | 0.14147 |
| Multi-family | 1 | . | . | . | . |
| Unimproved Properties | 4 | . | . | . | . |
| Improved Properties | 68 | 0.97453 | 1.685 | 1.023 | 0.15312 |
| Improved Properties<=$51,000 | 35 | 0.97718 | 0.899 | -0.200 | 0.57942 |
| Improved Properties>$51,000 | 33 | 0.95613 | 1.654 | 0.933 | 0.17542 |
| Overall Un-weighted | 72 | 0.97204 | 1.936 | 1.297 | 0.09737 |
| *This value represents the indicated probability that the underlying population is normally distributed. A value of less than .05 indicates a distribution that is not normal. | | | | | |

## Table 2. Sales Ratio Analysis: Stratified by Property Use

| | | Strata (all properties) | | | |
|---|---|---|---|---|---|
| | | Single Family | Unimproved Properties | Multi-family | Overall Un-weighted |
| Number of Sales | | 67 | 4 | 1 | 72 |
| Median | | .757 | .255 | .726 | .739 |
| 95% Confidence Interval for Median | Lower Bound | .675 | .172 | . | .636 |
| | Upper Bound | .793 | .528 | . | .782 |
| Weighted Mean | | .713 | .389 | .726 | .702 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .667 | .114 | . | .656 |
| | Upper Bound | .759 | .664 | . | .748 |
| Minimum | | .316 | .172 | .726 | .172 |
| Maximum | | 1.084 | .528 | .726 | 1.084 |
| Std. Deviation | | .186 | .162 | . | .206 |
| Price Related Differential | | .995 | .777 | 1.000 | .979 |
| Coefficient of Dispersion | | .201 | .460 | .000 | .226 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 14.9% | .0% | .0% | 13.9% |

## Table 3. Sales Ratio Analysis: Stratified by Use and Value

| | | Strata (without unimproved properties) | | |
|---|---|---|---|---|
| | | Improved Properties <=$51,000 | Improved Properties >$51,000 | Overall Un-weighted |
| Number of Sales | | 35 | 33 | 68 |
| Median | | .635 | .787 | .756 |
| 95% Confidence Interval for Median | Lower Bound | .528 | .711 | .675 |
| | Upper Bound | .773 | .852 | .793 |
| Weighted Mean | | .644 | .746 | .713 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .577 | .686 | .667 |
| | Upper Bound | .711 | .807 | .759 |
| Minimum | | .316 | .429 | .316 |
| Maximum | | 1.084 | 1.027 | 1.084 |
| Std. Deviation | | .204 | .145 | .185 |
| Price Related Differential | | 1.019 | 1.027 | .995 |
| Coefficient of Dispersion | | .272 | .142 | .199 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 14.3% | 15.2% | 14.7% |

## Table 4. Combined Results – Post Stratification and Weighting

| | Population Assessor's Value | Median | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Improved Properties <=$51,000 | 1,582,789 | 0.635 | 2,492,582 | 32.0% | 0.203 |
| Improved Properties >$51,000 | 4,160,947 | 0.787 | 5,287,100 | 68.0% | 0.535 |
| Total | 5,743,737 | | 7,779,681 | 100.0% | 73.8% |

| | Population Assessor's Value | Weighted Mean | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Improved Properties <=$51,000 | 1,582,789 | 0.644 | 2,457,748 | 30.6% | 0.197 |
| Improved Properties >$51,000 | 4,160,947 | 0.746 | 5,577,677 | 69.4% | 0.518 |
| Total | 5,743,737 | | 8,035,425 | 100.0% | 71.5% |

## Table 5. Sales Ratio Analysis: Stratified by Age

| | | Strata | | |
|---|---|---|---|---|
| | | Built 1975 and earlier | Built 1976 through 2002 | Overall Un-weighted |
| Number of Sales | | 28 | 27 | 55 |
| Median | | .647 | .787 | .751 |
| 95% Confidence Interval for Median | Lower Bound | .525 | .695 | .636 |
| | Upper Bound | .768 | .879 | .793 |
| Weighted Mean | | .657 | .769 | .716 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .592 | .705 | .668 |
| | Upper Bound | .722 | .833 | .764 |
| Minimum | | .316 | .352 | .316 |
| Maximum | | 1.084 | 1.027 | 1.084 |
| Std. Deviation | | .185 | .176 | .186 |
| Price Related Differential | | 1.000 | .977 | .982 |
| Coefficient of Dispersion | | .233 | .168 | .202 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 7.1% | 18.5% | 12.7% |

# Chapter 8. Franklin County

## 1. Significant Findings

1.1 Assessment Level: Franklin County's 2003 residential property assessments were approximately 80% of market value (Section 3.5). The results from the corresponding STC study are invalid because the STC's appraisals did not meet the requirement that they reflect market values (Section 4.3). Furthermore, the STC's sample is not representative of residential property for the county (Section 4.2).

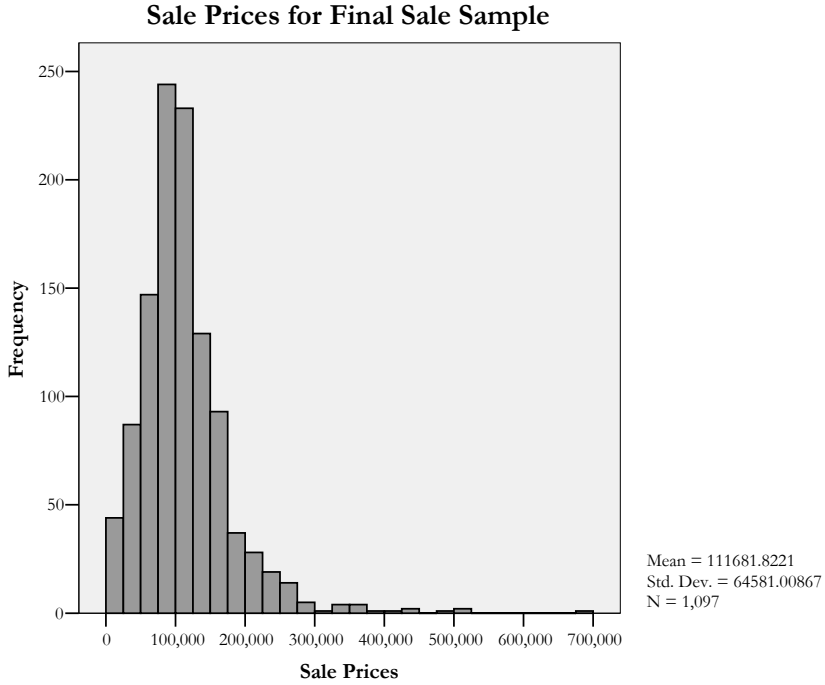
1.2 Assessment Equity: Unimproved properties, lower-valued properties and older properties are assessed less uniformly and at lower levels than other properties (Section 3.6 and Tables 4 & 8).

1.3 Reassessment History: Two indicators of market value changes suggest that three of the past four biennial reassessments have produced lower value increases than the market. Cumulatively, the reassessments from 1997 through 2003 produced only 48% of the expected rise in assessments (Section 5.1).

## 2. Data and Related Issues

2.1 Assessment Data: Sales and assessment information was available in electronic format. Sales were matched using a combination of computer techniques and software and then screened. The assessor answered all questions regarding the contents and coding of data when requested. The files received contained information allowing us to identify properties affected by new construction and to screen as appropriate.

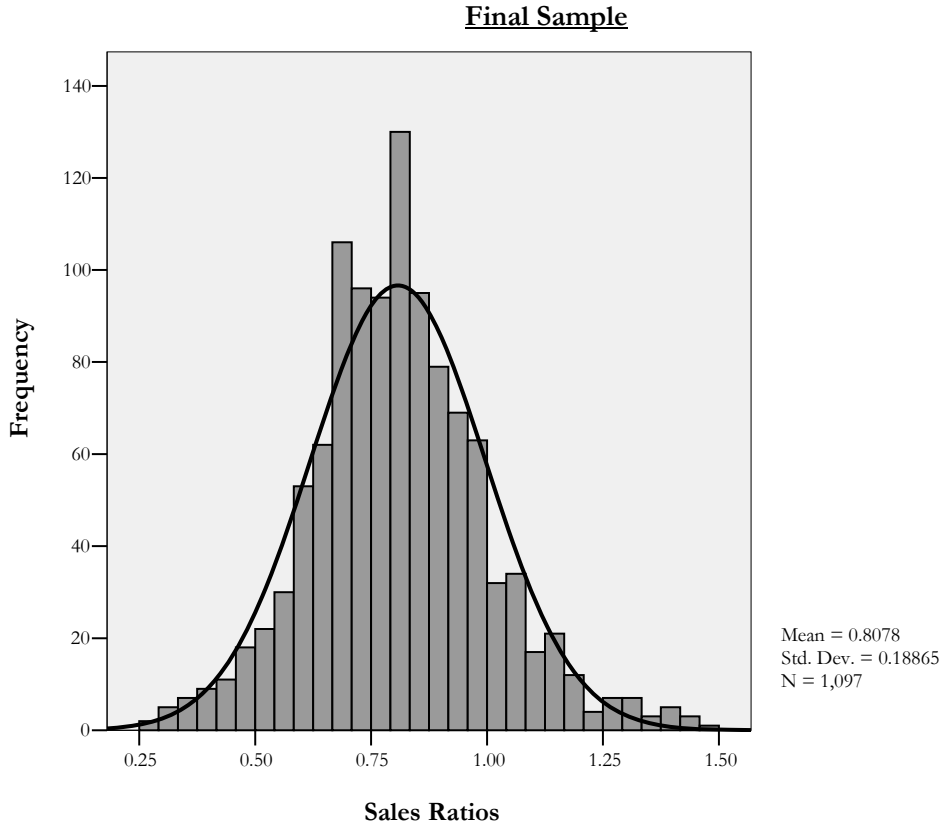
2.2 Sales and Ratio Data: The distribution of sale prices used is reflected in the following histogram.



The next table reports results of the data screening and trimming process. The "screened sales" represent the initial screened sample. The screened sales that were excluded from the final analysis because their ratios were deemed unrepresentative are identified as high or low trims. The "remaining ratios" represent the sample on which all the study's results are based.

| Trimming of Outliers | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Single Family <=$60,000 | Single Family >$60,000 & <=$80,000 | Single Family >$80,000 & <=$100,000 | Single Family >$100,000 & <=$150,000 | Single Family >$150,000 | Un-improved Property | Multi-family | Total |
| **Screened Sales** | | 301 | 248 | 198 | 242 | 134 | 67 | 19 | 1209 |
| Excluded | High Trims | 8 | 10 | 6 | 7 | 14 | 21 | 2 | 68 |
| | Low Trims | 25 | 6 | 4 | 1 | 2 | 6 | 0 | 44 |
| **Remaining Ratios** | | **268** | **232** | **188** | **234** | **118** | **40** | **17** | **1097** |

The histogram below shows the distribution of the ratios for the sample.




2.3 Population: Since a complete copy of the 2003 assessment rolls in electronic form was available, we were able to analyze the county's population in detail. This allowed us to stratify and weight sales on a variety of property and location characteristics.

## 3. Ratio Study Results

3.1 The Sample: The following table shows that two of the strata, the two highest value single-family strata, vary from 3.7% to 3.9% from the population. Initially, this exhibits excessive variability from the sample to the population. However, upon closer examination, this variation has no material effect and thus we conclude that the un-stratified sample is sufficiently representative of the population.

| Comparing Representivity | | | | | | |
|---|---|---|---|---|---|---|
| | Population Distribution | | | PPRC 2003 Sale Sample | | |
| Strata | N | $ | $ Weight | N | $ | $ Weight |
| Single Family <=$60,000 | 8,238 | 315,759,580 | 13.1% | 268 | 11,513,590 | 11.6% |
| Single Family >$60,000 & <=$80,000 | 4,628 | 324,185,440 | 13.5% | 232 | 16,290,010 | 16.4% |
| Single Family >$80,000 & <=$100,000 | 3,669 | 328,490,730 | 13.7% | 188 | 16,722,010 | 16.8% |
| Single Family >$100,000 & <=$150,000 | 4,942 | 599,855,630 | 25.0% | 234 | 28,604,800 | 28.7% |
| Single Family >$150,000 | 2,925 | 681,208,010 | 28.4% | 118 | 24,368,970 | 24.5% |
| Unimproved Properties | 11,822 | 63,544,960 | 2.6% | 40 | 497,920 | 0.5% |
| Multi-family | 559 | 88,532,450 | 3.7% | 17 | 1,529,630 | 1.5% |
| Total | 36,783 | 2,401,576,800 | | 1,097 | 99,526,930 | |

3.2 Representing the Population with the Sample: Since the un-stratified sample is sufficiently representative of the population (Section 3.1), the use of stratification and weighting is not essential. Nevertheless, we used stratification because it produces additional analytical benefits and further optimizes representivity.

3.3 Sales Chasing: Examinations showed the effects of an assessment procedure that would have produced a biased result in the ratio study. This was avoided by the selection of a sales period where the effect was absent.

3.4 Study Validity: The sample meets the requirements for producing valid inferences about the county's population of residential properties.

3.5 Assessment Level: Measures of the assessment level are summarized below. For the purposes of this study, the weighted mean from combined stratification is the preferred measure as long as both of the requirements from using the weighted mean are met. In this case, the distributions are not normal (Figure 3) and weighting is compromised by the use of seriously undersized samples. Since both requirements are not met, we focus on the median, though taking notice of the weighted mean, to conclude that the County's assessments for 2003 reflect approximately 80% of market value.

| Assessment Level (Based on Percent of Market Value) | | | | |
|---|---|---|---|---|
| | Stratification and Weighting | Reference | Weighted Mean | Median |
| **Overall Un-weighted** | None | Table 2 | 81.2% | 80.2% |
| **Combined** | By Property Use | Table 3 | 80.8% | 79.4% |
| **Combined** | By Property Use and Value Range | Table 5 | 80.9% | 80.9% |
| **Combined** | By Property Location | Table 7 | 81.1% | 79.9% |
| **Combined** | By Property Age | Table 9 | 80.5% | 79.4% |
| **Combined** | By Property Town Lots and Rural Lots | Table 11 | 80.9% | 80.1% |

3.6 Equity Measures and Evaluation:

i. Uniformity within Strata: Tables 2, 4, 6, 8 and 10 show results for individual strata of sufficient sample size for evaluation. The following strata represent problem areas for internal uniformity.

| Strata with Inadequate Uniformity | |
|---|---|
| **Property Strata** | **COD** |
| Multi-family | 25.6% |
| Unimproved Properties | 32.6% |
| Single Family <=$60,000 | 24.0% |
| Road "NH" | 27.5% |
| Built before 1950 | 22.1% |

ii. Uniformity between Strata: Another form of inequity exists when different strata are assessed at different levels. The IAAO has established guidelines for identifying such inequity, but compliance can be heavily affected by sample size and uniformity. Therefore, we confine our remarks to identifying where assessment levels differ markedly from the norm. The difference in assessment level (medians) between unimproved properties and the overall (48% versus 80% respectively, Table 2) is substantial. Also, assessment levels increase with property value (Table 4) and as age decreases (Table 8).

iii. Vertical Equity: The final form of potential inequity examined is vertical equity. The PRD for the overall sample of 0.994 complies with the IAAO standard.

## 4. STC Study

4.1 Comparative Results: The following table contrasts our results with those from the STC study. The STC found the level of assessment adequate, while ours does not. The STC reports similarly acceptable measures for horizontal and vertical equity. We have already demonstrated that the PPRC study meets the criteria for achieving valid results. The rest of Section 4 examines the validity of the STC's study.

| Comparison of Study Results | | | |
|---|---|---|---|
| **Measure** | **STC Study*** | **PPRC Study*** | **PPRC Study Combined**** |
| Assessment Level – median | 103.7% | 80.2% | 80.9% |
| Assessment Level - weighted mean | 100.0% | 81.2% | 80.9% |
| COD | 12.0% | 18.0% | |
| PRD | 1.03 | 0.99 | |
| Sample Size | 35 | 1,097 | |
| Relative Precision | 1.00 | 5.60 | |
| * Overall sample (un-stratified and un-weighted) | | | |
| ** Stratification and weighting by Property Use and Value Range | | | |

4.2 Representing the Population with the Sample: The STC does not examine the representivity of its sample, nor does it have the necessary sample size or information to do so. Therefore, in the following table, we provide that missing analysis. In this case, the table shows that four of the single-family value strata in the STC sample, vary from 7.7% to 15.1%. Initially, this exhibits excessive variability from the sample to the population. Upon closer examination, this variation has a cumulative material effect on the overall assessment level and thus we conclude that the STC sample is insufficiently representative of the population.

| Comparing Representivity | | | | | | |
|---|---|---|---|---|---|---|
| | Population | | | STC 2003 Appraisals | | |
| Strata | N | $ | % | N | $ | % |
| Single Family <=$60,000 | 8,238 | 315,759,580 | 13.1% | 4 | 124,421 | 5.4% |
| Single Family >$60,000 & <=$80,000 | 4,628 | 324,185,440 | 13.5% | 4 | 274,553 | 11.9% |
| Single Family >$80,000 & <=$100,000 | 3,669 | 328,490,730 | 13.7% | 6 | 520,021 | 22.5% |
| Single Family >$100,000 & <=$150,000 | 4,942 | 599,855,630 | 25.0% | 8 | 926,579 | 40.1% |
| Single Family >$150,000 | 2,925 | 681,208,010 | 28.4% | 2 | 412,789 | 17.9% |
| Unimproved Properties | 11,822 | 63,544,960 | 2.6% | 11 | 49,500 | 2.1% |
| Multi-family | 559 | 88,532,450 | 3.7% | 0 | 0 | 0.0% |
| Total | 36,783 | 2,401,576,800 | | 35 | 2,307,863 | |

4.3 Market Value: The final requirement for producing a valid appraisal study is that appraisals must represent market values. As discussed in the introduction for this Section II, and in greater depth in the Procedure Manual (Section III), we use 4 tests to make this determination. The results of each test are reported in the following tables.

| Mann-Whitney Test | | | | |
|---|---|---|---|---|
| For the Entire Sample | | | | |
| Study | Observations | Rank sum | Expected | Ho: Ratios (35 STC Appraisals)=Ratios (1097 Sales)<br>z = 6.543<br>Prob > \|z\| = 0.0000 |
| 0 | 35 | 32286 | 19827.5 | |
| 1 | 1097 | 608992 | 621450.5 | |
| Combined | 1132 | 641278 | 641278 | |
| For Single Family Properties Only | | | | |
| Study | Observations | Rank sum | Expected | Ho : Ratios (24 STC Appraisals)=Ratios (1040 Sales)<br>z = 5.518<br>Prob > \|z\| = 0.0000 |
| 0 | 24 | 20992 | 12780 | |
| 1 | 1040 | 545588 | 553800 | |
| Combined | 1064 | 566580 | 566580 | |

| K-Sample Test | | | | |
|---|---|---|---|---|
| For the Entire Sample | | | | |
| Study | Not Greater than the median | Greater than the median | Total | Ho: Ratios (35 STC Appraisals)=Ratios (1097 Sales)<br>Pearson chi2(1) = 24.7952 Pr = 0.000<br>Continuity corrected:<br>Pearson chi2(1) = 23.1147 Pr = 0.000 |
| 0 | 3 | 32 | 35 | |
| 1 | 563 | 534 | 1097 | |
| Total | 566 | 566 | 1132 | |
| For Single Family Properties Only | | | | |
| Study | Not Greater than the median | Greater than the median | Total | Ho: Ratios (24 STC Appraisals)=Ratios (1040 Sales)<br>Pearson chi2(1) = 20.6321 Pr = 0.000<br>Continuity corrected:<br>Pearson chi2(1) = 18.7990 Pr = 0.000 |
| 0 | 1 | 23 | 24 | |
| 1 | 531 | 509 | 1040 | |
| Total | 532 | 532 | 1064 | |

All four tests lead to the conclusion that the STC appraisals do not represent market values (all with 99% statistical confidence). Therefore, the STC study is invalid and its reported results are unreliable.

## 5. Additional Analysis and Findings

5.1 Analysis of Reassessment History: The following table provides a comparison of actual assessment changes (net of new construction) to those that might have been expected for each of the last four

reassessments as well as the six-year period leading up to 2003. Only one of the reassessments produced changes in line with the market indicator.

| Actual Value Changes from Reassessment vs. Expected Value Change | | | | | |
|---|---|---|---|---|---|
| Biennial Year | % Net Assessment Change | Missouri OFHEO Index | % Value Change: Actual vs. Expected | St. Louis MSA OFHEO Index | % Value Change: Actual vs. Expected |
| 1999 | 5.9 | 8.4 | 70% | 9.6 | 62% |
| 2001 | 5.3 | 11.4 | 47% | 13.5 | 39% |
| 2003 | 4.7 | 11.8 | 40% | 12.9 | 36% |
| 2005 | 12.3 | 12.4 | 99% | 16.8 | 73% |
| Cumulative 1997 - 2003 | 16.8 | 35.0 | 48% | 40.4 | 42% |

## 6. Figures and Tables

**Table 1. STC's Appraisal Ratio Studies**

| | | Group | | |
|---|---|---|---|---|
| | | 1999 | 2001 | 2003 |
| Number of Appraisals | | 36 | 39 | 35 |
| Median | | .995 | .999 | 1.037 |
| 95% Confidence Interval for Median | Lower Bound | .972 | .855 | .949 |
| | Upper Bound | 1.005 | 1.038 | 1.091 |
| Weighted Mean | | .852 | .907 | 1.000 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .659 | .849 | .947 |
| | Upper Bound | 1.045 | .964 | 1.053 |
| Minimum | | .147 | .215 | .695 |
| Maximum | | 2.960 | 2.021 | 1.305 |
| Std. Deviation | | .374 | .285 | .162 |
| Price Related Differential | | 1.167 | 1.068 | 1.033 |
| Coefficient of Dispersion | | .132 | .183 | .120 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 75.0% | 46.2% | 54.3% |

**Figure 1. Ratios before Outlier Trimming**

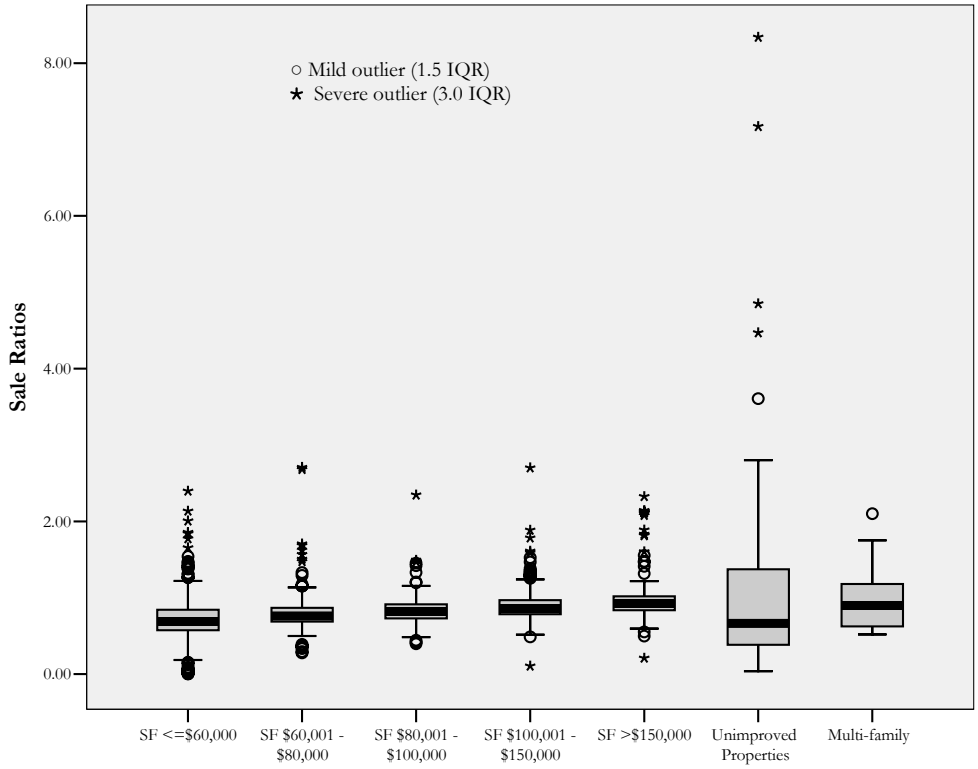
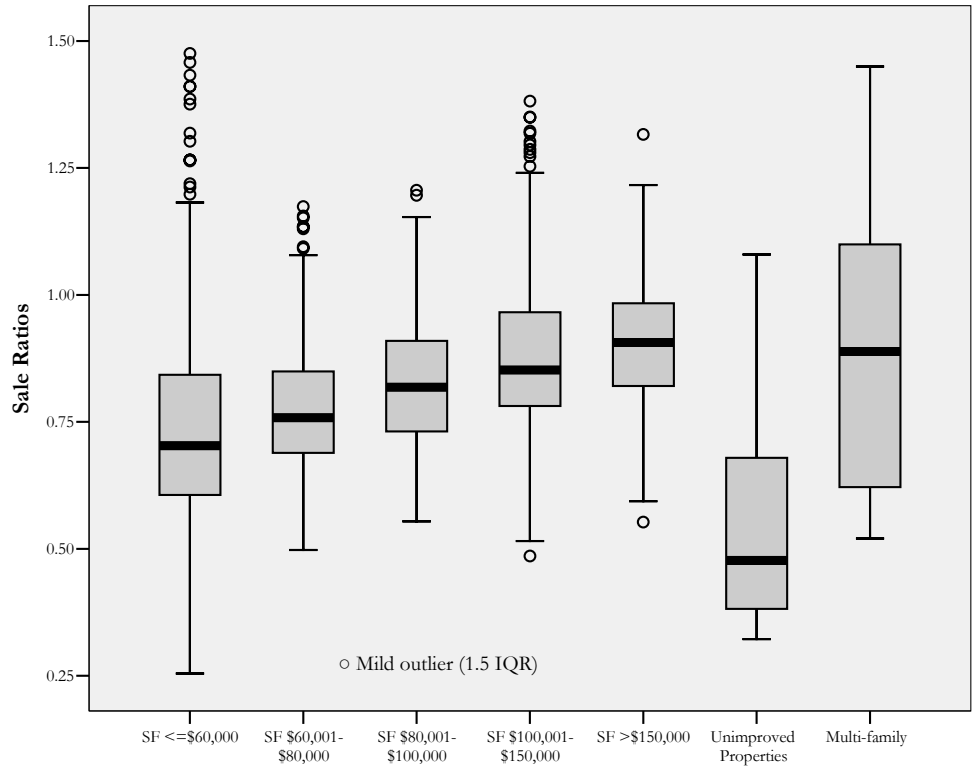
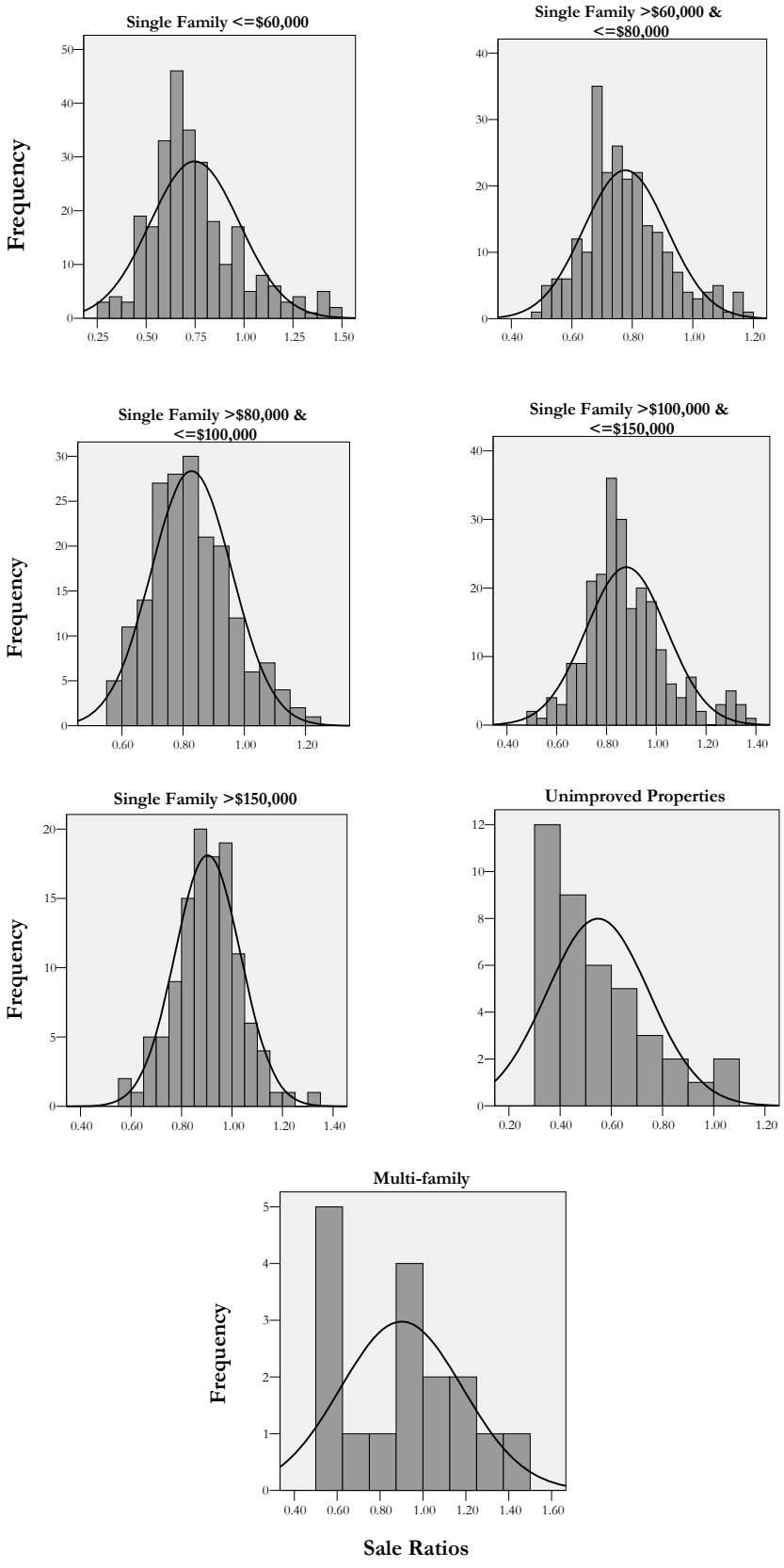



**Figure 2. Ratios after Outlier Trimming**



## Figure 3. Distribution of Final Sale Ratios



## Figure 3 (cont.). Distribution of Final Sale Ratios

### Shapiro-Francia W' Tests for Normality for Various Strata

| Strata | Observations | W' | V' | z | Prob* |
|---|---|---|---|---|---|
| Single Family | 1040 | 0.98504 | 10.327 | 4.993 | 0.00001 |
| Multi-family | 17 | 0.94209 | 1.354 | 0.531 | 0.29761 |
| Unimproved Properties | 40 | 0.87761 | 5.340 | 3.069 | 0.00107 |
| Single Family <=$60,000 | 268 | 0.94529 | 11.312 | 5.032 | 0.00001 |
| Single Family >$60,000 & <=$80,000 | 232 | 0.97093 | 5.309 | 3.481 | 0.00025 |
| Single Family >$80,000 & <=$100,000 | 188 | 0.98212 | 2.731 | 2.095 | 0.01809 |
| Single Family >$100,000 & <=$150,000 | 234 | 0.95957 | 7.439 | 4.159 | 0.00002 |
| Single Family >$150,000 | 118 | 0.99204 | 0.824 | -0.404 | 0.65684 |
| Overall Un-weighted | 1097 | 0.98872 | 8.137 | 4.530 | 0.00001 |

*This value represents the indicated probability that the underlying population is normally distributed. A value of less than .05 indicates a distribution that is not normal.

## Table 2. Sales Ratio Analysis: Stratified by Property Use

| | | Strata | | | |
|---|---|---|---|---|---|
| | | Single Family | Unimproved Properties | Multi-family | Overall Un-weighted |
| Number of Sales | | 1040 | 40 | 17 | 1097 |
| Median | | .806 | .478 | .889 | .802 |
| 95% Confidence Interval for Median | Lower Bound | .796 | .404 | .621 | .792 |
| | Upper Bound | .816 | .600 | 1.099 | .812 |
| Weighted Mean | | .813 | .620 | .875 | .812 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .801 | .475 | .731 | .801 |
| | Upper Bound | .824 | .765 | 1.020 | .824 |
| Minimum | | .254 | .322 | .520 | .254 |
| Maximum | | 1.475 | 1.080 | 1.450 | 1.475 |
| Std. Deviation | | .179 | .200 | .285 | .189 |
| Price Related Differential | | 1.004 | .884 | 1.029 | .994 |
| Coefficient of Dispersion | | .170 | .326 | .256 | .180 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 22.3% | 7.5% | 17.6% | 21.7% |

## Table 3. Combined Results – Post Stratification and Weighting

| | **Population Assessor's Value** | **Median** | **Estimated Actual Value** | **% of Total Est. Mkt. Value** | **Subtotal** |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Single Family | 2,249,499,390 | 0.806 | 2,790,942,171 | 92.3% | 0.744 |
| Unimproved Properties | 63,544,960 | 0.478 | 132,939,247 | 4.4% | 0.021 |
| Multi-family | 88,532,450 | 0.889 | 99,586,558 | 3.3% | 0.029 |
| Total | 2,401,576,800 | | 3,023,467,976 | 100.0% | 79.4% |
| | | | | | |
| | **Population Assessor's Value** | **Weighted Mean** | **Estimated Actual Value** | **% of Total Est. Mkt. Value** | **Subtotal** |
| **Strata** | | | | | |
| Single Family | 2,249,499,390 | 0.813 | 2,766,911,919 | 93.1% | 0.757 |
| Unimproved Properties | 63,544,960 | 0.62 | 102,491,871 | 3.5% | 0.021 |
| Multi-family | 88,532,450 | 0.875 | 101,179,943 | 3.4% | 0.030 |
| Total | 2,401,576,800 | | 2,970,583,733 | 100.0% | 80.8% |

## Table 4. Sales Ratio Analysis: Stratified by Use and Value

| | | Strata | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Single Family <=$60,000 | Single Family $60,001 - $80,000 | Single Family $80,001 - $100,000 | Single Family $100,001- $150,000 | Single Family >$150,000 | Un-improved Property | Multi-family | Overall Un-weighted |
| Number of Sales | | 268 | 232 | 188 | 234 | 118 | 40 | 17 | 1097 |
| Median | | .703 | .758 | .818 | .852 | .906 | .478 | .889 | .802 |
| 95% Confidence Interval for Median | Lower Bound | .680 | .736 | .796 | .831 | .877 | .404 | .621 | .792 |
| | Upper Bound | .727 | .781 | .834 | .871 | .942 | .600 | 1.099 | .812 |
| Weighted Mean | | .693 | .754 | .808 | .853 | .886 | .620 | .875 | .812 |
| 95% Confidence Interval For Weighted Mean | Lower Bound | .666 | .737 | .789 | .833 | .855 | .475 | .731 | .801 |
| | Upper Bound | .719 | .771 | .826 | .873 | .917 | .765 | 1.020 | .824 |
| Minimum | | .254 | .498 | .554 | .486 | .553 | .322 | .520 | .254 |
| Maximum | | 1.475 | 1.174 | 1.206 | 1.382 | 1.316 | 1.080 | 1.450 | 1.475 |
| Std. Deviation | | .229 | .138 | .132 | .162 | .130 | .200 | .285 | .189 |
| Price Related Differential | | 1.080 | 1.030 | 1.025 | 1.032 | 1.020 | .884 | 1.029 | .994 |
| Coefficient of Dispersion | | .240 | .140 | .126 | .141 | .111 | .326 | .256 | .180 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 11.6% | 14.2% | 23.9% | 29.5% | 45.8% | 7.5% | 17.6% | 21.7% |

## Table 5. Combined Results – Post Stratification and Weighting

| | Population Assessor's Value | Median | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Single Family <=$60,000 | 315,759,580 | 0.703 | 449,160,142 | 15.1% | 0.106 |
| Single Family >$60,000 & <=$80,000 | 324,185,440 | 0.758 | 427,685,277 | 14.4% | 0.109 |
| Single Family >$80,000 & <=$100,000 | 328,490,730 | 0.818 | 401,577,910 | 13.5% | 0.111 |
| Single Family >$100,000 & <=$150,000 | 599,855,630 | 0.852 | 704,055,904 | 23.7% | 0.202 |
| Single Family >$150,000 | 681,208,010 | 0.906 | 751,885,221 | 25.3% | 0.230 |
| Unimproved Properties | 63,544,960 | 0.478 | 132,939,247 | 4.5% | 0.021 |
| Multi-family | 88,532,450 | 0.889 | 99,586,558 | 3.4% | 0.030 |
| Total | 2,401,576,800 | | 2,966,890,258 | 100.0% | 80.9% |

| | Population Assessor's Value | Weighted Mean | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Single Family <=$60,000 | 315,759,580 | 0.693 | 455,641,530 | 15.4% | 0.106 |
| Single Family >$60,000 & <=$80,000 | 324,185,440 | 0.754 | 429,954,164 | 14.5% | 0.109 |
| Single Family >$80,000 & <=$100,000 | 328,490,730 | 0.808 | 406,547,933 | 13.7% | 0.111 |
| Single Family >$100,000 & <=$150,000 | 599,855,630 | 0.853 | 703,230,516 | 23.7% | 0.202 |
| Single Family >$150,000 | 681,208,010 | 0.886 | 768,857,799 | 25.9% | 0.230 |
| Unimproved Properties | 63,544,960 | 0.62 | 102,491,871 | 3.5% | 0.021 |
| Multi-family | 88,532,450 | 0.875 | 101,179,943 | 3.4% | 0.030 |
| Total | 2,401,576,800 | | 2,967,903,756 | 100.0% | 80.9% |

## Table 6. Sales Ratio Analysis: Stratified by Location

| | | Strata | | | | | |
|---|---|---|---|---|---|---|---|
| | | Road "1" | Road "US" | Road "SS" | Road "W" | Road "NH" | Overall Un-weighted |
| Number of Sales | | 658 | 131 | 102 | 180 | 26 | 1097 |
| Median | | .799 | .797 | .781 | .831 | .738 | .802 |
| 95% Confidence Interval for Median | Lower Bound | .788 | .726 | .752 | .796 | .598 | .792 |
| | Upper Bound | .814 | .816 | .834 | .877 | .849 | .812 |
| Weighted Mean | | .811 | .795 | .816 | .835 | .737 | .812 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .797 | .768 | .779 | .802 | .632 | .801 |
| | Upper Bound | .824 | .823 | .853 | .868 | .843 | .824 |
| Minimum | | .303 | .373 | .371 | .254 | .276 | .254 |
| Maximum | | 1.475 | 1.350 | 1.382 | 1.318 | 1.302 | 1.475 |
| Std. Deviation | | .184 | .175 | .169 | .209 | .261 | .189 |
| Price Related Differential | | .992 | .996 | .983 | 1.013 | 1.015 | .994 |
| Coefficient of Dispersion | | .173 | .173 | .163 | .203 | .275 | .180 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 20.2% | 22.1% | 19.6% | 29.4% | 11.5% | 21.7% |

## Table 7. Combined Results – Post Stratification and Weighting

| | Population Assessor's Value | Median | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Road US | 13,248,270 | 0.797 | 16,622,673 | 0.6% | 0.004 |
| Road SS | 8,885,420 | 0.781 | 11,376,978 | 0.4% | 0.003 |
| Road W | 32,442,250 | 0.831 | 39,040,012 | 1.3% | 0.011 |
| Road NH | 2,902,900 | 0.738 | 3,933,469 | 0.1% | 0.001 |
| Road 1 | 2,344,097,960 | 0.799 | 2,933,789,687 | 97.6% | 0.780 |
| Total | 2,401,576,800 | | 3,004,762,819 | 100.0% | 79.9% |

| | Population Assessor's Value | Weighted Mean | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Road US | 13,248,270 | 0.795 | 16,664,491 | 0.6% | 0.004 |
| Road SS | 8,885,420 | 0.816 | 10,888,995 | 0.4% | 0.003 |
| Road W | 32,442,250 | 0.835 | 38,852,994 | 1.3% | 0.011 |
| Road NH | 2,902,900 | 0.737 | 3,938,806 | 0.1% | 0.001 |
| Road 1 | 2,344,097,960 | 0.811 | 2,890,379,729 | 97.6% | 0.792 |
| Total | 2,401,576,800 | | 2,960,725,014 | 100.0% | 81.1% |

## Table 8. Sales Ratio Analysis: Stratified by Age

| | | Strata | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Un-improved Property | Multi-family | Un-known Age | Built before 1950 | Built 1950s | Built 1960s | Built 1970s | Built 1980s | Built 1990 thru 1995 | Built 1996 and newer | Over-all Un-weighted |
| Number of Sales | | 40 | 17 | 33 | 190 | 83 | 128 | 160 | 99 | 156 | 191 | 1097 |
| Median | | .478 | .889 | .656 | .765 | .760 | .772 | .781 | .811 | .830 | .865 | .802 |
| 95% Confidence Interval for Median | Lower Bound | .404 | .621 | .574 | .714 | .717 | .734 | .748 | .781 | .820 | .853 | .792 |
| | Upper Bound | .600 | 1.099 | .721 | .791 | .815 | .797 | .810 | .851 | .846 | .893 | .812 |
| Weighted Mean | | .620 | .875 | .663 | .768 | .776 | .777 | .779 | .813 | .824 | .875 | .812 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .475 | .731 | .587 | .737 | .735 | .744 | .755 | .779 | .796 | .853 | .801 |
| | Upper Bound | .765 | 1.020 | .739 | .799 | .818 | .809 | .803 | .846 | .852 | .897 | .824 |
| Minimum | | .322 | .520 | .415 | .326 | .438 | .351 | .459 | .543 | .254 | .276 | .254 |
| Maximum | | 1.080 | 1.450 | 1.266 | 1.458 | 1.410 | 1.475 | 1.411 | 1.131 | 1.206 | 1.350 | 1.475 |
| Std. Deviation | | .200 | .285 | .218 | .217 | .199 | .180 | .166 | .139 | .142 | .153 | .189 |
| Price Related Differential | | .884 | 1.029 | 1.038 | 1.036 | 1.035 | 1.019 | 1.020 | 1.015 | 1.017 | 1.002 | .994 |
| Coefficient of Dispersion | | .326 | .256 | .237 | .221 | .198 | .173 | .156 | .141 | .127 | .128 | .180 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 7.5% | 17.6% | 3.0% | 16.8% | 16.9% | 18.8% | 13.8% | 30.3% | 25.6% | 36.1% | 21.7% |

## Table 9. Combined Results – Post Stratification and Weighting

| | Population Assessor's Value | Median | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Unimproved Properties | 63,544,960 | 0.478 | 132,939,247 | 4.4% | 0.021 |
| Multi-family | 88,532,450 | 0.889 | 99,586,558 | 3.3% | 0.029 |
| Unknown Age | 33,616,670 | 0.656 | 51,244,924 | 1.7% | 0.011 |
| Built before 1950 | 243,515,640 | 0.765 | 318,321,098 | 10.5% | 0.081 |
| Built 1950's | 154,285,770 | 0.76 | 203,007,592 | 6.7% | 0.051 |
| Built 1960's | 220,267,970 | 0.772 | 285,321,205 | 9.4% | 0.073 |
| Built 1970's | 345,712,020 | 0.781 | 442,653,035 | 14.6% | 0.114 |
| Built 1980's | 322,445,730 | 0.811 | 397,590,296 | 13.2% | 0.107 |
| Built 1990-1995 | 362,001,630 | 0.83 | 436,146,542 | 14.4% | 0.120 |
| Built 1995 and newer | 567,653,960 | 0.865 | 656,247,353 | 21.7% | 0.188 |
| Total | 2,401,576,800 | | 3,023,057,849 | 100.0% | 79.4% |
| | **Population Assessor's Value** | **Weighted Mean** | **Estimated Actual Value** | **% of Total Est. Mkt. Value** | **Subtotal** |
| **Strata** | | | | | |
| Unimproved Properties | 63,544,960 | 0.62 | 102,491,871 | 3.4% | 0.021 |
| Multi-family | 88,532,450 | 0.875 | 101,179,943 | 3.4% | 0.030 |
| Unknown Age | 33,616,670 | 0.663 | 50,703,876 | 1.7% | 0.011 |
| Built before 1950 | 243,515,640 | 0.768 | 317,077,656 | 10.6% | 0.082 |
| Built 1950's | 154,285,770 | 0.776 | 198,821,869 | 6.7% | 0.052 |
| Built 1960's | 220,267,970 | 0.777 | 283,485,161 | 9.5% | 0.074 |
| Built 1970's | 345,712,020 | 0.779 | 443,789,499 | 14.9% | 0.116 |
| Built 1980's | 322,445,730 | 0.813 | 396,612,214 | 13.3% | 0.108 |
| Built 1990-1995 | 362,001,630 | 0.824 | 439,322,367 | 14.7% | 0.121 |
| Built 1995 and newer | 567,653,960 | 0.875 | 648,747,383 | 21.8% | 0.190 |
| Total | 2,401,576,800 | | 2,982,231,839 | 100.0% | 80.5% |

## Table 10. Sales Ratio Analysis: Stratified by Town Lots and Rural Lots

| | | Strata | | |
|---|---|---|---|---|
| | | Rural Lots | Town Lots | Overall Un-weighted |
| Number of Sales | | 353 | 744 | 1097 |
| Median | | .800 | .803 | .802 |
| 95% Confidence Interval for Median | Lower Bound | .783 | .788 | .792 |
| | Upper Bound | .821 | .815 | .812 |
| Weighted Mean | | .802 | .818 | .812 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .788 | .803 | .801 |
| | Upper Bound | .817 | .834 | .824 |
| Minimum | | .438 | .254 | .254 |
| Maximum | | 1.433 | 1.475 | 1.475 |
| Std. Deviation | | .156 | .202 | .189 |
| Price Related Differential | | 1.005 | .988 | .994 |
| Coefficient of Dispersion | | .149 | .194 | .180 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 21.5% | 21.8% | 21.7% |

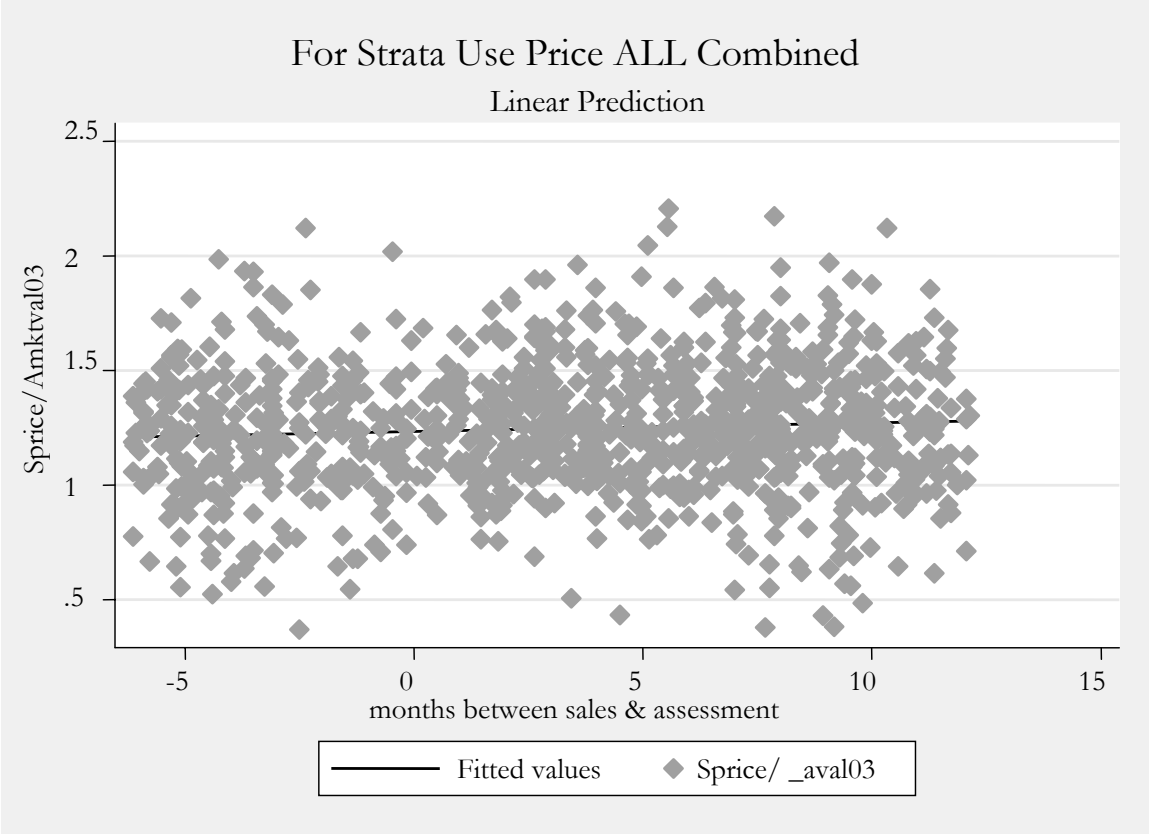
## Table 11. Combined Results – Post Stratification and Weighting

| | Population Assessor's Value | Median | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Town Lot | 1,114,718,010 | 0.803 | 1,388,191,793 | 46.3% | 0.372 |
| Rural Lot | 1,286,858,790 | 0.8 | 1,608,573,488 | 53.7% | 0.429 |
| Total | 2,401,576,800 | | 2,996,765,281 | 100.0% | 80.1% |

| | Population Assessor's Value | Weighted Mean | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Town Lot | 1,114,718,010 | 0.818 | 1,362,735,954 | 45.9% | 0.376 |
| Rural Lot | 1,286,858,790 | 0.802 | 1,604,562,082 | 54.1% | 0.434 |
| Total | 2,401,576,800 | | 2,967,298,036 | 100.0% | 80.9% |

**Graph 1. Single Family Property Price Trend**

A thorough analysis of price-time trends by price strata determined that adjusting reported prices was desirable for all single family properties combined. The prices for these strata ranged from $12,500 - $1,250,000. The resultant trend and statistical analysis is shown below.



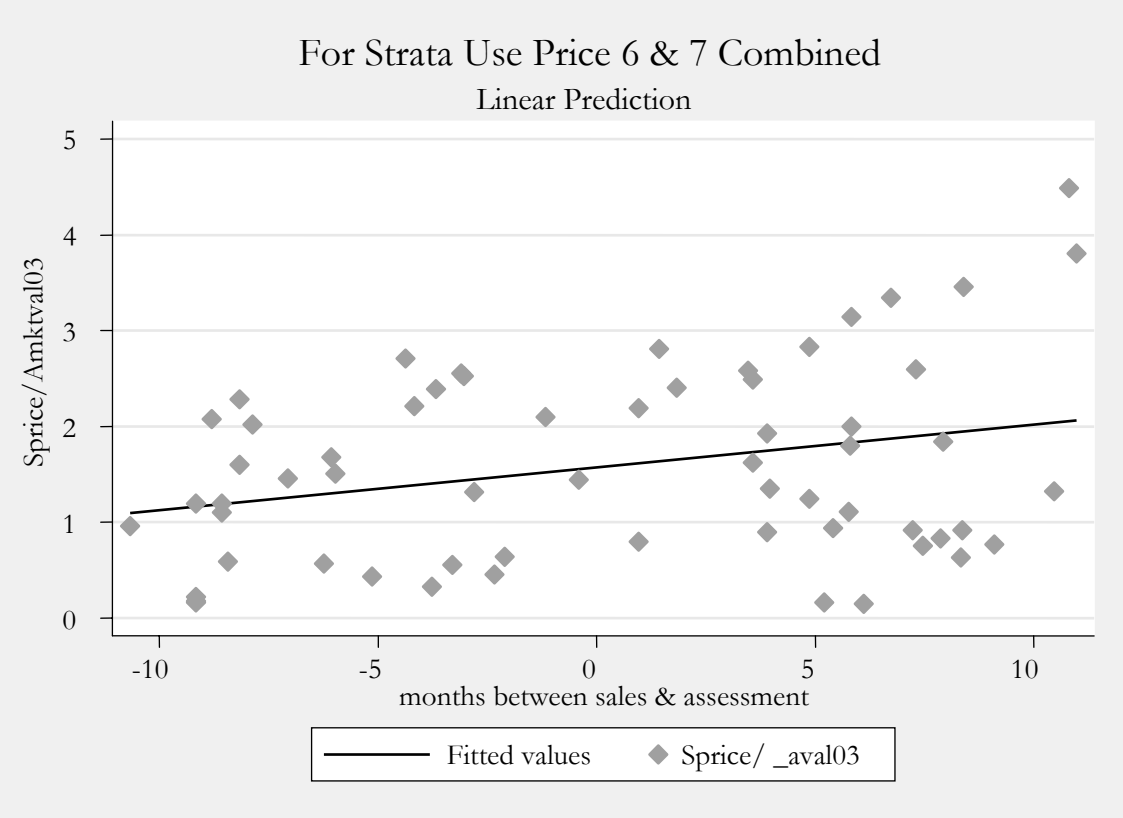

**Price Trend Regression Statistics**

| Source | SS | df | MS | Number of obs = 1048 | R-squared = 0. 0049 |
|---|---|---|---|---|---|
| Model | .399523347 | 1 | .399523347 | F(1, 1046) = 5.14 | Adj R-squared= 0. 0039 |
| Residual | 81.3366721 | 1046 | .077759725 | Prob > F = 0.0236 | Root MSE = .27885 |
| Total | 81.7361954 | 1047 | .078067044 | | |

| _aratio | Coef. | Std. Err. | t | P> t | [80% Conf. Interval] | |
|---|---|---|---|---|---|---|
| _adjperiod | .0037942 | .0016739 | 2.27 | 0.024 | .0016477 | .0059407 |
| _cons | 1.232591 | .0102597 | 120.14 | 0.000 | 1.219434 | 1.245747 |
| Monthly adjustment rate=.00307823 | | | | Annualized adjustment rate=.03693876 | | |

**Graph 2. Unimproved Property Price Trend**

A thorough analysis of price-time trends by price strata determined that adjusting reported prices was desirable for the unimproved property strata. The prices for these strata ranged from $1,500 - $185,000. The resultant trend and statistical analysis is shown below.




**Price Trend Regression Statistics**

| Source | SS | df | MS | | |
|---|---|---|---|---|---|
| Model | 5.15288006 | 1 | 5.15288006 | Number of obs = 61 | R-squared = 0. 0859 |
| Residual | 54.8496313 | 59 | .929654767 | F(1, 59) = 5.54 | Adj R-squared= 0. 0704 |
| Total | 60.0025113 | 60 | 1.00004186 | Prob > F = 0.0219 | Root MSE = .96419 |

| _aratio | Coef. | Std. Err. | t | P> t | [80% Conf. Interval] | |
|---|---|---|---|---|---|---|
| _adjperiod | .0447482 | .0190069 | 2.35 | 0.022 | .020114 | .0693824 |
| _cons | 1.56914 | .1235736 | 12.70 | 0.000 | 1.408981 | 1.7293 |
| Monthly adjustment rate=.02851766 | | | | Annualized adjustment rate=.34221192 | | |

# Chapter 9. Gasconade County

## 1. Significant Findings

1.1 Assessment Level: Gasconade County's 2003 residential property assessments were approximately 79% of market value (Section 3.5). The results from the corresponding STC study are invalid because the STC's appraisals did not meet the requirement that they reflect market values (Section 4.3).

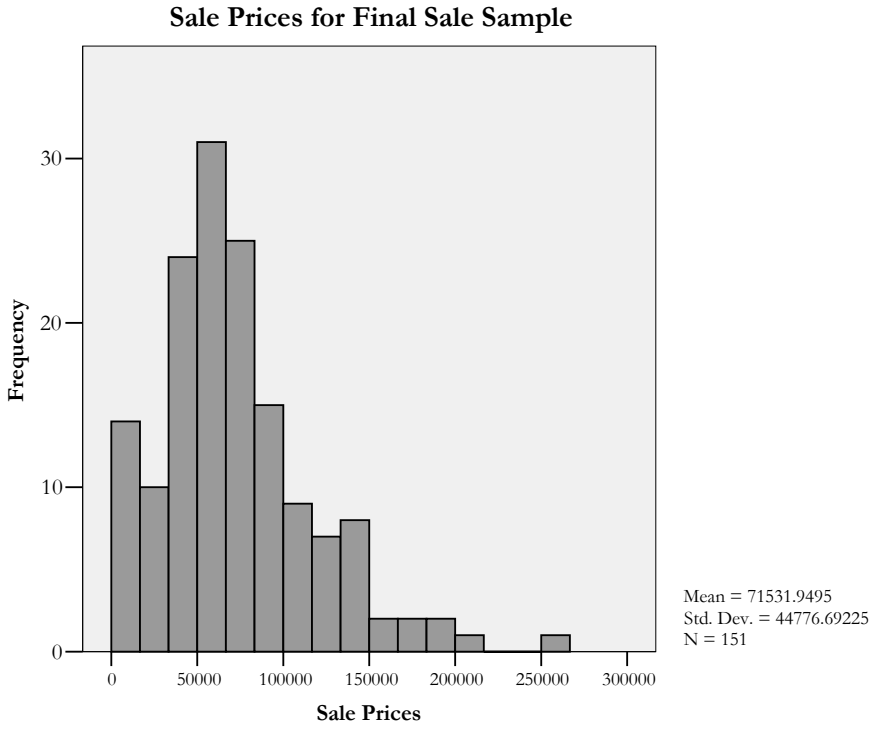
1.2 Assessment Equity: Lower-valued properties and properties outside of Hermann are assessed at lower levels than higher-valued properties and properties in Hermann respectively (Section 3.6 and Tables 3 & 5).

1.3 Reassessment History: One indicator of market value changes suggests that one of the past four biennial reassessments has produced lower value increases than the market. Cumulatively, the reassessments from 1997 through 2003 produced 71% of the expected rise in assessments (Section 5.1).

## 2. Data and Related Issues

2.1 Assessment Data: Sales and assessment information were matched at the county offices. Subsequently, the assessor reviewed the matched parcels and provided further information that assisted our screening process.

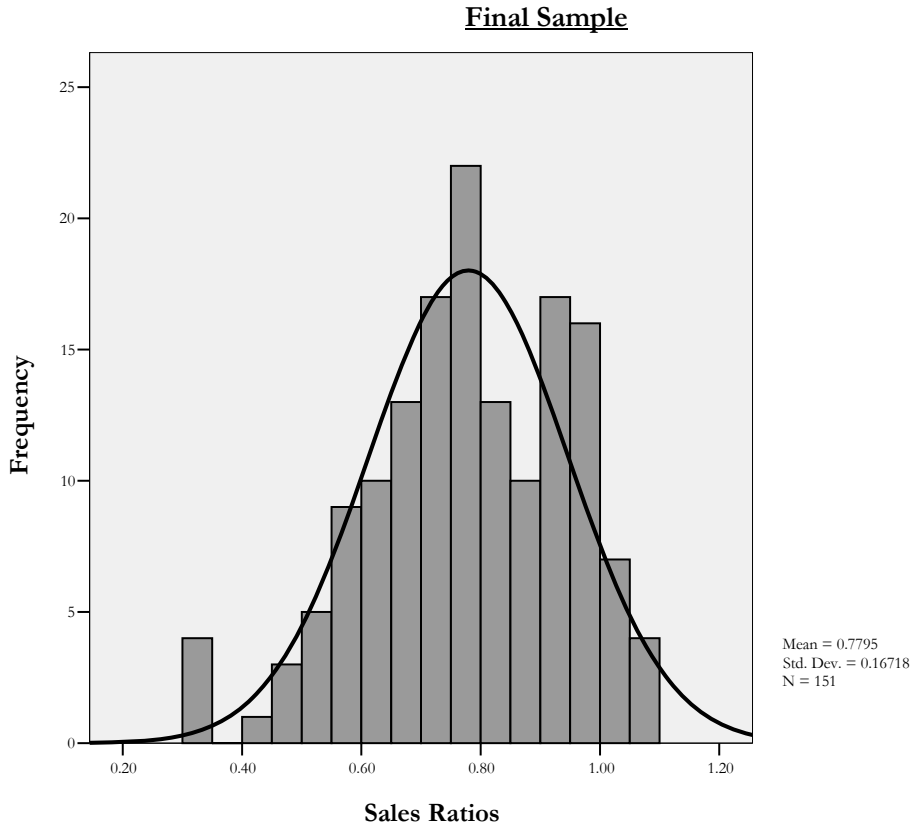
2.2 Sales and Ratio Data: The distribution of sale prices used is reflected in the following histogram.



The next table reports results of the data screening and trimming process. The "screened sales" represent the initial screened sample. The screened sales that were excluded from the final analysis because their ratios were deemed unrepresentative are identified as high or low trims. The "remaining ratios" represent the sample on which all the study's results are based.

| Trimming of Outliers | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | Improved Properties <=$39,000 | Improved Properties >$39,000 & <=$59,970 | Improved Properties >$59,970 & <=$77,690 | Improved Properties >$77,690 & <=$175,000 | Unimproved Properties | Total |
| **Screened Sales** | | 41 | 41 | 37 | 35 | 16 | 170 |
| Excluded | High Trims | 2 | 7 | 0 | 4 | 2 | 15 |
| | Low Trims | 3 | 1 | 0 | 0 | 0 | 4 |
| **Remaining Ratios** | | **36** | **33** | **37** | **31** | **14** | **151** |

The histogram below shows the distribution of the ratios for the sample.




2.3 Population: Since a complete copy of the assessment rolls in electronic form was not available, we used the best available alternative as a pseudo-population (hereinafter, "the population"), i.e. three random samples that were drawn and used by the STC.

## 3. Ratio Study Results

3.1 The Sample: The following table shows that the four single-family value strata vary from 5.5% to 7.1% from the population. Initially, this exhibits excessive variability from the sample to the

population. However, upon closer examination, this variation has no material effect and thus we conclude that the un-stratified sample is sufficiently representative of the population.

| Comparing Representivity | | | | | | |
|---|---|---|---|---|---|---|
| | Population Distribution | | | PPRC 2003 Sale Sample | | |
| Strata | N | $ | $ Weight | N | $ | $ Weight |
| Improved Properties <=$39,000 | 46 | 944,316 | 17.4% | 36 | 1,018,740 | 11.9% |
| Improved Properties >$39,000 & <=$59,970 | 13 | 633,789 | 11.7% | 33 | 1,609,640 | 18.8% |
| Improved Properties >$59,970 & <=$77,690 | 18 | 1,217,158 | 22.5% | 37 | 2,497,490 | 29.2% |
| Improved Properties >$77,690 & <=$175,000 | 22 | 2,468,105 | 45.5% | 31 | 3,368,670 | 39.4% |
| Unimproved Properties | 48 | 157,526 | 2.9% | 14 | 50,820 | 0.6% |
| Total | 147 | 5,420,895 | | 151 | 8,545,360 | |

3.2 Representing the Population with the Sample: Since the un-stratified sample is sufficiently representative of the population (Section 3.1), the use of stratification and weighting is not essential. Nevertheless, we used stratification because it produces additional analytical benefits and further optimizes representivity.

3.3 Sales Chasing: There was no indication of sales chasing.

3.4 Study Validity: The sample meets the requirements for producing valid inferences about the county's population of residential properties.

3.5 Assessment Level: Measures of the assessment level are summarized below. For the purposes of this study, the weighted mean from combined stratification is the preferred measure as long as both of the requirements from using the weighted mean are met. In this case, the distributions are normal (Figure 3) and weighting is compromised by the use of seriously undersized samples. Since both requirements are not met, we focus on the median, though taking notice of the weighted mean, to conclude that the County's assessments for 2003 reflect approximately 79% of market value.

| Assessment Level (Based on Percent of Market Value) | | | | |
|---|---|---|---|---|
| | Stratification and Weighting | Reference | Weighted Mean | Median |
| **Overall Un-weighted** | None | Table 3 | 79.1% | 78.5% |
| **Combined** | By Property Use and Value Range | Table 4 | 77.1% | 80.0% |

3.6 Equity Measures and Evaluation:

i. Uniformity within Strata: Results from Tables 2, 3, 5 & 6 for the strata with sufficient sample size for individual evaluation indicate no problem areas for internal uniformity.

ii. Uniformity between Strata: Another form of inequity exists when different strata are assessed at different levels. The IAAO has established guidelines for identifying such inequity, but compliance can be heavily affected by sample size and uniformity. Therefore, we confine our remarks to identifying where assessment levels differ markedly from the norm. The difference in assessment level (medians) between the lower and higher valued strata (73.8% versus 82.4% respectively, Table 3), as well as between locations outside of Hermann and Owensville to Herman (71.6% versus 79.6%, respectively, Table 5) is notable.

iii. Vertical Equity: The final form of potential inequity examined is vertical equity. The PRD for the overall sample of 0.985 complies with the IAAO standard.

## 4. STC Study

4.1 Comparative Results: The following table contrasts our results with those from the STC study. The STC found the level of assessment adequate, while ours does not. The STC reports a substandard horizontal equity measure and a poor measure for vertical equity, while our results find no such problems. We have already demonstrated that the PPRC study meets the criteria for achieving valid results. The rest of Section 4 examines the validity of the STC's study.

| Comparison of Study Results | | | |
|---|---|---|---|
| **Measure** | **STC Study*** | **PPRC Study*** | **PPRC Study Combined**** |
| Assessment Level – median | 103.8% | 78.5% | 80.0% |
| Assessment Level - wtd. Mean | 117.7% | 79.1% | 77.1% |
| COD | 25.2% | 17.0% | |
| PRD | 0.93 | 0.99 | |
| Sample Size | 35 | 151 | |
| Relative Precision | 1.00 | 2.08 | |
| * Overall sample (un-stratified and un-weighted) | | | |
| ** Stratification and weighting by Property Use and Value Range | | | |

4.2 Representing the Population with the Sample: The STC does not examine the representivity of its sample, nor does it have the necessary sample size or information to do so. Therefore, in the following table, we provide that missing analysis. In this case, the table shows that two of the strata in the STC sample, the two highest single-family value strata, vary from 8.3% to 15.0%. Initially, this exhibits excessive variability from the sample to the population. However, upon closer examination, this variation has no material effect and thus we conclude that the STC sample is sufficiently representative of the population.

| Comparing Representivity | | | | | | |
|---|---|---|---|---|---|---|
| | **Population** | | | **STC 2003 Appraisals** | | |
| **Strata** | **N** | **$** | **%** | **N** | **$** | **%** |
| Improved Properties <=$39,000 | 46 | 944,316 | 17.4% | 13 | 301,211 | 16.0% |
| Improved Properties >$39,000 & <=$59,970 | 13 | 633,789 | 11.7% | 4 | 198,316 | 10.6% |
| Improved Properties >$59,970 & <=$77,690 | 18 | 1,217,158 | 22.5% | 4 | 264,579 | 14.1% |
| Improved Properties >$77,690 & <=$175,000 | 22 | 2,468,105 | 45.5% | 9 | 1,098,526 | 58.5% |
| Unimproved Properties | 48 | 157,526 | 2.9% | 5 | 16,474 | 0.9% |
| Total | 147 | 5,420,895 | | 35 | 1,879,105 | |

4.3 Market Value: The final requirement for producing a valid appraisal study is that appraisals must represent market values. As discussed in the introduction for this Section II, and in greater depth in the Procedure Manual (Section III), we use 4 tests to make this determination. The results of each test are reported in the following tables.

| Mann-Whitney Test | | | | |
|---|---|---|---|---|
| For the Entire Sample | | | | |
| Study | Observations | Rank sum | Expected | Ho: Ratios (35 STC Appraisals)=Ratios (151 Sales)<br>z = 5.570<br>Prob > \|z\| = 0.0000 |
| 0 | 35 | 4871 | 3272.5 | |
| 1 | 151 | 12520 | 14118.5 | |
| Combined | 186 | 17391 | 17391 | |
| For Single Family Properties Only | | | | |
| Study | Observations | Rank sum | Expected | Ho : Ratios (30 STC Appraisals)=Ratios (136 Sales)<br>z = 6.026<br>Prob > \|z\| = 0.0000 |
| 0 | 30 | 3941 | 2505 | |
| 1 | 136 | 9920 | 11356 | |
| Combined | 166 | 13861 | 13861 | |

| K-Sample Test | | | | |
|---|---|---|---|---|
| For the Entire Sample | | | | |
| Study | Not Greater than the median | Greater than the median | Total | Ho: Ratios (35 STC Appraisals)=Ratios(151 Sales)<br>Pearson chi2(1) = 12.7050 Pr = 0.000<br>Continuity corrected:<br>Pearson chi2(1) = 11.4028 Pr = 0.001 |
| 0 | 8 | 27 | 35 | |
| 1 | 85 | 66 | 151 | |
| Total | 93 | 93 | 186 | |
| For Single Family Properties Only | | | | |
| Study | Not Greater than the median | Greater than the median | Total | Ho: Ratios (30 STC Appraisals)=Ratios(136 Sales)<br>Pearson chi2(1) = 16.2745 Pr = 0.000<br>Continuity corrected:<br>Pearson chi2(1) = 14.6877 Pr = 0.000 |
| 0 | 5 | 25 | 30 | |
| 1 | 78 | 58 | 136 | |
| Total | 83 | 83 | 166 | |

All four tests lead to the conclusion that the STC appraisals do not represent market values (all with 99% statistical confidence). Therefore, the STC study is invalid and its reported results are unreliable.

## 5. Additional Analysis and Findings

5.1 Analysis of Reassessment History: The following table provides a comparison of actual assessment changes (net of new construction) to those that might have been expected for each of the last four reassessments as well as the six-year period leading up to 2003. Three of the reassessments produced changes in line with the market indicator.

| Actual Value Changes from Reassessment vs. Expected Value Change | | | |
|---|---|---|---|
| Biennial Year | % Net Assessment Change | Missouri OFHEO Index | % Value Change: Actual vs. Expected |
| 1999 | 8.7 | 8.4 | 103% |
| 2001 | 8.7 | 11.4 | 76% |
| 2003 | 5.6 | 11.8 | 48% |
| 2005 | 10.6 | 12.4 | 85% |
| Cumulative 1997 - 2003 | 24.7 | 35.0 | 71% |

## 6. Figures and Tables

**Table 1. STC's Appraisal Ratio Studies**

| | | Group | | |
|---|---|---|---|---|
| | | 1999 | 2001 | 2003 |
| Number of Appraisals | | 39 | 39 | 35 |
| Median | | 1.000 | 1.008 | 1.038 |
| 95% Confidence Interval for Median | Lower Bound | .968 | .881 | .967 |
| | Upper Bound | 1.028 | 1.037 | 1.168 |
| Weighted Mean | | 1.004 | .944 | 1.177 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .954 | .888 | 1.032 |
| | Upper Bound | 1.054 | 1.001 | 1.322 |
| Minimum | | .342 | .224 | .499 |
| Maximum | | 1.317 | 3.008 | 2.876 |
| Std. Deviation | | .197 | .398 | .412 |
| Price Related Differential | | .967 | 1.076 | .934 |
| Coefficient of Dispersion | | .122 | .193 | .252 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 53.8% | 51.3% | 31.4% |

**Figure 1. Ratios before Outlier Trimming**

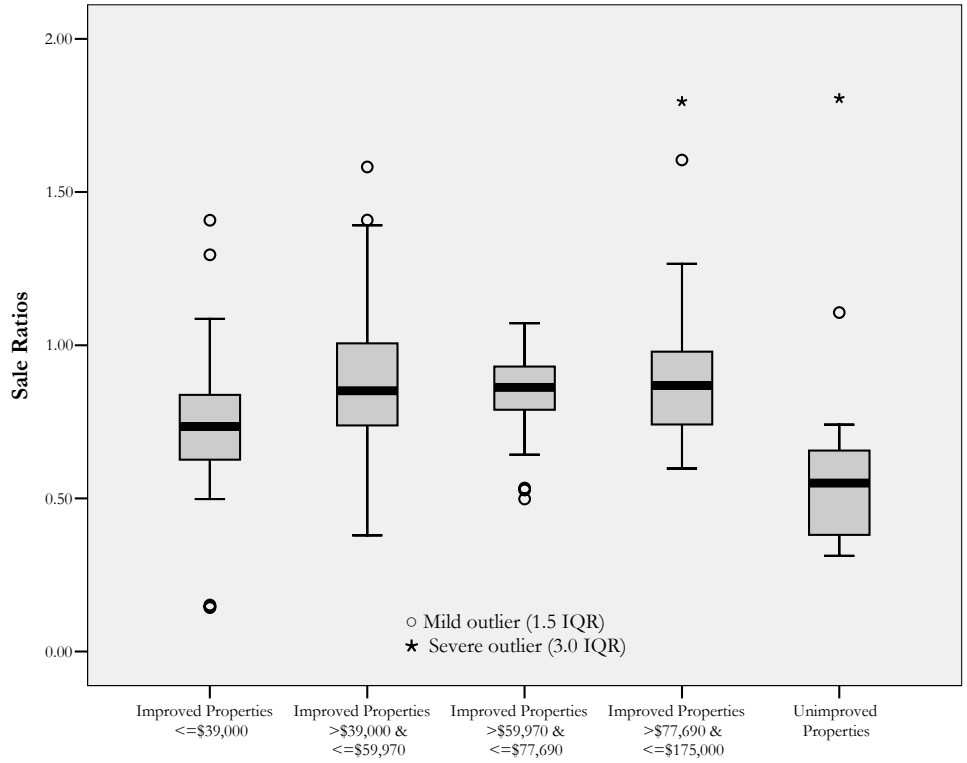
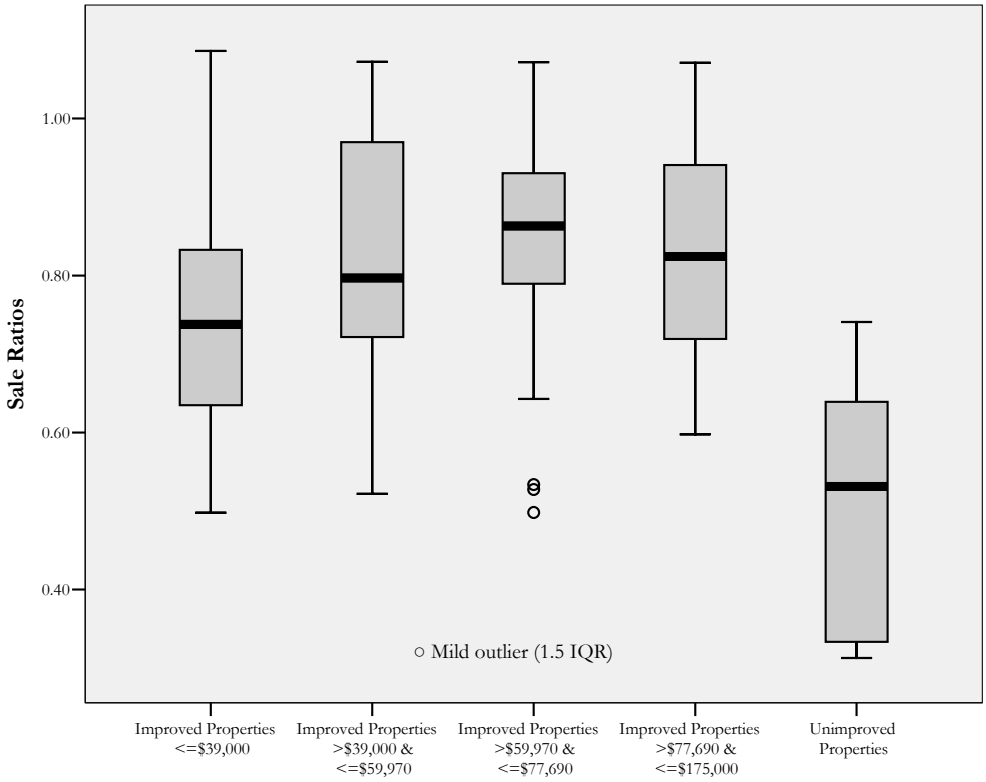
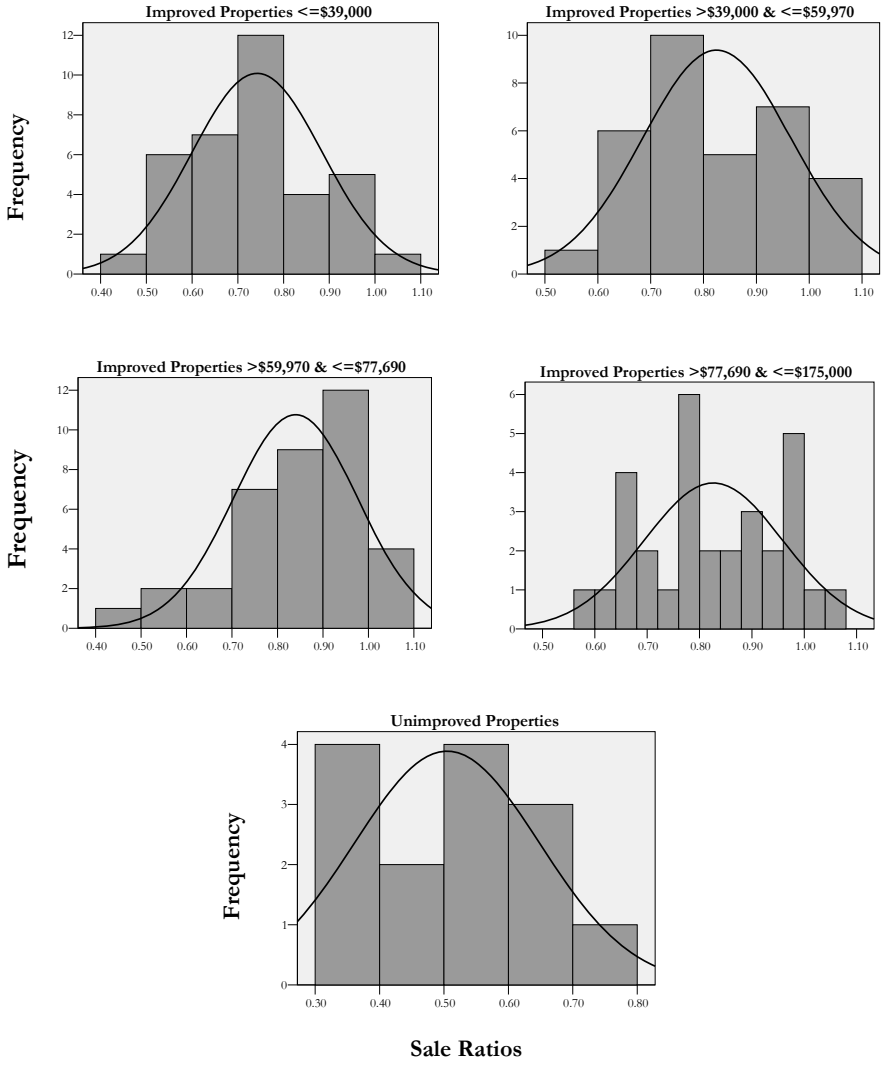



**Figure 2. Ratios after Outlier Trimming**



## Figure 3. Distribution of Final Sale Ratios




## Shapiro-Francia W' Tests for Normality for Various Strata

| Strata | Observations | W' | V' | z | Prob* |
|---|---|---|---|---|---|
| Single Family | 136 | 0.98605 | 1.625 | 1.002 | 0.15811 |
| Multi-family | 1 | . | . | . | . |
| Unimproved Properties | 14 | 0.94485 | 1.133 | 0.214 | 0.41532 |
| Improved Properties | 137 | 0.98525 | 1.728 | 1.128 | 0.12958 |
| Improved Properties <=$39,000 | 36 | 0.97146 | 1.149 | 0.261 | 0.39700 |
| Improved Properties >$39,000 & <=$59,970 | 33 | 0.97281 | 1.025 | 0.046 | 0.48153 |
| Improved Properties >$59,970 & <=$77,690 | 37 | 0.93678 | 2.599 | 1.770 | 0.03839 |
| Improved Properties >$77,690 & <=$175,000 | 31 | 0.97598 | 0.864 | -0.273 | 0.60750 |
| Overall Un-weighted | 151 | 0.97721 | 2.895 | 2.180 | 0.01461 |
| *This value represents the indicated probability that the underlying population is normally distributed. A value of less than .05 indicates a distribution that is not normal. | | | | | |

## Table 2. Sales Ratio Analysis: Stratified by Property Use

| | | Strata | | | |
|---|---|---|---|---|---|
| | | Single Family | Unimproved Properties | Multi-family | Overall Un-weighted |
| Number of Sales | | 136 | 14 | 1 | 151 |
| Median | | .798 | .531 | 1.015 | .785 |
| 95% Confidence Interval for Median | Lower Bound | .777 | .326 | . | .751 |
| | Upper Bound | .836 | .645 | . | .824 |
| Weighted Mean | | .794 | .434 | 1.015 | .791 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .767 | .354 | . | .765 |
| | Upper Bound | .821 | .515 | . | .818 |
| Minimum | | .498 | .313 | 1.015 | .313 |
| Maximum | | 1.086 | .741 | 1.015 | 1.086 |
| Std. Deviation | | .142 | .144 | . | .167 |
| Price Related Differential | | 1.016 | 1.162 | 1.000 | .985 |
| Coefficient of Dispersion | | .147 | .224 | .000 | .170 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 31.6% | .0% | 100.0% | 29.1% |

## Table 3. Sales Ratio Analysis: Stratified by Use and Value

| | | Strata | | | | | |
|---|---|---|---|---|---|---|---|
| | | Improved Properties <=$39,000 | Improved Properties >$39,000 &<=$59,970 | Improved Properties >$59,970 & <=$77,690 | Improved Properties >$77,690 & <=$175,000 | Unimproved Properties | Overall Un-weighted |
| Number of Sales | | 36 | 33 | 37 | 31 | 14 | 151 |
| Median | | .738 | .797 | .863 | .824 | .531 | .785 |
| 95% Confidence Interval for Median | Lower Bound | .662 | .751 | .806 | .760 | .326 | .751 |
| | Upper Bound | .799 | .916 | .922 | .905 | .645 | .824 |
| Weighted Mean | | .719 | .799 | .810 | .808 | .434 | .791 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .671 | .746 | .755 | .758 | .354 | .765 |
| | Upper Bound | .766 | .851 | .866 | .858 | .515 | .818 |
| Minimum | | .498 | .522 | .498 | .598 | .313 | .313 |
| Maximum | | 1.086 | 1.072 | 1.072 | 1.071 | .741 | 1.086 |
| Std. Deviation | | .142 | .140 | .137 | .132 | .144 | .167 |
| Price Related Differential | | 1.033 | 1.033 | 1.036 | 1.023 | 1.162 | .985 |
| Coefficient of Dispersion | | .150 | .145 | .121 | .137 | .224 | .170 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 16.7% | 33.3% | 43.2% | 35.5% | .0% | 29.1% |

## Table 4. Combined Results – Post Stratification and Weighting

| | Population Assessor's Value | Median | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Improved Properties <=$39,000 | 944,316 | 0.738 | 1,279,561 | 18.9% | 0.139 |
| Improved Properties >$39,000 & <=$59,970 | 633,789 | 0.797 | 795,219 | 11.7% | 0.094 |
| Improved Properties >$59,970 & <=$77,690 | 1,217,158 | 0.863 | 1,410,380 | 20.8% | 0.180 |
| Improved Properties >$77,690 & <=$175,000 | 2,468,105 | 0.824 | 2,995,273 | 44.2% | 0.364 |
| Unimproved Properties | 157,526 | 0.531 | 296,660 | 4.4% | 0.023 |
| Total | 5,420,895 | | 6,777,093 | 100.0% | 80.0% |

| | Population Assessor's Value | Weighted Mean | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Improved Properties <=$39,000 | 944,316 | 0.719 | 1,313,374 | 18.7% | 0.134 |
| Improved Properties >$39,000 & <=$59,970 | 633,789 | 0.799 | 793,228 | 11.3% | 0.090 |
| Improved Properties >$59,970 & <=$77,690 | 1,217,158 | 0.81 | 1,502,664 | 21.4% | 0.173 |
| Improved Properties >$77,690 & <=$175,000 | 2,468,105 | 0.808 | 3,054,586 | 43.5% | 0.351 |
| Unimproved Properties | 157,526 | 0.434 | 362,964 | 5.2% | 0.022 |
| Total | 5,420,895 | | 7,026,816 | 100.0% | 77.1% |

## Table 5. Sales Ratio Analysis: Stratified by Location

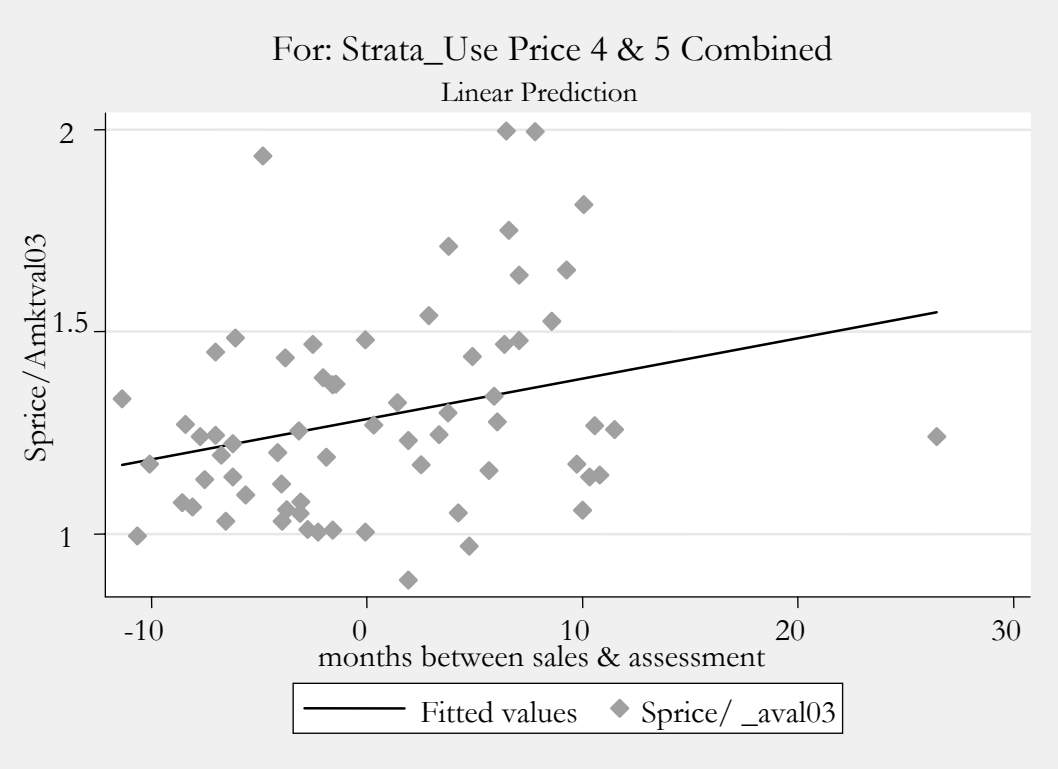
| | | Strata | | | |
|---|---|---|---|---|---|
| | | Hermann Area | Owensville Area | All other areas | Overall Un-weighted |
| Number of Sales | | 39 | 93 | 19 | 151 |
| Median | | .796 | .785 | .716 | .785 |
| 95% Confidence Interval for Median | Lower Bound | .741 | .742 | .662 | .751 |
| | Upper Bound | .927 | .824 | .901 | .824 |
| Weighted Mean | | .814 | .784 | .764 | .791 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .763 | .749 | .683 | .765 |
| | Upper Bound | .864 | .819 | .845 | .818 |
| Minimum | | .518 | .313 | .498 | .313 |
| Maximum | | 1.086 | 1.072 | 1.025 | 1.086 |
| Std. Deviation | | .151 | .174 | .155 | .167 |
| Price Related Differential | | 1.011 | .973 | 1.009 | .985 |
| Coefficient of Dispersion | | .158 | .175 | .175 | .170 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 35.9% | 26.9% | 26.3% | 29.1% |

## Table 6. Sales Ratio Analysis: Stratified by Age

| | | Strata | | | | | |
|---|---|---|---|---|---|---|---|
| | | Unimproved Properties | Built before 1950 | Built 1950's through 1960's | Built 1970's through 1980's | Built 1990 through 2003 | Overall Un-weighted |
| Number of Sales | | 14 | 27 | 33 | 29 | 20 | 123 |
| Median | | .531 | .796 | .908 | .793 | .778 | .782 |
| 95% Confidence Interval for Median | Lower Bound | .326 | .734 | .754 | .739 | .675 | .745 |
| | Upper Bound | .645 | .922 | .944 | .916 | .871 | .827 |
| Weighted Mean | | .434 | .800 | .848 | .798 | .754 | .795 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .354 | .753 | .790 | .728 | .689 | .764 |
| | Upper Bound | .515 | .847 | .905 | .867 | .819 | .825 |
| Minimum | | .313 | .562 | .556 | .498 | .534 | .313 |
| Maximum | | .741 | 1.086 | 1.072 | 1.072 | 1.025 | 1.086 |
| Std. Deviation | | .144 | .133 | .151 | .156 | .140 | .176 |
| Price Related Differential | | 1.162 | 1.015 | 1.002 | 1.005 | 1.023 | .979 |
| Coefficient of Dispersion | | .224 | .134 | .140 | .155 | .149 | .182 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | .0% | 29.6% | 51.5% | 31.0% | 25.0% | 31.7% |

**Graph 1. Single Family Property Price Trend**

A thorough analysis of price-time trends by price strata determined that adjusting reported prices was desirable for the highest valued single family properties. The prices for these strata ranged from $71,000 - $250,000. The resultant trend and statistical analysis is shown below.




**Price Trend Regression Statistics**

| Source | SS | df | MS | | |
|---|---|---|---|---|---|
| Model | .328769834 | 1 | .328769834 | Number of obs = 66 | R-squared = 0.0792 |
| Residual | 3.82312284 | 64 | .059736294 | F( 1, 64) = 5.50 | Adj R-squared= 0.0648 |
| Total | 4.15189268 | 65 | .063875272 | Prob > F = 0.0221 | Root MSE = .24441 |

| _aratio | Coef. | Std. Err. | T | P> t | [80% Conf. Interval] | |
|---|---|---|---|---|---|---|
| _adjperiod | .010001 | .004263 | 2.35 | 0.022 | .0044808 | .0155213 |
| _cons | 1.28439 | .0301844 | 42.55 | 0.000 | 1.245304 | 1.323477 |
| Monthly adjustment rate=.0077866 | | | | Annualized adjustment rate=.0934389 | | |

# Chapter 10. Howell County

## 1. Significant Findings

1.1 Assessment Level: Howell County's 2003 residential property assessments were approximately 86% of market value (Section 3.5). The results from the corresponding STC study are invalid because the STC's appraisals did not meet the essential requirement that they reflect market values (Section 4.3).

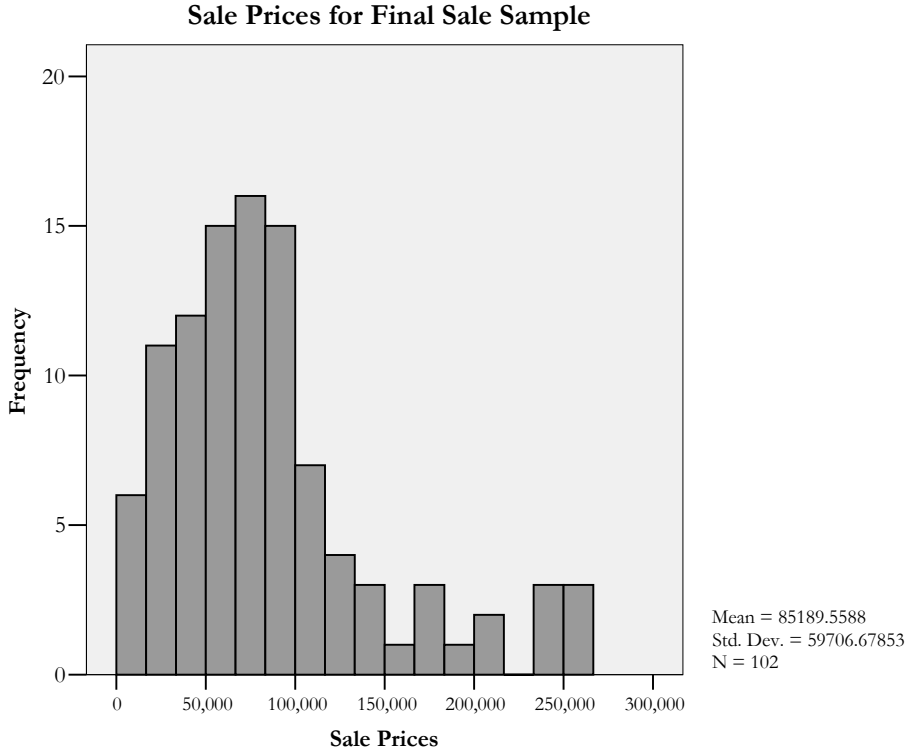
1.2 Assessment Equity: There were no substantial problems (Section 3.6).

1.3 Reassessment History: One indicator of market value changes suggests that two of the past four biennial reassessments have produced lower value increases than the market. Cumulatively, the reassessments from 1997 through 2003 produced only 25% of the expected rise in assessments. The net change in assessments in 1999 and 2003 raises questions regarding whether any serious revaluation occurred (Section 5.1).

## 2. Data and Related Issues

2.1 Assessment Data: Sales and assessment information were matched at the county offices. Subsequently, the assessor reviewed the matched parcels and provided further information that assisted our screening process.

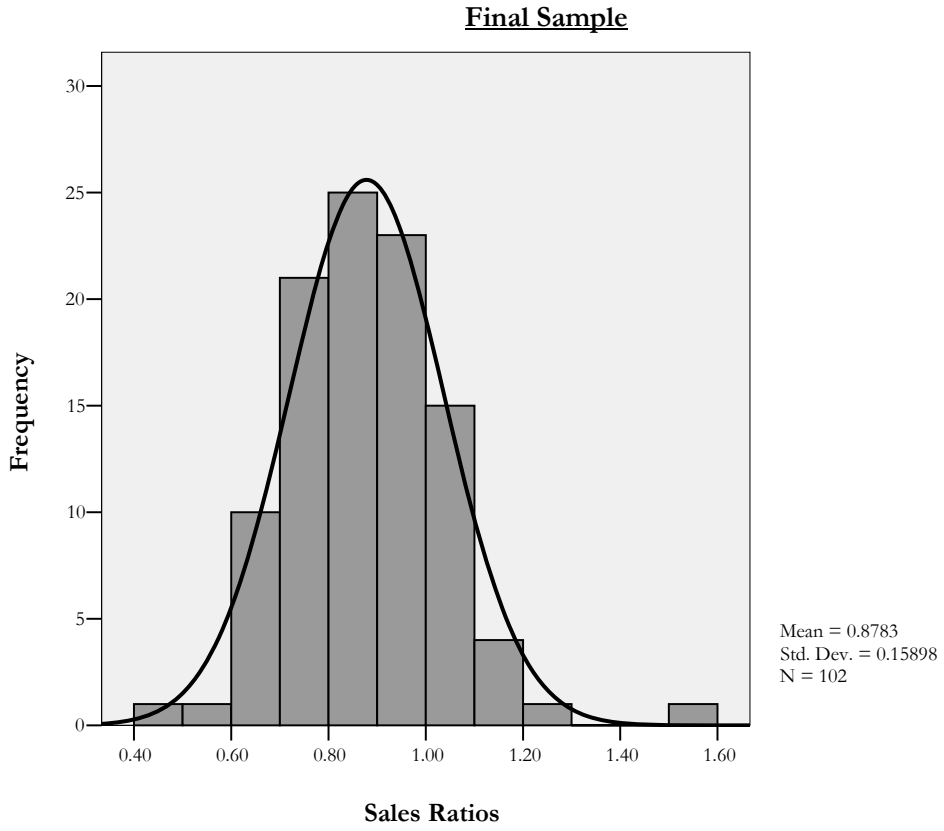
2.2 Sales and Ratio Data: The distribution of sale prices used is reflected in the following histogram.



The next table reports results of the data screening and trimming process. The "screened sales" represent the initial screened sample. The screened sales that were excluded from the final analysis because their ratios were deemed unrepresentative are identified as high or low trims. The "remaining ratios" represent the sample on which all the study's results are based.

| Trimming of Outliers | | | | | | |
|---|---|---|---|---|---|---|
| | | Improved Properties <=$49,700 | Improved Properties $49,701 - $84,000 | Improved Properties >$84,000 | Unimproved Properties | Total |
| **Screened Sales** | | 39 | 38 | 34 | 11 | 122 |
| Excluded | High Trims | 3 | 5 | 1 | 2 | 11 |
| | Low Trims | 6 | 1 | 2 | 0 | 9 |
| **Remaining Ratios** | | **30** | **32** | **31** | **9** | **102** |

The histogram below shows the distribution of the ratios for the sample.




2.3 Population: Since a complete copy of the assessment rolls in electronic form was not available, we used the best available alternative as a pseudo-population (hereinafter, "the population"), i.e. three random samples that were drawn and used by the STC.

## 3. Ratio Study Results

3.1 The Sample: The following table shows that the three improved property strata vary from 13.0% to 35.8% from the population. Initially, this exhibits excessive variability from the sample to the

population. Upon closer examination, this variation has a cumulative material effect on the overall assessment level and thus we conclude that the un-stratified sample is insufficiently representative of the population.

| Comparing Representivity | | | | | | |
|---|---|---|---|---|---|---|
| | Population Distribution | | | PPRC 2003 Sale Sample | | |
| Strata | N | $ | $ Weight | N | $ | $ Weight |
| Improved Properties <=$49,700 | 52 | 1,551,789 | 29.6% | 30 | 1,037,632 | 13.6% |
| Improved Properties $49,701 - $84,000 | 38 | 2,458,526 | 46.9% | 32 | 2,110,316 | 27.7% |
| Improved Properties >$84,000 | 8 | 1,107,000 | 21.1% | 31 | 4,339,316 | 56.9% |
| Unimproved Properties | 15 | 121,421 | 2.3% | 9 | 140,000 | 1.8% |
| Total | 113 | 5,238,737 | | 102 | 7,627,263 | |

3.2 Representing the Population with the Sample: Since the un-stratified sample is insufficiently representative of the population (Section 3.1), the use of stratification and weighting is essential. Furthermore, stratification provides additional analytical benefits.

3.3 Sales Chasing: There was no indication of sales chasing.

3.4 Study Validity: Once the sample has been stratified and weighted, all requirements for producing valid inferences about the county's population of residential properties are met.

3.5 Assessment Level: Measures of the assessment level are summarized below. For the purposes of this study, the weighted mean from combined stratification is the preferred measure as long as both of the requirements for using the weighted mean are met. In this case, the distributions are approximately normal (Figure 3) and weighting is not severely compromised by the use of seriously undersized samples. Since both requirements are met, we focus on the weighted mean, though taking notice of the median, to conclude that the County's assessments for 2003 reflect approximately 86% of market value.

| Assessment Level (Based on Percent of Market Value) | | | | |
|---|---|---|---|---|
| | Stratification and Weighting | Reference | Weighted Mean | Median |
| **Overall Un-weighted** | None | Table 3 | 87.8% | 86.2% |
| **Combined** | By Property Use and Value Range | Table 4 | 85.5% | 86.3% |

3.6 Equity Measures and Evaluation:

i. Uniformity within Strata: Results from Tables 2, 3 & 5 for the strata with sufficient sample size for individual evaluation indicate no problem areas for internal uniformity.

ii. Uniformity between Strata: Another form of inequity exists when different strata are assessed at different levels. The IAAO has established guidelines for identifying such inequity, but compliance can be heavily affected by sample size and uniformity. Therefore, we confine our remarks to identifying where assessment levels differ markedly from the norm. For this county, there were no substantial differences.

iii. Vertical Equity: The final form of potential inequity examined is vertical equity. The PRD for the overall sample of 1.001 complies with the IAAO standard.

## 4. STC Study

4.1 Comparative Results: The following table contrasts our results with those from the STC study. The STC found the level of assessment adequate, while ours does not. The STC reports similarly acceptable measures for horizontal and vertical equity. We have already demonstrated that the PPRC study meets the criteria for achieving valid results. The rest of Section 4 examines the validity of the STC's study.

| Comparison of Study Results | | | |
|---|---|---|---|
| **Measure** | **STC Study*** | **PPRC Study*** | **PPRC Study Combined**** |
| Assessment Level - median | 97.6% | 86.2% | 86.3% |
| Assessment Level - wtd. mean | 95.9% | 87.8% | 85.5% |
| COD | 12.8% | 14.1% | |
| PRD | .985 | 1.00 | |
| Sample Size | 34 | 102 | |
| Relative Precision | 1.00 | 1.73 | |
| * Overall sample (un-stratified and un-weighted) | | | |
| ** Stratification and weighting by Property Use and Value Range | | | |

4.2 Representing the Population with the Sample: The STC does not examine the representivity of its sample, nor does it have the necessary sample size or information to do so. Therefore, in the following table, we provide that missing analysis. In this case, the table shows that two of the strata in the STC sample, the lowest and highest improved property strata, vary from 8.4% to 9.0%. Initially, this exhibits excessive variability from the sample to the population. However, upon closer examination, this variation has no material effect and thus we conclude that the STC sample is sufficiently representative of the population.

| Comparing Representivity | | | | | | |
|---|---|---|---|---|---|---|
| | **Population** | | | **STC 2003 Appraisals** | | |
| **Strata** | **N** | **$** | **%** | **N** | **$** | **%** |
| Improved Properties <=$49,700 | 52 | 1,551,789 | 29.6% | 19 | 571,000 | 38.0% |
| Improved Properties $49,701 - $84,000 | 38 | 2,458,526 | 46.9% | 10 | 676,105 | 45.0% |
| Improved Properties >$84,000 | 8 | 1,107,000 | 21.1% | 2 | 181,526 | 12.1% |
| Unimproved Properties | 15 | 121,421 | 2.3% | 3 | 74,053 | 4.9% |
| Total | 113 | 5,238,737 | | 34 | 1,502,684 | |

4.3 Market Value: The final requirement for producing a valid appraisal study is that appraisals must represent market values. As discussed in the introduction for this Section II, and in greater depth in the Procedure Manual (Section III), we use 4 tests to make this determination. The results of each test are reported in the following tables.

| Mann-Whitney Test | | | | |
|---|---|---|---|---|
| For the Entire Sample | | | | |
| Study | Observations | Rank sum | Expected | Ho: Ratios (34 STC Appraisals)=Ratios (102 Sales)<br>z = 2.754<br>Prob > \|z\| = 0.0059 |
| 0 | 34 | 2877 | 2329 | |
| 1 | 102 | 6439 | 6987 | |
| Combined | 136 | 9316 | 9316 | |
| For Single Family Properties Only | | | | |
| Study | Observations | Rank sum | Expected | Ho : Ratios (31 STC Appraisals)=Ratios (92 Sales)<br>z = 2.645<br>Prob > \|z\| = 0.0082 |
| 0 | 31 | 2376 | 1922 | |
| 1 | 92 | 5250 | 5704 | |
| Combined | 123 | 7626 | 7626 | |

| K-Sample Test | | | | |
|---|---|---|---|---|
| For the Entire Sample | | | | |
| Study | Not Greater than the median | Greater than the median | Total | Ho: Ratios (34 STC Appraisals)=Ratios (102 Sales)<br>Pearson chi2(1) = 5.6471 Pr = 0.017<br>Continuity corrected:<br>Pearson chi2(1) = 4.7451 Pr = 0.029 |
| 0 | 11 | 23 | 34 | |
| 1 | 57 | 45 | 102 | |
| Total | 68 | 68 | 136 | |
| For Single Family Properties Only | | | | |
| Study | Not Greater than the median | Greater than the median | Total | Ho: Ratios (31 STC Appraisals)=Ratios (92 Sales)<br>Pearson chi2(1) = 5.4607 Pr = 0.019<br>Continuity corrected:<br>Pearson chi2(1) = 4.5332 Pr = 0.033 |
| 0 | 10 | 21 | 31 | |
| 1 | 52 | 40 | 92 | |
| Total | 62 | 61 | 123 | |

All four tests lead to the conclusion that the STC appraisals do not represent market values (all with 95% statistical confidence). Therefore, the STC study is invalid and its reported results are unreliable.

## 5. Additional Analysis and Findings

5.1 Analysis of Reassessment History: The following table provides a comparison of actual assessment changes (net of new construction) to those that might have been expected for each of the last four reassessments as well as the six-year period leading up to 2003. Two of the reassessments produced changes in line with the market indicator.

| Actual Value Changes from Reassessment vs. Expected Value Change | | | |
|---|---|---|---|
| Biennial Year | % Net Assessment Change | Missouri OFHEO Index | % Value Change: Actual vs. Expected |
| 1999 | 0.3 | 8.4 | 4% |
| 2001 | 8.4 | 11.4 | 74% |
| 2003 | -0.2 | 11.8 | -2% |
| 2005 | 7.9 | 12.4 | 63% |
| Cumulative 1997 - 2003 | 8.6 | 35.0 | 25% |

## 6. Figures and Tables

**Table 1. STC's Appraisal Ratio Studies**

| | | Group | | |
|---|---|---|---|---|
| | | 1999 | 2001 | 2003 |
| Number of Appraisal | | 39 | 40 | 34 |
| Median | | 1.032 | 1.012 | .976 |
| 95% Confidence Interval for Median | Lower Bound | .992 | 1.001 | .885 |
| | Upper Bound | 1.118 | 1.045 | 1.029 |
| Weighted Mean | | 1.031 | 1.056 | .959 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .954 | 1.003 | .913 |
| | Upper Bound | 1.107 | 1.110 | 1.006 |
| Minimum | | .611 | .748 | .327 |
| Maximum | | 7.090 | 2.438 | 1.241 |
| Std. Deviation | | .991 | .262 | .176 |
| Price Related Differential | | 1.178 | 1.007 | .985 |
| Coefficient of Dispersion | | .306 | .112 | .128 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 43.6% | 75.0% | 52.9% |

**Figure 1. Ratios before Outlier Trimming**

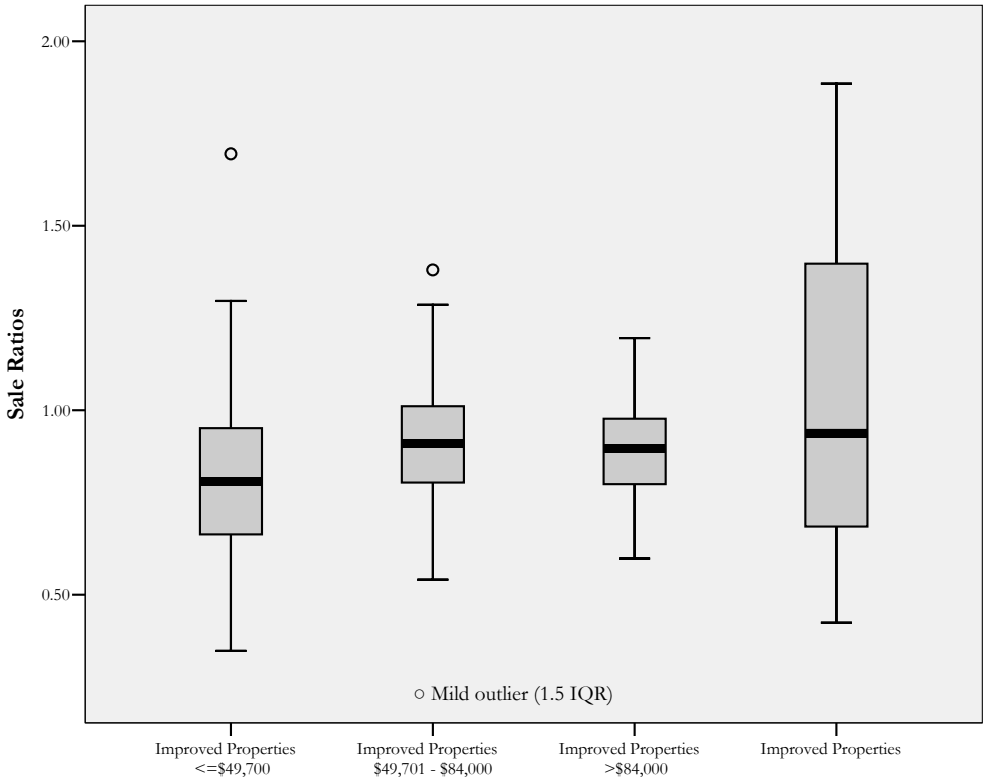
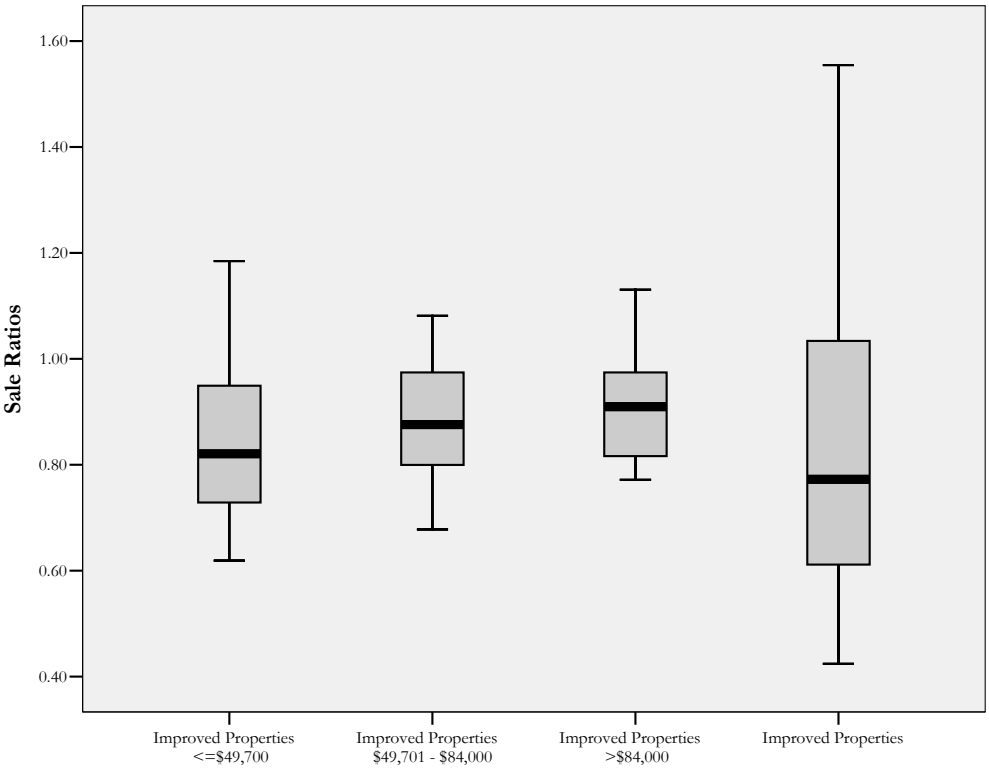
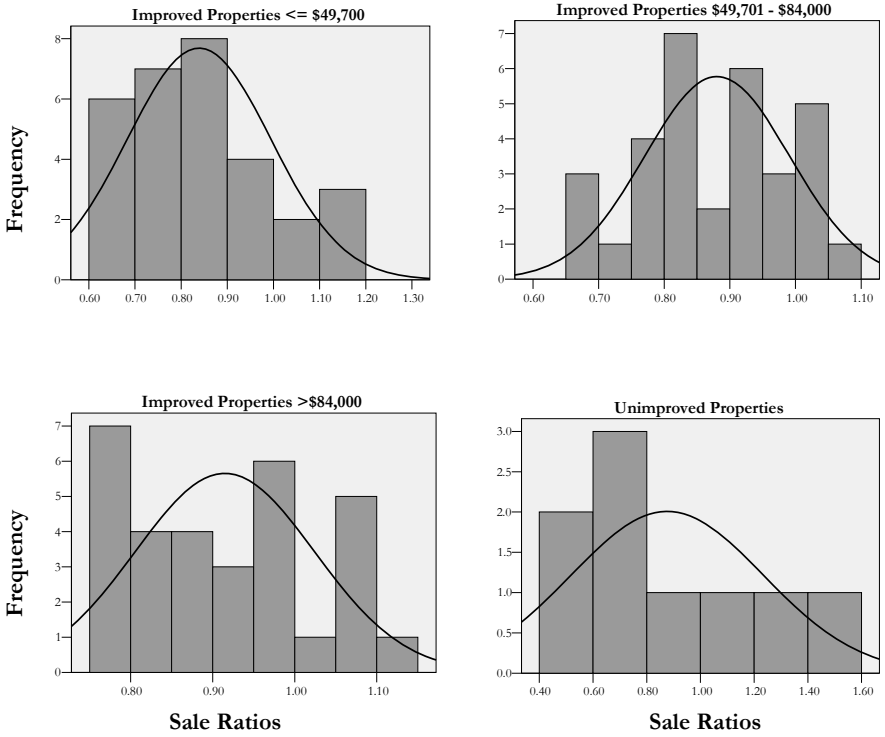



**Figure 2. Ratios after Outlier Trimming**



## Figure 3. Distribution of Final Sale Ratios




## Shapiro-Francia W' Tests for Normality for Various Strata

| Strata | Observations | W' | V' | z | Prob* |
|---|---|---|---|---|---|
| Single Family | 92 | 0.98863 | 0.960 | -0.084 | 0.53330 |
| Multi-family | 1 | . | . | . | . |
| Unimproved Properties | 9 | 0.95604 | 0.693 | -0.564 | 0.71360 |
| Improved Properties | 93 | 0.98974 | 0.873 | -0.277 | 0.60911 |
| Improved Properties <=$49,700 | 30 | 0.96136 | 1.356 | 0.562 | 0.28691 |
| Improved Properties $49,701 - $84,000 | 32 | 0.98003 | 0.736 | -0.576 | 0.71768 |
| Improved Properties >$84,000 | 31 | 0.94529 | 1.968 | 1.246 | 0.10647 |
| Overall Un-weighted | 102 | 0.95869 | 3.794 | 2.638 | 0.00417 |
| *This value represents the indicated probability that the underlying population is normally distributed. A value of less than .05 indicates a distribution that is not normal. | | | | | |

## Table 2. Sales Ratio Analysis: Stratified by Property Use

| | | Strata | | | |
|---|---|---|---|---|---|
| | | Single Family | Unimproved Properties | Multi-family | Overall Un-weighted |
| Number of Sales | | 92 | 9 | 1 | 102 |
| Median | | .862 | .773 | .900 | .862 |
| 95% Confidence Interval for Median | Lower Bound | .830 | .554 | . | .827 |
| | Upper Bound | .920 | 1.240 | . | .920 |
| Weighted Mean | | .881 | .730 | .900 | .878 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .852 | .564 | . | .850 |
| | Upper Bound | .910 | .895 | . | .906 |
| Minimum | | .619 | .424 | .900 | .424 |
| Maximum | | 1.185 | 1.555 | .900 | 1.555 |
| Std. Deviation | | .130 | .358 | . | .159 |
| Price Related Differential | | .997 | 1.201 | 1.000 | 1.001 |
| Coefficient of Dispersion | | .124 | .348 | .000 | .141 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 39.1% | 22.2% | 100.0% | 38.2% |

## Table 3. Sales Ratio Analysis: Stratified by Use and Value

| | | Strata | | | | |
|---|---|---|---|---|---|---|
| | | Improved Properties <= $49,700 | Improved Properties $49,701 - $84,000 | Improved Properties >$84,000 | Unimproved Properties | Overall Un-weighted |
| Number of Sales | | 30 | 32 | 31 | 9 | 102 |
| Median | | .821 | .876 | .909 | .773 | .862 |
| 95% Confidence Interval for Median | Lower Bound | .753 | .814 | .830 | .554 | .827 |
| | Upper Bound | .877 | .946 | .970 | 1.240 | .920 |
| Weighted Mean | | .811 | .869 | .906 | .730 | .878 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .752 | .829 | .862 | .564 | .850 |
| | Upper Bound | .869 | .909 | .950 | .895 | .906 |
| Minimum | | .619 | .678 | .772 | .424 | .424 |
| Maximum | | 1.185 | 1.081 | 1.131 | 1.555 | 1.555 |
| Std. Deviation | | .156 | .111 | .109 | .358 | .159 |
| Price Related Differential | | 1.035 | 1.013 | 1.010 | 1.201 | 1.001 |
| Coefficient of Dispersion | | .149 | .107 | .103 | .348 | .141 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 23.3% | 46.9% | 48.4% | 22.2% | 38.2% |

## Table 4. Combined Results – Post Stratification and Weighting

| | Population Assessor's Value | Median | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Improved Properties <=$49,700 | 1,551,789 | 0.821 | 1,890,121 | 31.1% | 0.256 |
| Improved Properties $49,700 - $84,000 | 2,458,526 | 0.876 | 2,806,537 | 46.2% | 0.405 |
| Improved Properties >$84,000 | 1,107,000 | 0.909 | 1,217,822 | 20.1% | 0.182 |
| Unimproved Properties | 121,421 | 0.773 | 157,078 | 2.6% | 0.020 |
| Total | 5,238,737 | | 6,071,558 | 100.0% | 86.3% |

| | Population Assessor's Value | Weighted Mean | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Improved Properties <=$49,684 | 1,551,789 | 0.811 | 1,913,427 | 31.2% | 0.253 |
| Improved Properties $49,700 - $84,000 | 2,458,526 | 0.869 | 2,829,144 | 46.1% | 0.401 |
| Improved Properties >$84,000 | 1,107,000 | 0.906 | 1,221,854 | 19.9% | 0.181 |
| Unimproved Properties | 121,421 | 0.73 | 166,330 | 2.7% | 0.020 |
| Total | 5,238,737 | | 6,130,756 | 100.0% | 85.5% |

## Table 5. Sales Ratio Analysis: Stratified by Age

| | | Strata | | | | |
|---|---|---|---|---|---|---|
| | | Unimproved Properties | Built before 1974 | Built 1974 through 1993 | Built after 1993 | Overall Un-weighted |
| Number of Sales | | 9 | 33 | 32 | 28 | 102 |
| Median | | .773 | .834 | .855 | .893 | .862 |
| 95% Confidence Interval for Median | Lower Bound | .554 | .768 | .814 | .813 | .827 |
| | Upper Bound | 1.240 | .949 | .972 | .935 | .920 |
| Weighted Mean | | .730 | .845 | .880 | .898 | .878 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .564 | .785 | .842 | .847 | .850 |
| | Upper Bound | .895 | .906 | .919 | .948 | .906 |
| Minimum | | .424 | .619 | .687 | .619 | .424 |
| Maximum | | 1.555 | 1.185 | 1.081 | 1.096 | 1.555 |
| Std. Deviation | | .358 | .158 | .107 | .115 | .159 |
| Price Related Differential | | 1.201 | 1.021 | 1.011 | .984 | 1.001 |
| Coefficient of Dispersion | | .348 | .153 | .108 | .102 | .141 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 22.2% | 27.3% | 43.8% | 50.0% | 38.2% |

# Chapter 11. Iron County

## 1. Significant Findings

1.1 Assessment Level: Iron County's 2003 residential property assessments were approximately 75% of market value (Section 3.5). The results from the corresponding STC study are invalid because the STC's appraisals did not meet the requirement that they reflect market values (Section 4.3). Furthermore, the STC's sample is not representative of residential property for the county (Section 4.2).

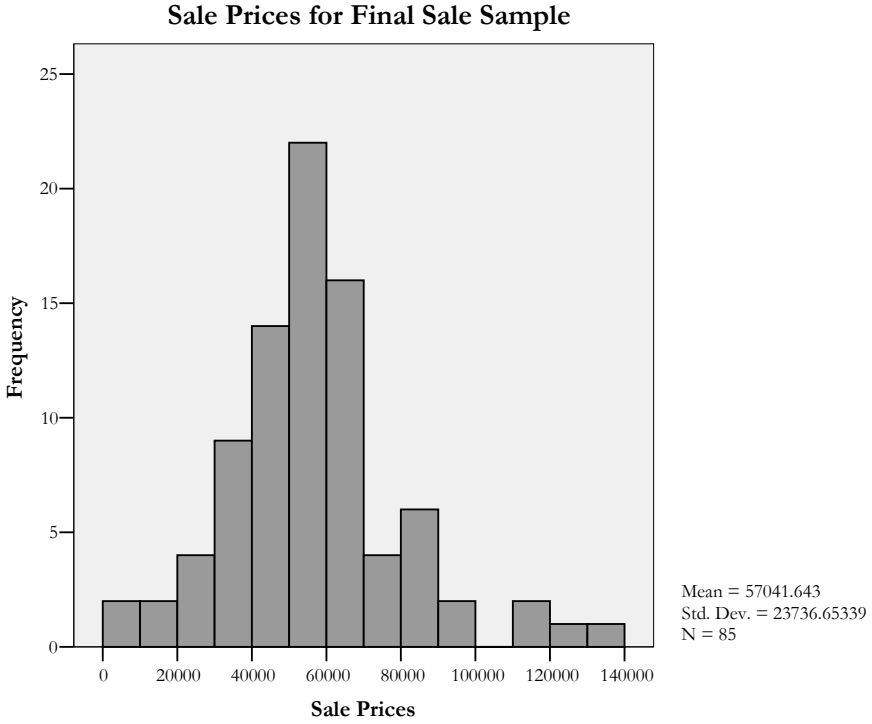
1.2 Assessment Equity: Lower-valued and older properties are assessed less uniformly and at lower levels than higher valued and newer properties respectively (Section 3.6 and Tables 3 & 6).

1.3 Reassessment History: One indicator of market value changes suggests that three of the past four biennial reassessments have produced lower value increases than the market. Cumulatively, the reassessments from 1997 through 2003 produced only 9% of the expected rise in assessments. The net change in assessments in 1999 and 2003 raises questions regarding whether any serious revaluation occurred (Section 5.1).

## 2. Data and Related Issues

2.1 Assessment Data: Sales and assessment information were matched at the county offices. Subsequently, the assessor reviewed the matched parcels and provided further information that assisted our screening process.

2.2 Sales and Ratio Data: The distribution of sale prices used is reflected in the following histogram.

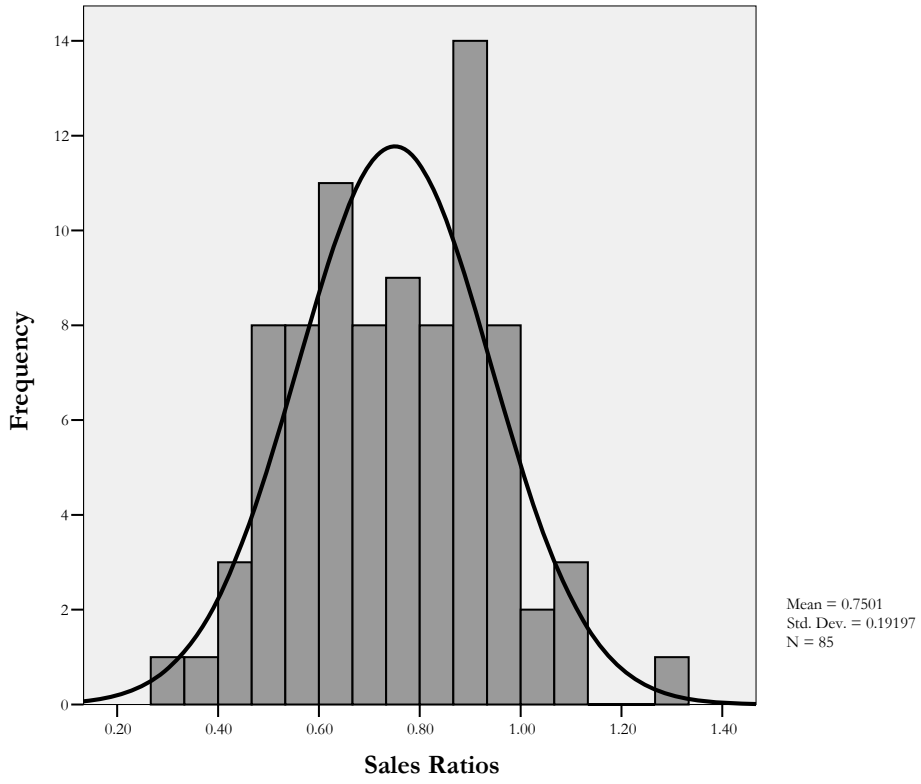


The next table reports results of the data screening and trimming process. The "screened sales" represent the initial screened sample. The screened sales that were excluded from the final analysis because their ratios were deemed unrepresentative are identified as high or low trims. The "remaining ratios" represent the sample on which all the study's results are based.

| Trimming of Outliers | | | | | |
|---|---|---|---|---|---|
| | | Improved Properties <=$41,800 | Improved Properties >$41,800 | Unimproved Properties | Total |
| **Screened Sales** | | 43 | 40 | 5 | 88 |
| Excluded | High Trims | 1 | 0 | 1 | 3 |
| | Low Trims | 0 | 0 | 1 | 1 |
| **Remaining Ratios** | | **42** | **40** | **3** | **85** |

The histogram below shows the distribution of the ratios for the sample.

**Final Sample**




2.3 Population: Since a complete copy of the assessment rolls in electronic form was not available, we used the best available alternative as a pseudo-population (hereinafter, "the population"), i.e. four random samples that were drawn and used by the STC.

## 3. Ratio Study Results

3.1 The Sample: The following table shows that the lower valued improved property stratum varies by more than 3 percent from the population. However, upon closer examination, this variance has no

material effect on the overall level of assessment and thus we conclude that the un-stratified sample is sufficiently representative of the population.

| Comparing Representivity | | | | | | |
|---|---|---|---|---|---|---|
| | Population Distribution | | | PPRC 2003 Sale Sample | | |
| Strata | N | $ | $ Weight | N | $ | $ Weight |
| Improved Properties <=$41,800 | 50 | 1,082,632 | 31.0% | 42 | 1,290,600 | 36.1% |
| Improved Properties >$41,800 | 33 | 2,247,474 | 64.3% | 40 | 2,268,250 | 63.5% |
| Unimproved Properties | 67 | 163,105 | 4.7% | 3 | 15,200 | 0.4% |
| Total | 150 | 3,493,211 | | 85 | 3,574,050 | |

3.2 Representing the Population with the Sample: Since the un-stratified sample is sufficiently representative of the population (Section 3.1), the use of stratification and weighting is not essential. Nevertheless, we used stratification because it produces additional analytical benefits and further optimizes representivity.

3.3 Sales Chasing: There was no indication of sales chasing.

3.4 Study Validity: The sample meets the requirements for producing valid inferences about the county's population of residential properties.

3.5 Assessment Level: Measures of the assessment level are summarized below. For the purposes of this study, the weighted mean from combined stratification is the preferred measure as long as both of the requirements for using the weighted mean are met. In this case, the distributions are approximately normal (Figure 3) and weighting is not severely compromised by the use of seriously undersized samples. Since both requirements are met, we focus on the weighted mean, though taking notice of the median, to conclude that the County's assessments for 2003 reflect approximately 75% of market value.

| Assessment Level (Based on Percent of Market Value) | | | | |
|---|---|---|---|---|
| | Stratification and Weighting | Reference | Weighted Mean | Median |
| **Overall Un-weighted** | None | Table 3 | 73.8% | 77.5% |
| **Combined** | By Property Use and Value Range | Table 4 | 74.5% | 77.2% |

3.6 Equity Measures and Evaluation:

i. Uniformity within Strata: Tables 2, 3, 5, and 6 show results for individual strata of sufficient sample size for evaluation. The following strata represent problem areas for internal uniformity.

| Strata with Inadequate Uniformity | |
|---|---|
| **Property Strata** | **COD** |
| Improved Properties <= $41,800 | 23.6% |
| Ironton Area | 20.4% |
| Built before 1950 | 28.1% |

ii. Uniformity between Strata: Another form of inequity exists when different strata are assessed at different levels. The IAAO has established guidelines for identifying such inequity, but compliance can be heavily affected by sample size and uniformity. Therefore, we confine our

remarks to identifying where assessment levels differ markedly from the norm. The difference in assessment level (medians) between the lower and higher valued strata (64.7% versus 85.1% respectively, Table 3) and between properties built before 1950 and properties built between 1950 through 1970 (67.2% and 79.2%, respectively, Table 6) is substantial.

iii. Vertical Equity: The final form of potential inequity examined is vertical equity. The PRD for the overall sample of 1.018 complies with the IAAO standard.

## 4. STC Study

4.1 Comparative Results: The following table contrasts our results with those from the STC study. The STC found the level of assessment adequate, while ours does not. The STC reports a substandard horizontal equity measure and an extremely poor measure for vertical equity, while our results find no such problems. We have already demonstrated that the PPRC study meets the criteria for achieving valid results. The rest of Section 4 examines the validity of the STC's study.

| Comparison of Study Results | | | |
|---|---|---|---|
| **Measure** | **STC Study*** | **PPRC Study*** | **PPRC Study Combined**** |
| Assessment Level - median | 100.0% | 77.5% | 77.2% |
| Assessment Level - wtd. mean | 88.1% | 73.8% | 74.5% |
| COD | 43.5% | 20.2% | |
| PRD | 1.40 | 1.03 | |
| Sample Size | 35 | 85 | |
| Relative Precision | 1.00 | 1.56 | |
| * Overall sample (un-stratified and un-weighted) | | | |
| ** Stratification and weighting by Property Use and Value Range | | | |

4.2 Representing the Population with the Sample: The STC does not examine the representivity of its sample, nor does it have the necessary sample size or information to do so. Therefore, in the following table, we provide that missing analysis. In this case, the table shows that both of the improved value strata in the STC sample vary from 36.3% to 38.5%. Initially, this exhibits excessive variability from the sample to the population. Upon closer examination, this variation has a cumulative material effect on the overall assessment level and thus we conclude that the STC sample is insufficiently representative of the population.

| Comparing Representivity | | | | | | |
|---|---|---|---|---|---|---|
| | **Population** | | | **STC 2003 Appraisals** | | |
| **Strata** | **N** | **$** | **%** | **N** | **$** | **%** |
| Improved Properties <=$41,800 | 50 | 1,082,632 | 31.0% | 21 | 495,842 | 69.5% |
| Improved Properties >$41,800 | 33 | 2,247,474 | 64.3% | 3 | 200,053 | 28.0% |
| Unimproved Properties | 67 | 163,105 | 4.7% | 11 | 18,000 | 2.5% |
| Total | 150 | 3,493,211 | | 35 | 713,895 | |

4.3 Market Value: The final requirement for producing a valid appraisal study is that appraisals must represent market values. As discussed in the introduction for this Section II, and in greater depth in the Procedure Manual (Section III), we use 4 tests to make this determination. The results of each test are reported in the following tables.

| Mann-Whitney Test | | | | |
|---|---|---|---|---|
| **For the Entire Sample** | | | | |
| Study | Observations | Rank sum | Expected | Ho: Ratios (35 STC Appraisals)=Ratios (85 Sales)<br>z = 4.853<br>Prob > \|z\| = 0.0000 |
| 0 | 35 | 2958 | 2117.5 | |
| 1 | 85 | 4302 | 5142.5 | |
| Combined | 120 | 7260 | 7260 | |
| **For Single Family Properties Only** | | | | |
| Study | Observations | Rank sum | Expected | Ho : Ratios (24 STC Appraisals)=Ratios (81 Sales)<br>z = 3.411<br>Prob > \|z\| = 0.0006 |
| 0 | 24 | 1719 | 1272 | |
| 1 | 81 | 3846 | 4293 | |
| Combined | 105 | 5565 | 5565 | |

| K-Sample Test | | | | |
|---|---|---|---|---|
| **For the Entire Sample** | | | | |
| Study | Not Greater than the median | Greater than the median | Total | Ho: Ratios (35 STC Appraisals)=Ratios (85 Sales)<br>Pearson chi2(1) = 11.6571 Pr = 0.001<br>Continuity corrected:<br>Pearson chi2(1) = 10.3261 Pr = 0.001 |
| 0 | 9 | 26 | 35 | |
| 1 | 51 | 34 | 85 | |
| Total | 60 | 60 | 120 | |
| **For Single Family Properties Only** | | | | |
| Study | Not Greater than the median | Greater than the median | Total | Ho: Ratios (24 STC Appraisals)=Ratios (81 Sales)<br>Pearson chi2(1) = 5.6515 Pr = 0.017<br>Continuity corrected:<br>Pearson chi2(1) = 4.6005 Pr = 0.032 |
| 0 | 7 | 17 | 24 | |
| 1 | 46 | 35 | 81 | |
| Total | 53 | 52 | 105 | |

All four tests lead to the conclusion that the STC appraisals do not represent market values (all with 95% statistical confidence). Therefore, the STC study is invalid and its reported results are unreliable.

## 5. Additional Analysis and Findings

5.1 Analysis of Reassessment History: The following table provides a comparison of actual assessment changes (net of new construction) to those that might have been expected for each of the last four reassessments as well as the six-year period leading up to 2003. Only one of the reassessments produced changes in line with the market indicator.

| Actual Value Changes from Reassessment vs. Expected Value Change | | | |
|---|---|---|---|
| Biennial Year | % Net Assessment Change | Missouri OFHEO Index | % Value Change: Actual vs. Expected |
| 1999 | -0.2 | 8.4 | -2% |
| 2001 | 4.5 | 11.4 | 39% |
| 2003 | -1.1 | 11.8 | -9% |
| 2005 | 16.4 | 12.4 | 133% |
| Cumulative 1997 - 2003 | 3.2 | 35.0 | 9% |

## 6. Figures and Tables

**Table 1. STC's Appraisal Ratio Studies**

| | | Group | | | |
|---|---|---|---|---|---|
| | | 1999 | 2001 | 2003 | 2005* |
| Number of Appraisals | | 40 | 40 | 35 | 35 |
| Median | | 1.028 | 1.000 | 1.000 | .955 |
| 95% Confidence Interval | Lower Bound | .974 | .956 | .898 | .898 |
| for Median | Upper Bound | 1.153 | 1.053 | 1.053 | 1.053 |
| Weighted Mean | | .898 | 1.003 | .881 | 1.038 |
| 95% Confidence Interval | Lower Bound | .824 | .856 | .787 | .939 |
| for Weighted Mean | Upper Bound | .971 | 1.151 | .975 | 1.137 |
| Minimum | | .039 | .602 | .557 | .351 |
| Maximum | | 5.263 | 2.526 | 5.158 | 9.632 |
| Std. Deviation | | .790 | .366 | .893 | 1.504 |
| Price Related Differential | | 1.306 | 1.049 | 1.402 | 1.167 |
| Coefficient of Dispersion | | .375 | .189 | .435 | .494 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 37.5% | 55.0% | 37.1% | 42.9% |

*The STC has not completed its studies for the 2005 reassessment cycle. These results may not represent final values.

**Figure 1. Ratios before Outlier Trimming**

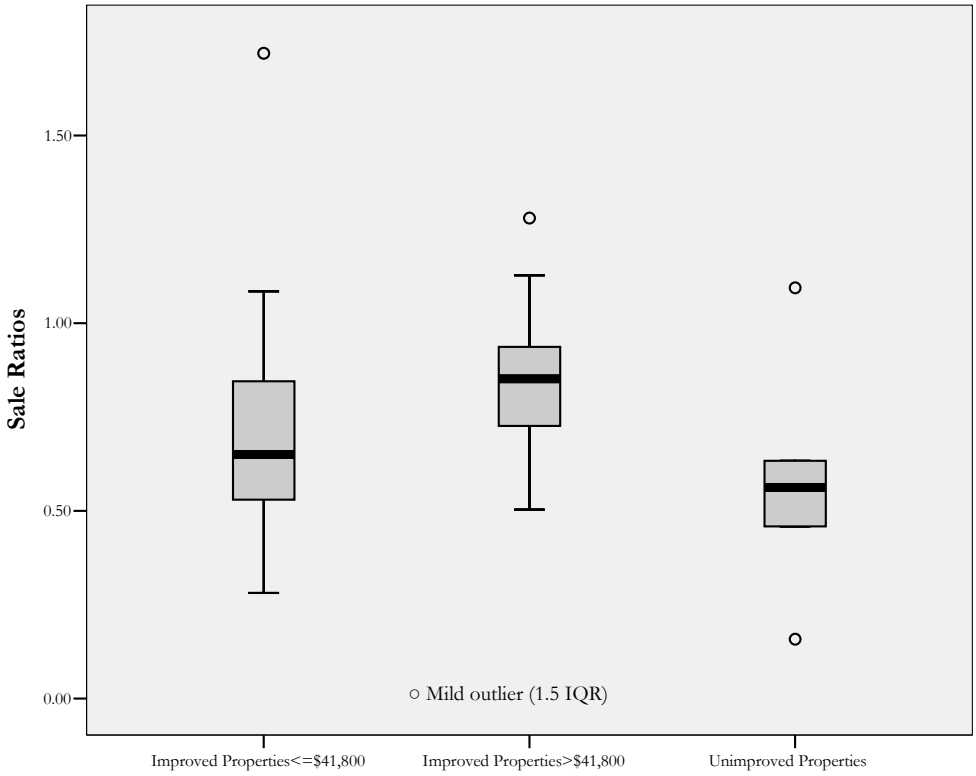
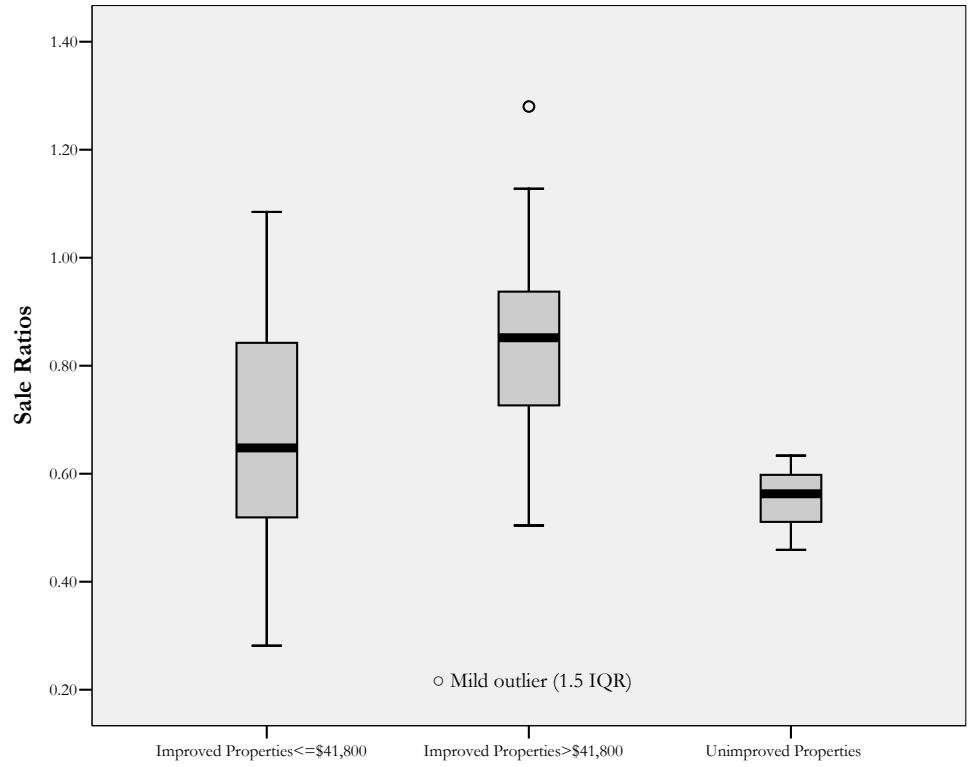
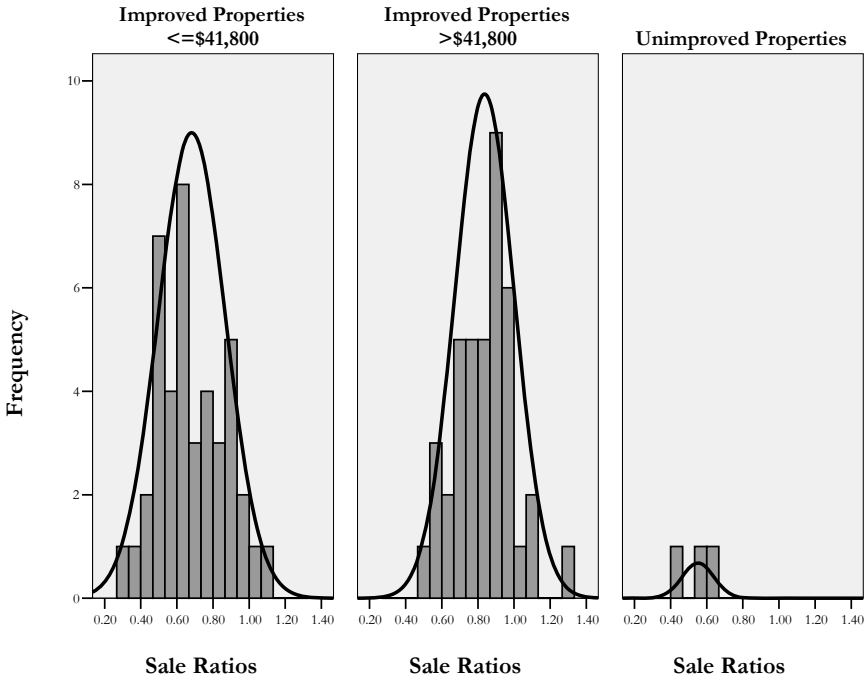



**Figure 2. Ratios after Outlier Trimming**



## Figure 3. Distribution of Final Sale Ratios




## Shapiro-Francia W' Tests for Normality for Various Strata

| Strata | Observations | W' | V' | z | Prob* |
|---|---|---|---|---|---|
| Single Family | 81 | 0.98822 | 0.896 | -0.221 | 0.58762 |
| Multi-family | 1 | . | . | . | . |
| Unimproved Properties | 3 | . | . | . | . |
| Improved Properties | 82 | 0.98873 | 0.866 | -0.291 | 0.61445 |
| Improved Properties <=$41,800 | 42 | 0.98381 | 0.734 | -0.598 | 0.72494 |
| Improved Properties >$41,800 | 40 | 0.98066 | 0.844 | -0.325 | 0.62760 |
| Overall Un-weighted | 85 | 0.98808 | 0.943 | -0.118 | 0.54714 |
| *This value represents the indicated probability that the underlying population is normally distributed. A value of less than .05 indicates a distribution that is not normal. | | | | | |

## Table 2. Sales Ratio Analysis: Stratified by Property Use

| | | Strata (all properties) | | | |
|---|---|---|---|---|---|
| | | Single Family | Unimproved Properties | Multi-family | Overall Un-weighted |
| Number of Sales | | 81 | 3 | 1 | 85 |
| Median | | .775 | .563 | .787 | .760 |
| 95% Confidence Interval for Median | Lower Bound | .708 | .459 | . | .692 |
| | Upper Bound | .842 | .633 | . | .832 |
| Weighted Mean | | .738 | .545 | .787 | .737 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .696 | .311 | . | .697 |
| | Upper Bound | .779 | .779 | . | .778 |
| Minimum | | .282 | .459 | .787 | .282 |
| Maximum | | 1.280 | .633 | .787 | 1.280 |
| Std. Deviation | | .192 | .088 | . | .192 |
| Price Related Differential | | 1.026 | 1.012 | 1.000 | 1.018 |
| Coefficient of Dispersion | | .204 | .103 | .000 | .209 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 19.8% | .0% | .0% | 18.8% |

## Table 3. Sales Ratio Analysis: Stratified by Use and Value

| | | Strata (without unimproved properties) | | |
|---|---|---|---|---|
| | | Improved Properties <=$41,800 | Improved Properties >$41,800 | Overall Un-weighted |
| Number of Sales | | 42 | 40 | 82 |
| Median | | .647 | .851 | .775 |
| 95% Confidence Interval for Median | Lower Bound | .599 | .775 | .708 |
| | Upper Bound | .775 | .897 | .842 |
| Weighted Mean | | .643 | .806 | .738 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .588 | .755 | .697 |
| | Upper Bound | .698 | .858 | .779 |
| Minimum | | .282 | .504 | .282 |
| Maximum | | 1.085 | 1.280 | 1.280 |
| Std. Deviation | | .186 | .164 | .191 |
| Price Related Differential | | 1.061 | 1.038 | 1.026 |
| Coefficient of Dispersion | | .236 | .149 | .202 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 14.3% | 25.0% | 19.5% |

## Table 4. Combined Results – Post Stratification and Weighting

| | Population Assessor's Value | Median | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Improved Properties <=$41,800 | 1,082,632 | 0.647 | 1,673,310 | 38.8% | 0.251 |
| Improved Properties >$41,800 | 2,247,474 | 0.851 | 2,640,980 | 61.2% | 0.521 |
| Total | 3,330,105 | | 4,314,290 | 100.0% | 77.2% |

| | Population Assessor's Value | Weighted Mean | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Improved Properties <=$41,800 | 1,082,632 | 0.643 | 1,683,719 | 37.6% | 0.242 |
| Improved Properties >$41,800 | 2,247,474 | 0.806 | 2,788,429 | 62.4% | 0.503 |
| Total | 3,330,105 | | 4,472,148 | 100.0% | 74.5% |

## Table 5. Sales Ratio Analysis: Stratified by Location

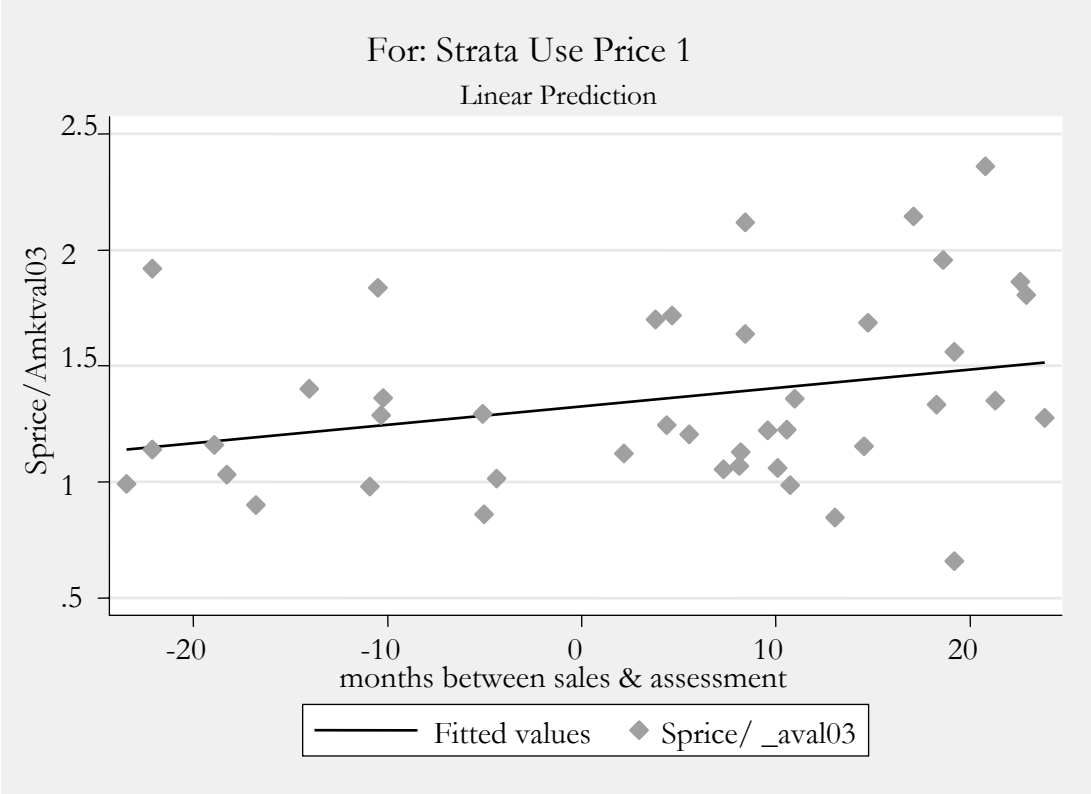
| | | Strata | | |
|---|---|---|---|---|
| | | Ironton Area | All Other Areas | Overall Un-weighted |
| Number of Sales | | 57 | 25 | 82 |
| Median | | .775 | .775 | .775 |
| 95% Confidence Interval for Median | Lower Bound | .692 | .645 | .708 |
| | Upper Bound | .842 | .872 | .842 |
| Weighted Mean | | .742 | .729 | .738 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .693 | .651 | .697 |
| | Upper Bound | .791 | .808 | .779 |
| Minimum | | .282 | .449 | .282 |
| Maximum | | 1.280 | 1.085 | 1.280 |
| Std. Deviation | | .197 | .181 | .191 |
| Price Related Differential | | 1.021 | 1.038 | 1.026 |
| Coefficient of Dispersion | | .204 | .196 | .202 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 17.5% | 24.0% | 19.5% |

## Table 6. Sales Ratio Analysis: Stratified by Age

| | | Strata | | | |
|---|---|---|---|---|---|
| | | Built Before 1950 | Built 1950 through 1970 | Built 1971 and After | Overall Un-weighted |
| Number of Sales | | 20 | 33 | 29 | 82 |
| Median | | .672 | .792 | .775 | .775 |
| 95% Confidence Interval for Median | Lower Bound | .504 | .658 | .692 | .708 |
| | Upper Bound | .870 | .859 | .885 | .842 |
| Weighted Mean | | .648 | .770 | .764 | .738 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .546 | .712 | .702 | .697 |
| | Upper Bound | .749 | .829 | .825 | .779 |
| Minimum | | .282 | .492 | .460 | .282 |
| Maximum | | .983 | 1.119 | 1.280 | 1.280 |
| Std. Deviation | | .217 | .165 | .190 | .191 |
| Price Related Differential | | 1.041 | 1.011 | 1.035 | 1.026 |
| Coefficient of Dispersion | | .281 | .170 | .192 | .202 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 25.0% | 21.2% | 13.8% | 19.5% |

**Graph 1. Lower Valued Improved Property Price Trend**

A thorough analysis of price-time trends by price strata determined that adjusting reported prices was desirable for the lowest valued improved properties. The prices for this stratum ranged from $14,000 - $59,900. The resultant trend and statistical analysis is shown below.



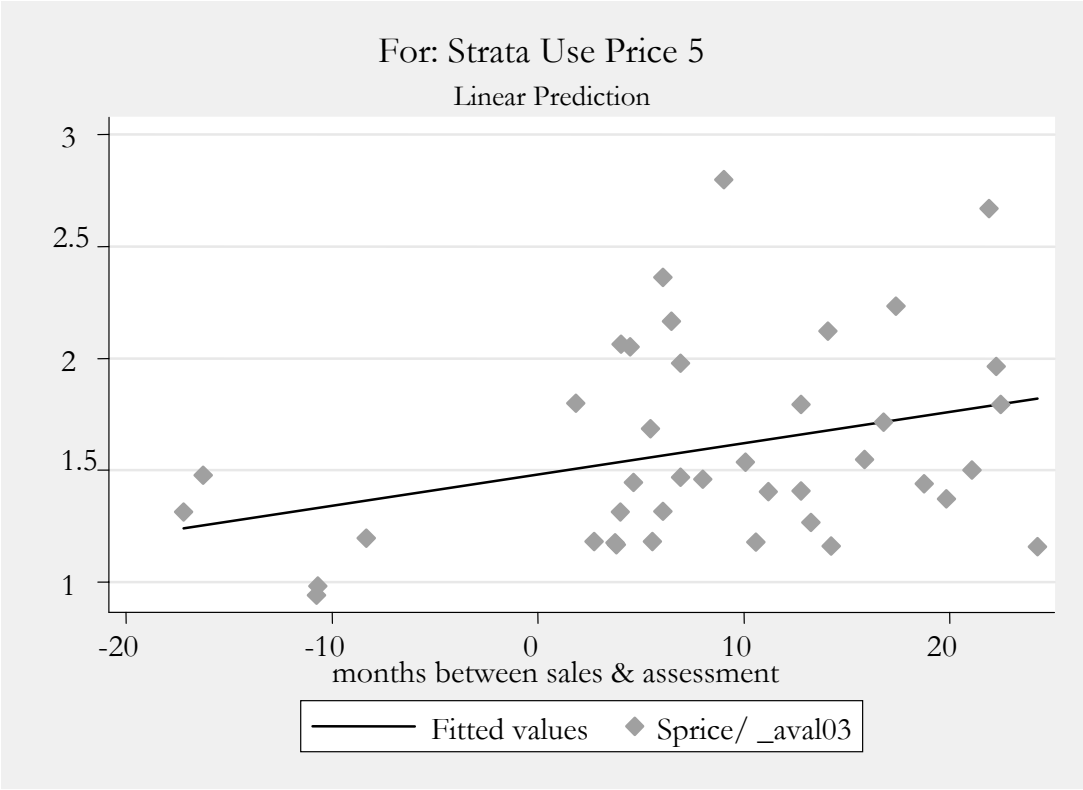

**Price Trend Regression Statistics**

| Source | SS | df | MS | | |
|---|---|---|---|---|---|
| Model | .522949245 | 1 | .522949245 | Number of obs = 42 | R-squared = 0. 0807 |
| Residual | 5.95740365 | 40 | .148935091 | F( 1, 40) = 3.51 | Adj R-squared= 0. 0577 |
| Total | 6.48035289 | 41 | .158057388 | Prob > F = 0. 0683 | Root MSE = .38592 |

| _aratio | Coef. | Std. Err. | T | P> t | [80% Conf. Interval] | |
|---|---|---|---|---|---|---|
| _adjperiod | .0079369 | .0042356 | 1.87 | 0.068 | .0024175 | .0134563 |
| _cons | 1.326178 | .0618856 | 21.43 | 0.000 | 1.245536 | 1.40682 |
| Monthly adjustment rate=.0059848 | | | | Annualized adjustment rate=.0718175 | | |

**Graph 2. Higher Valued Improved Property Price Trend**

A thorough analysis of price-time trends by price strata determined that adjusting reported prices was desirable for the highest valued improved properties. The prices for this stratum ranged from $60,000 - $149,500. The resultant trend and statistical analysis is shown below.




**Price Trend Regression Statistics**

| Source | SS | df | MS | | |
|---|---|---|---|---|---|
| Model | .79707782 | 1 | .79707782 | | R-squared = 0.1015 |
| Residual | 7.05608094 | 38 | .185686341 | Number of obs = 40 | Adj R-squared= 0.0779 |
| Total | 7.85315876 | 39 | .201363045 | F( 1, 38) = 4.29 | Root MSE = .43091 |
| | | | | Prob > F = 0.0451 | |

| _aratio | Coef. | Std. Err. | t | P> t | [80% Conf. Interval] | |
|---|---|---|---|---|---|---|
| _adjperiod | .0140033 | .0067588 | 2.07 | 0.045 | .0051883 | .0228183 |
| _cons | 1.480518 | .0875976 | 16.90 | 0.000 | 1.366271 | 1.594766 |
| Monthly adjustment rate=.0094584 | | | | Annualized adjustment rate=.1135005 | | |

# Chapter 12. Jackson County

## 1. Significant Findings

1.1 Assessment Level: Jackson County's 2003 residential property assessments were approximately 85% of market value (Section 3.5). The results from the corresponding STC study are invalid because the STC's appraisals did not meet the requirement that they reflect market values (Section 4.3). Furthermore, the STC's sample is not representative of residential property for the county (Section 4.2).

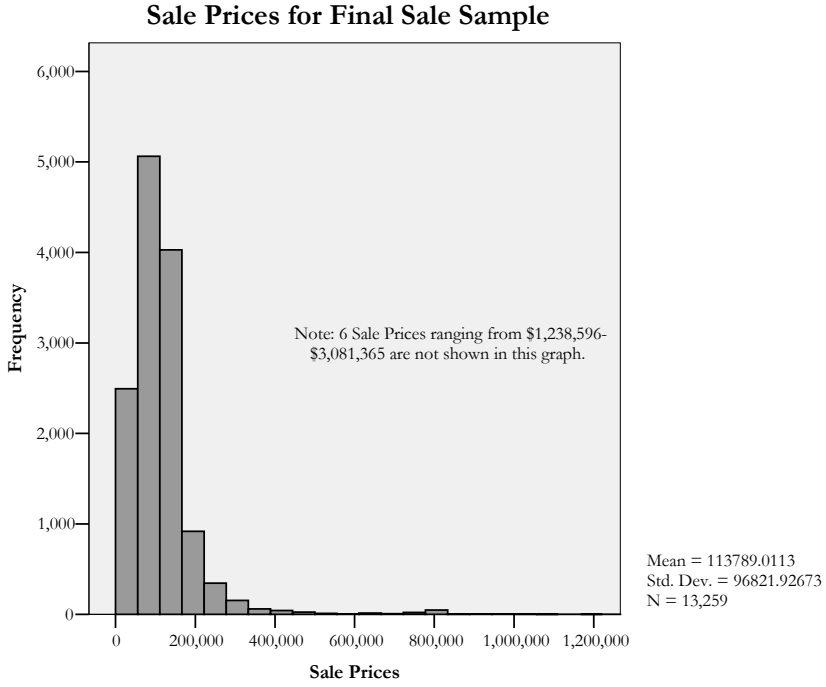
1.2 Assessment Equity: The lowest and highest-valued properties and oldest and newest properties are assessed less uniformly than overall (Section 3.6 and Tables 4 & 8).

1.3 Reassessment History: Two indicators of market value changes suggest that one of the past four biennial reassessments has produced lower value increases than the market. Cumulatively, the reassessments from 1997 through 2003 produced 82% of the expected rise in assessments (Section 5.1).

## 2. Data and Related Issues

2.1 Assessment Data: Sales and assessment information was available in electronic format. Sales were matched using a combination of computer techniques and software and then screened. The assessor answered all questions regarding the contents and coding of data when requested. The files received contained information allowing us to identify properties affected by new construction and to screen as appropriate.

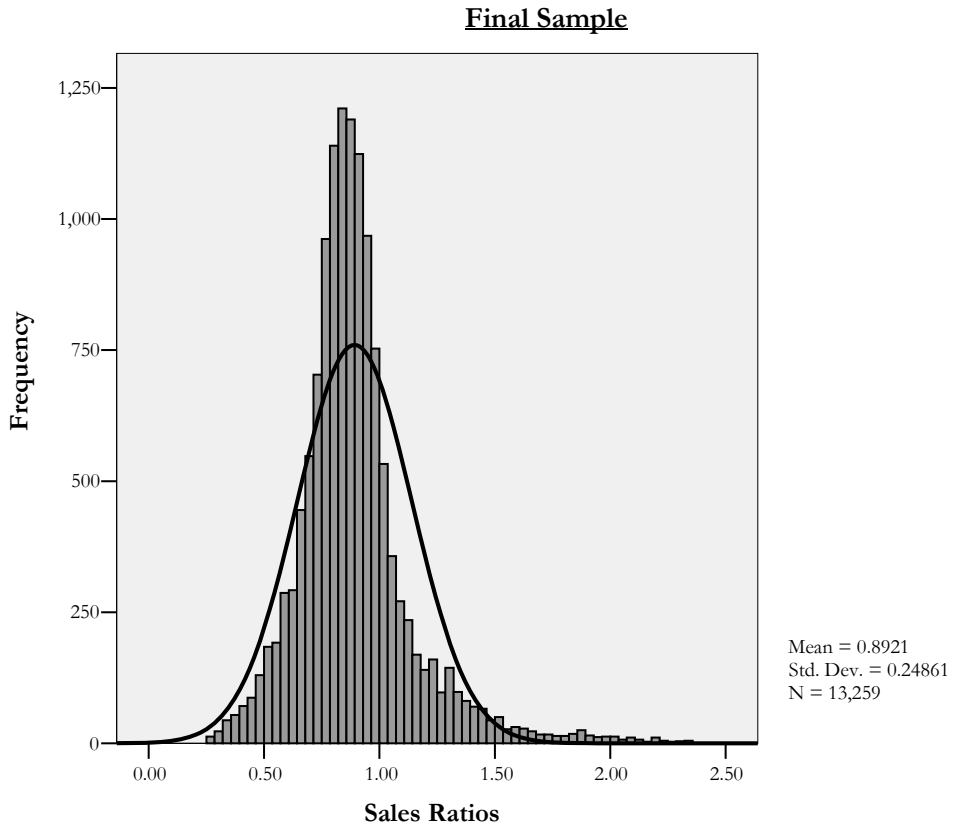
2.2 Sales and Ratio Data: The distribution of sale prices used is reflected in the following histogram.



The next table reports results of the data screening and trimming process. The "screened sales" represent the initial screened sample. The screened sales that were excluded from the final analysis because their ratios were deemed unrepresentative are identified as high or low trims. The "remaining ratios" represent the sample on which all the study's results are based.

| Trimming of Outliers | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Single Family <=$49,000 | Single Family $49,001 - $76,000 | Single Family $76,001 - $102,000 | Single Family $102,001 - $146,000 | Single Family >$146,000 | Unimproved Properties | Multi-family | Total |
| **Screened Sales** | | 2,805 | 2,791 | 3,157 | 2,948 | 1,662 | 98 | 306 | 13767 |
| Excluded | Value Outliers | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 |
| | High Trims | 44 | 86 | 99 | 58 | 25 | 8 | 14 | 334 |
| | Low Trims | 26 | 10 | 15 | 30 | 47 | 41 | 4 | 173 |
| **Remaining Ratios** | | **2,735** | **2,695** | **3,043** | **2,860** | **1,590** | **48** | **288** | **13259** |

The histogram below shows the distribution of the ratios for the sample.




2.3 Population: Since a complete copy of the 2003 assessment rolls in electronic form was available, we were able to analyze the county's population in detail. This allowed us to stratify and weight sales on a variety of property and location characteristics.

## 3. Ratio Study Results

3.1 The Sample: The following table shows that the three highest valued single family strata vary from 3.3% to 4.6% from the population. Initially, this exhibits excessive variability from the sample to the population. However, upon closer examination, this variation has no material effect and thus we conclude that the un-stratified sample is sufficiently representative of the population.

| Comparing Representivity | | | | | | |
|---|---|---|---|---|---|---|
| | Population Distribution | | | PPRC 2003 Sale Sample | | |
| Strata | N | $ | $ Weight | N | $ | $ Weight |
| Single Family <=$49,000 | 51,203 | 1,552,055,019 | 7.8% | 2735 | 89,794,968 | 7.1% |
| Single Family $49,001-$76,000 | 39,701 | 2,512,740,090 | 12.6% | 2695 | 170,569,234 | 13.5% |
| Single Family $76,001-$102,000 | 41,002 | 3,626,677,703 | 18.1% | 3043 | 269,801,050 | 21.4% |
| Single Family $102,001-$146,000 | 39,302 | 4,745,468,056 | 23.7% | 2860 | 344,075,326 | 27.3% |
| Single Family >$146,000 | 29,716 | 6,582,003,288 | 32.9% | 1590 | 360,857,437 | 28.6% |
| Unimproved Properties | 17,103 | 190,139,949 | 1.0% | 48 | 1,738,577 | 0.1% |
| Multi-family | 7,953 | 793,093,946 | 4.0% | 288 | 24,397,043 | 1.9% |
| Total | 225980 | 20,002,178,051 | | 13259 | 1,261,233,635 | |

3.2 Representing the Population with the Sample: Since the un-stratified sample is sufficiently representative of the population (Section 3.1), the use of stratification and weighting is not essential. Nevertheless, we used stratification because it produces additional analytical benefits and further optimizes representivity.

3.3 Sales Chasing: There was no indication of sales chasing.

3.4 Study Validity: The sample meets the requirements for producing valid inferences about the county's population of residential properties.

3.5 Assessment Level: Measures of the assessment level are summarized below. For the purposes of this study, the weighted mean from combined stratification is the preferred measure as long as the both of the requirements from using the weighted mean are met. In this case, weighting is not compromised by the use of seriously undersized samples but the distributions are not sufficiently normal (Figure 3). Since both requirements are not met, we focus on the median, though taking notice of the weighted mean, to conclude that the County's assessments for 2003 reflect approximately 85% of market value.

| Assessment Level (Based on Percent of Market Value) | | | | |
|---|---|---|---|---|
| | Stratification and Weighting | Reference | Weighted Mean | Median |
| **Overall Un-weighted** | None | Table 2 | 83.6% | 86.4% |
| **Combined** | By Property Use | Table 3 | 83.4% | 86.3% |
| **Combined** | By Property Use and Value Range | Table 5 | 83.4% | 87.6% |
| **Combined** | By Property Location | Table 7 | 83.7% | 85.9% |
| **Combined** | By Property Age | Table 9 | 83.3% | 85.9% |
| **Combined** | By Property Town and Rural Lots | Table 11 | 83.6% | 86.3% |

3.6 Equity Measures and Evaluation:

i. Uniformity within Strata: Tables 2, 4, 6, 8 & 10 show results for strata of sufficient sample size for evaluation. The following strata represent problem areas for internal uniformity.

| Strata with Inadequate Uniformity | |
|---|---|
| **Property Strata** | **COD** |
| Unimproved Properties | 28.6% |
| Multi-family | 23.8% |
| Single Family <=$49,000 | 35.9% |
| Kansas City | 28.0% |
| Built before 1950 | 34.1% |

ii. Uniformity between Strata: Another form of inequity exists when different strata are assessed at different levels. The IAAO has established guidelines for identifying such inequity, but compliance can be heavily affected by sample size and uniformity. Therefore, we confine our remarks to identifying where assessment levels differ markedly from the norm. The differences in assessment levels (median) of the lowest valued single family properties and the highest valued single family properties to the overall assessment level (93% and 91% versus 85% respectively, Table 4) and the differences in assessment levels of the oldest and newest properties to the overall assessment level (80% and 92% versus 85% respectively, Table 8) are notable.

iii. Vertical Equity: The final form of potential inequity examined is vertical equity. The PRD for the overall sample of 1.067 is slightly regressive according to the IAAO standard (Table 2).

## 4. STC Study

4.1 Comparative Results: The following table contrasts our results with those from the STC study. The STC found the level of assessment adequate, while ours does not. The STC reports an equally acceptable horizontal equity measure and an equally substandard vertical equity measure. We have already demonstrated that the PPRC study meets the criteria for achieving valid results. The rest of Section 4 examines the validity of the STC's study.

| Comparison of Study Results | | | |
|---|---|---|---|
| **Measure** | **STC Study*** | **PPRC Study*** | **PPRC Study Combined**** |
| Assessment Level - median | 96.7% | 86.4% | 87.6% |
| Assessment Level - weighted mean | 96.8% | 83.6% | 83.4% |
| COD | 17.4% | 19.4% | |
| PRD | 1.07 | 1.07 | |
| Sample Size | 40 | 13,259 | |
| Relative Precision | 1.00 | 18.21 | |
| * Overall sample (un-stratified and un-weighted) | | | |
| ** Stratification and weighting by Property Use and Value Range | | | |

4.2 Representing the Population with the Sample: The STC does not examine the representivity of its sample, nor does it have the necessary sample size or information to do so. Therefore, in the following table, we provide that missing analysis. In this case, the table shows that five of the strata in the STC sample, the four highest single-family value strata as well as the unimproved stratum, vary from 3.1% to 7.6%. Initially, this exhibits excessive variability from the sample to the population. Upon closer examination, this variation has a cumulative material effect on the overall assessment level and thus we conclude that the STC sample is insufficiently representative of the population.

| Comparing Representivity | | | | | | |
|---|---|---|---|---|---|---|
| | Population | | | STC 2003 Appraisals | | |
| Strata | N | $ | % | N | $ | % |
| Single Family <=$49,000 | 51,203 | 1,552,055,019 | 7.8% | 9 | 288,647 | 8.0% |
| Single Family $49,001- $76,000 | 39,701 | 2,512,740,090 | 12.6% | 4 | 261,079 | 7.3% |
| Single Family $76,001- $102,000 | 41,002 | 3,626,677,703 | 18.1% | 4 | 376,605 | 10.5% |
| Single Family $102,001- $146,000 | 39,302 | 4,745,468,056 | 23.7% | 8 | 961,305 | 26.7% |
| Single Family >$146,000 | 29,716 | 6,582,003,288 | 32.9% | 7 | 1,293,505 | 36.0% |
| Unimproved Properties | 17,103 | 190,139,949 | 1.0% | 3 | 37,053 | 1.0% |
| Multi-family | 7,953 | 793,093,946 | 4.0% | 5 | 376,021 | 10.5% |
| Total | 225980 | 20,002,178,051 | | 40 | 3,594,216 | |

4.3 Market Value: The final requirement for producing a valid appraisal study is that appraisals must represent market values. As discussed in the introduction for this Section II, and in greater depth in the Procedure Manual (Section III), we use 4 tests to make this determination. The results of each test are reported in the following tables.

| Mann-Whitney Test | | | | |
|---|---|---|---|---|
| For the Entire Sample | | | | |
| Study | Observations | Rank sum | Expected | Ho: Ratios (40 STC Appraisals)=Ratios (13259 Sales)<br>z = 4.011<br>Prob > \|z\| = 0.0001 |
| 0 | 40 | 363241 | 266000 | |
| 1 | 13259 | 88075109 | 88172350 | |
| Combined | 13299 | 88438350 | 88438350 | |
| For Single Family Properties Only | | | | |
| Study | Observations | Rank sum | Expected | Ho : Ratios (32 STC Appraisals)=Ratios (12923 Sales)<br>z = 2.759<br>Prob > \|z\| = 0.0058 |
| 0 | 32 | 265594 | 207296 | |
| 1 | 12923 | 83656896 | 83715194 | |
| Combined | 12955 | 83922490 | 83922490 | |

| K-Sample Test | | | | |
|---|---|---|---|---|
| For the Entire Sample | | | | |
| Study | Not Greater than the median | Greater than the median | Total | Ho: Ratios (40 STC Appraisals)=Ratios (13259 Sales)<br>Pearson chi2(1) = 14.4471 Pr = 0.000<br>Continuity corrected:<br>Pearson chi2(1) = 13.2684 Pr = 0.000 |
| 0 | 8 | 32 | 40 | |
| 1 | 6642 | 6617 | 13259 | |
| Total | 6650 | 6649 | 13299 | |
| For Single Family Properties Only | | | | |
| Study | Not Greater than the median | Greater than the median | Total | Ho: Ratios (32 STC Appraisals)=Ratios (12923 Sales)<br>Pearson chi2(1) = 8.0223 Pr = 0.005<br>Continuity corrected:<br>Pearson chi2(1) = 7.0510 Pr = 0.008 |
| 0 | 8 | 24 | 32 | |
| 1 | 6470 | 6453 | 12923 | |
| Total | 6478 | 6477 | 12955 | |

All four tests lead to the conclusion that the STC appraisals do not represent market values (all with 99% statistical confidence).

## 5. Additional Analysis and Findings

5.1 Analysis of Reassessment History: The following table provides a comparison of actual assessment changes (net of new construction) to those that might have been expected for each of the last four reassessments as well as the six-year period leading up to 2003. Three of the reassessments produced changes in line with the market indicator. In our study, previous assessment information was available for Jackson County, so we were able to test for the real reassessment rate. Using this information, we found evidence that a real reassessment took place in 2003.

| Actual Value Changes from Reassessment vs. Expected Value Change | | | | | |
|---|---|---|---|---|---|
| Biennial Year | % Net Assessment Change | Missouri OFHEO Index | % Value Change: Actual vs. Expected | KC MSA OFHEO Index | % Value Change: Actual vs. Expected |
| 1999 | 10.4 | 8.4 | 123% | 12.3 | 84% |
| 2001 | 5.8 | 11.4 | 51% | 13.0 | 45% |
| 2003 | 13.4 | 11.8 | 114% | 9.9 | 135% |
| 2005 | 13.8 | 12.4 | 111% | 10.5 | 131% |
| Cumulative 1997 - 2003 | 32.4 | 35.0 | 93% | 39.5 | 82% |

## 6. Figures and Tables

**Table 1. STC's Appraisal Ratio Studies**

| | | Group | | |
|---|---|---|---|---|
| | | 1999 | 2001 | 2003 |
| Number of Appraisals | | 46 | 143 | 40 |
| Median | | 1.036 | .896 | .967 |
| 95% Confidence Interval for | Lower Bound | .958 | .872 | .930 |
| Median | Upper Bound | 1.137 | .930 | 1.008 |
| Weighted Mean | | .999 | .861 | .968 |
| 95% Confidence Interval for | Lower Bound | .936 | .832 | .916 |
| Weighted Mean | Upper Bound | 1.062 | .890 | 1.021 |
| Minimum | | .350 | .297 | .633 |
| Maximum | | 2.463 | 3.390 | 2.032 |
| Std. Deviation | | .358 | .364 | .272 |
| Price Related Differential | | 1.124 | 1.109 | 1.066 |
| Coefficient of Dispersion | | .237 | .238 | .174 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 39.1% | 31.5% | 50.0% |

**Figure 1. Ratios before Outlier Trimming**

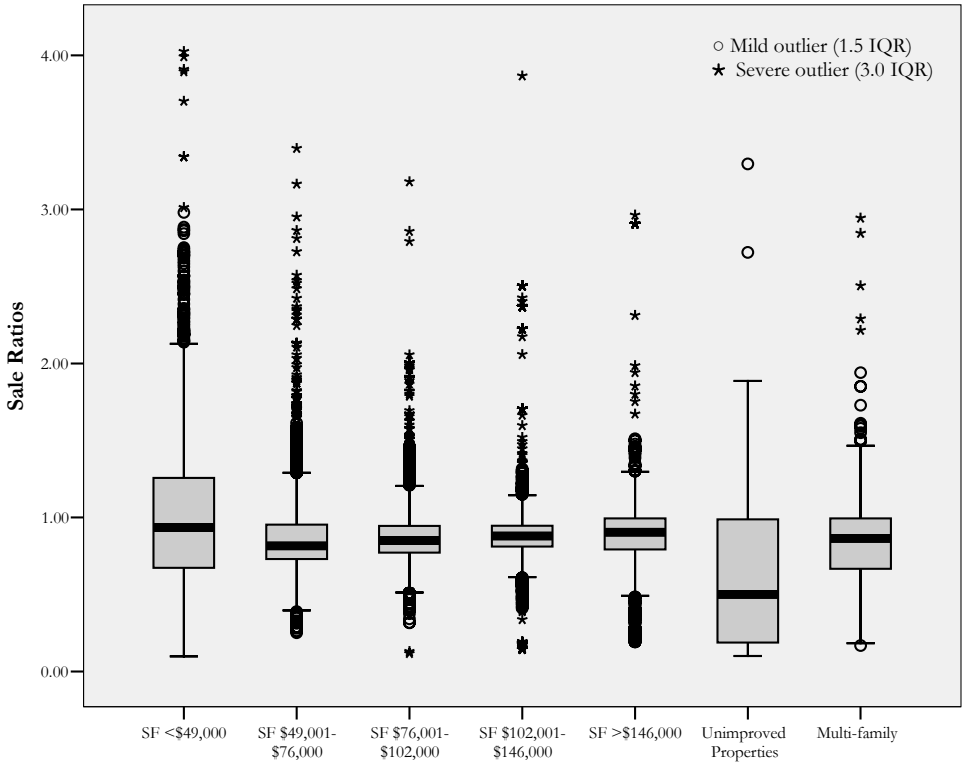
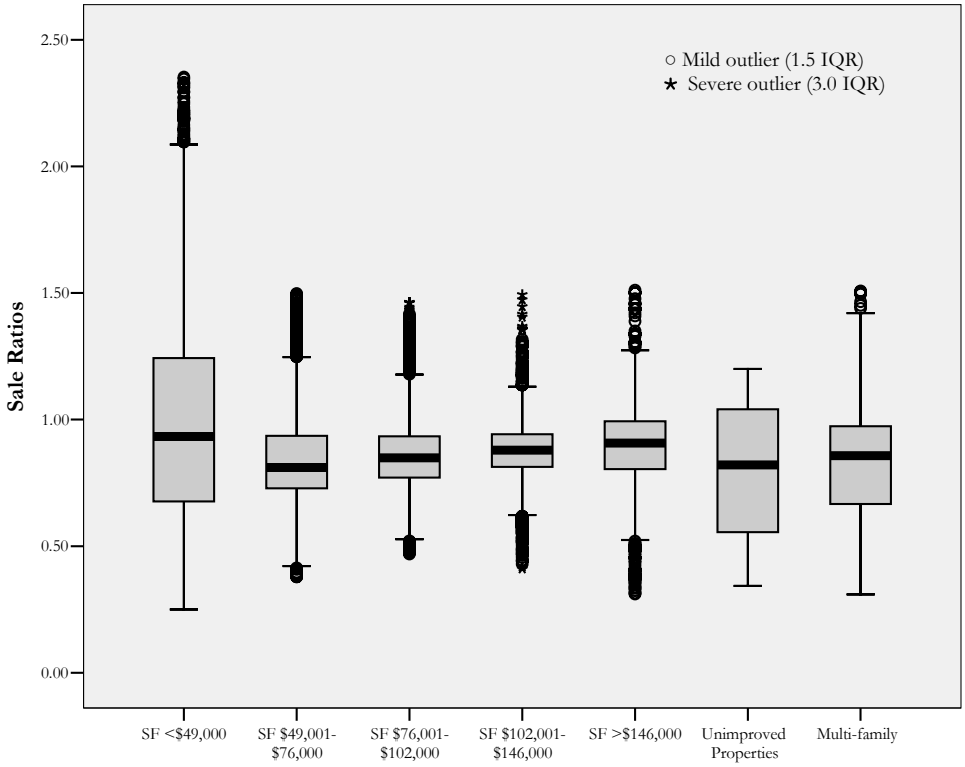
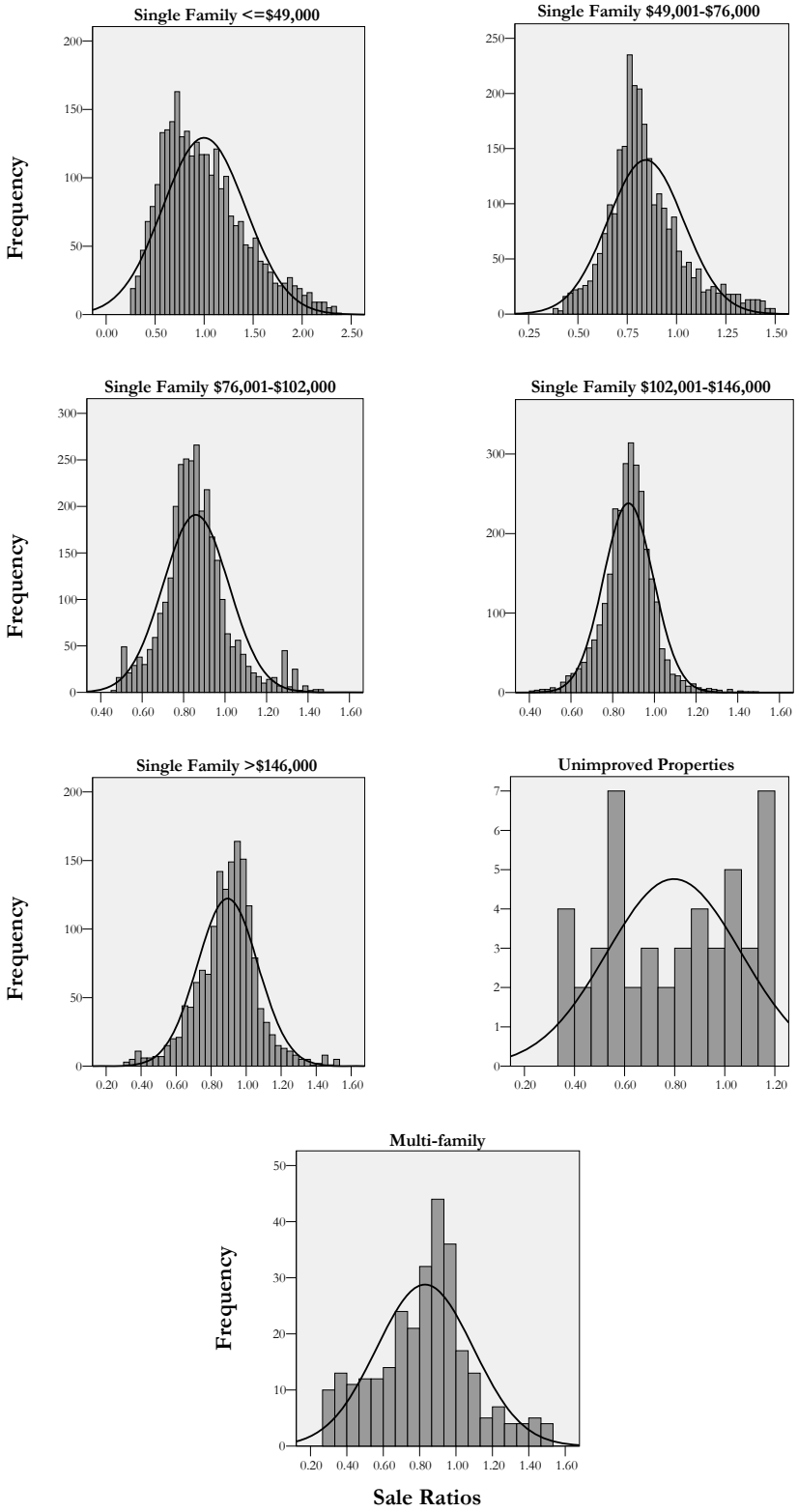



**Figure 2. Ratios after Outlier Trimming**



## Figure 3. Distribution of Final Sale Ratios



## Figure 3 (cont.). Distribution of Final Sale Ratios

### Shapiro-Francia W' Tests for Normality for Various Strata

| Strata | Observations | W' | V' | z | Prob* |
|---|---|---|---|---|---|
| Single Family | 12923 | 0.89263 | 99.671 | 0.800 | 0.21187 |
| Unimproved Properties | 48 | 0.94563 | 2.731 | 1.894 | 0.02911 |
| Multi-family | 288 | 0.97538 | 5.417 | 3.569 | 0.00018 |
| Single Family <=$49,000 | 2735 | 0.95719 | 50.181 | 6.057 | 0.00001 |
| Single Family $49,001- $76,000 | 2695 | 0.95609 | 51.319 | 6.120 | 0.00001 |
| Single Family $76,001- $102,000 | 3043 | 0.96111 | 46.312 | 5.662 | 0.00001 |
| Single Family $102,001- $146,000 | 2860 | 0.97264 | 32.310 | 5.545 | 0.00001 |
| Single Family >$146,000 | 1590 | 0.97540 | 23.178 | 6.178 | 0.00001 |
| Overall Un-weighted | 13259 | 0.89754 | 94.554 | 0.752 | 0.22590 |

*This value represents the indicated probability that the underlying population is normally distributed. A value of less than .05 indicates a distribution that is not normal.

### Skewness and Kurtosis Test for Normality for Strata with more than 5,000 Observations

| Strata | Pr(Skewness) | Pr(Kurtosis) | Adj chi2(2) | Prob>chi2* |
|---|---|---|---|---|
| Single Family | 0.000 | 0.000 | 4284.50 | 0.000 |
| Overall Un-weighted | 0.000 | 0.000 | 4232.89 | 0.000 |

*This value represents the indicated probability that the underlying population is normally distributed. A value of less than .05 indicates a distribution that is not normal.

## Table 2. Sales Ratio Analysis: Stratified by Property Use

| | | Strata | | | |
|---|---|---|---|---|---|
| | | Single Family | Unimproved Properties | Multi-family | Overall Un-weighted |
| Number of Sales | | 12923 | 48 | 288 | 13259 |
| Median | | .864 | .821 | .857 | .864 |
| 95% Confidence Interval for Median | Lower Bound | .861 | .627 | .837 | .861 |
| | Upper Bound | .867 | .988 | .891 | .867 |
| Weighted Mean | | .837 | .829 | .772 | .836 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .833 | .749 | .735 | .831 |
| | Upper Bound | .842 | .909 | .809 | .840 |
| Minimum | | .250 | .343 | .310 | .250 |
| Maximum | | 2.353 | 1.200 | 1.508 | 2.353 |
| Std. Deviation | | .248 | .268 | .266 | .249 |
| Price Related Differential | | 1.067 | .961 | 1.075 | 1.067 |
| Coefficient of Dispersion | | .193 | .286 | .238 | .194 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 28.2% | 27.1% | 31.6% | 28.3% |

## Table 3. Combined Results – Post Stratification and Weighting

| | **Population Assessor's Value** | **Median** | **Estimated Actual Value** | **% of Total Est. Mkt. Value** | **Subtotal** |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Single Family | 19,018,944,156 | 0.864 | 22,012,666,847 | 95.0% | 0.821 |
| Unimproved Properties | 190,139,949 | 0.821 | 231,595,553 | 1.0% | 0.008 |
| Multi-family | 793,093,946 | 0.857 | 925,430,509 | 4.0% | 0.034 |
| Total | 20,002,178,051 | | 23,169,692,909 | 100.0% | 86.3% |
| | | | | | |
| | **Population Assessor's Value** | **Weighted Mean** | **Estimated Actual Value** | **% of Total Est. Mkt. Value** | **Subtotal** |
| **Strata** | | | | | |
| Single Family | 19,018,944,156 | 0.837 | 22,722,752,875 | 94.8% | 0.793 |
| Unimproved Properties | 190,139,949 | 0.829 | 229,360,614 | 1.0% | 0.008 |
| Multi-family | 793,093,946 | 0.772 | 1,027,323,764 | 4.3% | 0.033 |
| Total | 20,002,178,051 | | 23,979,437,253 | 100.0% | 83.4% |

## Table 4. Sales Ratio Analysis: Stratified by Use and Value

| | | Strata | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | SF <=$49,000 | SF $49,001-$76,000 | SF $76,001-$102,000 | SF $102,001 - $146,000 | SF >$146,000 | Un-improved Properties | Multi-family | Overall Un-weighted |
| Number of Sales | | 2735 | 2695 | 3043 | 2860 | 1590 | 48 | 288 | 13259 |
| Median | | .933 | .811 | .849 | .879 | .908 | .821 | .857 | .864 |
| 95% Confidence Interval for Median | Lower Bound | .912 | .804 | .843 | .876 | .899 | .627 | .837 | .861 |
| | Upper Bound | .952 | .817 | .853 | .884 | .916 | .988 | .891 | .867 |
| Weighted Mean | | .829 | .803 | .831 | .859 | .841 | .829 | .772 | .836 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .814 | .796 | .826 | .855 | .827 | .749 | .735 | .831 |
| | Upper Bound | .843 | .809 | .837 | .864 | .854 | .909 | .809 | .840 |
| Minimum | | .250 | .379 | .469 | .411 | .311 | .343 | .310 | .250 |
| Maximum | | 2.353 | 1.498 | 1.463 | 1.494 | 1.511 | 1.200 | 1.508 | 2.353 |
| Std. Deviation | | .422 | .192 | .159 | .120 | .173 | .268 | .266 | .249 |
| Price Related Differential | | 1.207 | 1.052 | 1.034 | 1.019 | 1.064 | .961 | 1.075 | 1.067 |
| Coefficient of Dispersion | | .359 | .174 | .136 | .100 | .141 | .286 | .238 | .194 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 16.9% | 20.4% | 27.5% | 38.3% | 44.2% | 27.1% | 31.6% | 28.3% |

## Table 5. Combined Results – Post Stratification and Weighting

| | Population Assessor's Value | Median | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Single Family <=$49,000 | 1,552,055,019 | 0.933 | 1,663,510,203 | 7.3% | 0.068 |
| Single Family $49,001 - $76,000 | 2,512,740,090 | 0.811 | 3,098,323,169 | 13.6% | 0.110 |
| Single Family $76,001 - $102,000 | 3,626,677,703 | 0.849 | 4,271,705,186 | 18.7% | 0.159 |
| Single Family $102,001 - $146,000 | 4,745,468,056 | 0.879 | 5,398,712,237 | 23.6% | 0.208 |
| Single Family >$146,000 | 6,582,003,288 | 0.908 | 7,248,902,300 | 31.7% | 0.288 |
| Unimproved Properties | 190,139,949 | 0.821 | 231,595,553 | 1.0% | 0.008 |
| Multi-family | 793,093,946 | 0.857 | 925,430,509 | 4.1% | 0.035 |
| Total | 20,002,178,051 | | 22,838,179,156 | 100.0% | 87.6% |

| | Population Assessor's Value | Weighted Mean | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Single Family <=$49,000 | 1,552,055,019 | 0.829 | 1,872,201,470 | 7.8% | 0.065 |
| Single Family $49,001 - $76,000 | 2,512,740,090 | 0.803 | 3,129,190,648 | 13.1% | 0.105 |
| Single Family $76,001 - $102,000 | 3,626,677,703 | 0.831 | 4,364,233,096 | 18.2% | 0.151 |
| Single Family $102,001 - $146,000 | 4,745,468,056 | 0.859 | 5,524,409,844 | 23.0% | 0.198 |
| Single Family >$146,000 | 6,582,003,288 | 0.841 | 7,826,401,056 | 32.6% | 0.275 |
| Unimproved Properties | 190,139,949 | 0.829 | 229,360,614 | 1.0% | 0.008 |
| Multi-family | 793,093,946 | 0.772 | 1,027,323,764 | 4.3% | 0.033 |
| Total | 20,002,178,051 | 0.836 | 23,973,120,492 | 100.0% | 83.4% |

## Table 6. Sales Ratio Analysis: Stratified by Location

| | | Strata | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Kansas City | Blue Springs | Independence | Lee's Summit | Raytown | Other | Overall Un-weighted |
| Number of Sales | | 6096 | 1051 | 2313 | 1825 | 706 | 1268 | 13259 |
| Median | | .833 | .895 | .865 | .892 | .871 | .854 | .864 |
| 95% Confidence Interval for Median | Lower Bound | .824 | .888 | .859 | .887 | .863 | .848 | .861 |
| | Upper Bound | .840 | .901 | .872 | .899 | .879 | .861 | .867 |
| Weighted Mean | | .781 | .895 | .862 | .887 | .877 | .862 | .836 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .772 | .888 | .856 | .881 | .867 | .852 | .831 |
| | Upper Bound | .790 | .901 | .869 | .893 | .887 | .871 | .840 |
| Minimum | | .250 | .357 | .340 | .303 | .347 | .265 | .250 |
| Maximum | | 2.353 | 1.379 | 2.346 | 1.511 | 1.460 | 2.148 | 2.353 |
| Std. Deviation | | .325 | .110 | .191 | .117 | .146 | .178 | .249 |
| Price Related Differential | | 1.148 | 1.005 | 1.028 | 1.005 | 1.012 | 1.019 | 1.067 |
| Coefficient of Dispersion | | .280 | .091 | .152 | .097 | .119 | .145 | .194 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 20.2% | 44.0% | 30.1% | 44.1% | 30.2% | 26.8% | 28.3% |

## Table 7. Combined Results – Post Stratification and Weighting

| | Population Assessor's Value | Median | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Kansas City | 7,644,259,192 | 0.833 | 9,176,781,743 | 39.4% | 0.328 |
| Blue Springs | 1,975,066,383 | 0.895 | 2,206,778,082 | 9.5% | 0.085 |
| Independence | 3,308,141,646 | 0.865 | 3,824,441,209 | 16.4% | 0.142 |
| Lee's Summit | 3,748,461,081 | 0.892 | 4,202,310,629 | 18.0% | 0.161 |
| Raytown | 978,363,168 | 0.871 | 1,123,264,257 | 4.8% | 0.042 |
| Other | 2,347,886,581 | 0.854 | 2,749,281,711 | 11.8% | 0.101 |
| Total | 20,002,178,051 | | 23,282,857,631 | 100.0% | 85.9% |

| | Population Assessor's Value | Weighted Mean | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Kansas City | 7,644,259,192 | 0.781 | 9,787,783,857 | 41.0% | 0.320 |
| Blue Springs | 1,975,066,383 | 0.895 | 2,206,778,082 | 9.2% | 0.083 |
| Independence | 3,308,141,646 | 0.862 | 3,837,751,329 | 16.1% | 0.138 |
| Lee's Summit | 3,748,461,081 | 0.887 | 4,225,998,964 | 17.7% | 0.157 |
| Raytown | 978,363,168 | 0.877 | 1,115,579,439 | 4.7% | 0.041 |
| Other | 2,347,886,581 | 0.862 | 2,723,766,335 | 11.4% | 0.098 |
| Total | 20,002,178,051 | | 23,897,658,006 | 100.0% | 83.7% |

## Table 8. Sales Ratio Analysis: Stratified by Age

| | | Strata | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Un-improved Property | Multi-family | Built before 1950 | Built 1950s | Built 1960s | Built 1970s | Built 1980s | Built 1990 thru 1995 | Built 1996 and newer | Overall Un-weighted |
| Number of Sales | | 48 | 288 | 3899 | 2376 | 1715 | 1481 | 1122 | 936 | 1394 | 13259 |
| Median | | .821 | .857 | .795 | .840 | .859 | .879 | .898 | .874 | .922 | .864 |
| 95% Confidence Interval for Median | Lower Bound | .627 | .837 | .782 | .834 | .852 | .872 | .891 | .867 | .914 | .861 |
| | Upper Bound | .988 | .891 | .810 | .847 | .864 | .885 | .905 | .879 | .931 | .867 |
| Weighted Mean | | .829 | .772 | .731 | .845 | .861 | .877 | .884 | .872 | .882 | .836 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .749 | .735 | .722 | .838 | .855 | .870 | .874 | .865 | .865 | .831 |
| | Upper Bound | .909 | .809 | .740 | .853 | .867 | .885 | .894 | .880 | .899 | .840 |
| Minimum | | .343 | .310 | .250 | .273 | .349 | .355 | .374 | .483 | .311 | .250 |
| Maximum | | 1.200 | 1.508 | 2.353 | 2.294 | 2.332 | 1.831 | 1.606 | 1.477 | 1.511 | 2.353 |
| Std. Deviation | | .268 | .266 | .365 | .244 | .142 | .122 | .124 | .106 | .183 | .249 |
| Price Related Differential | | .961 | 1.075 | 1.223 | 1.064 | 1.016 | 1.015 | 1.020 | 1.007 | 1.039 | 1.067 |
| Coefficient of Dispersion | | .286 | .238 | .341 | .196 | .116 | .102 | .102 | .089 | .139 | .194 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 27.1% | 31.6% | 14.6% | 22.2% | 29.7% | 37.6% | 43.8% | 35.9% | 47.1% | 28.3% |

## Table 9. Combined Results – Post Stratification and Weighting

| | Population Assessor's Value | Median | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Unimproved Properties | 190,139,949 | 0.821 | 231,595,553 | 1.0% | 0.008 |
| Multi-family | 793,093,946 | 0.857 | 925,430,509 | 4.0% | 0.034 |
| Built before 1950 | 4,082,354,149 | 0.795 | 5,135,036,665 | 22.0% | 0.175 |
| Built 1950s | 2,636,214,818 | 0.84 | 3,138,350,974 | 13.5% | 0.113 |
| Built 1960s | 2,711,035,229 | 0.859 | 3,156,036,355 | 13.6% | 0.116 |
| Built 1970s | 2,561,561,261 | 0.879 | 2,914,176,634 | 12.5% | 0.110 |
| Built 1980s | 2,175,261,937 | 0.898 | 2,422,340,687 | 10.4% | 0.093 |
| Built 1990 thru 1995 | 1,730,041,967 | 0.874 | 1,979,453,051 | 8.5% | 0.074 |
| Built 1996 and newer | 3,122,474,795 | 0.922 | 3,386,632,099 | 14.5% | 0.134 |
| Total | 20,002,178,051 | | 23,289,052,527 | 100.0% | 85.9% |
| | | | | | |
| | **Population Assessor's Value** | **Weighted Mean** | **Estimated Actual Value** | **% of Total Est. Mkt. Value** | **Subtotal** |
| **Strata** | | | | | |
| Unimproved Properties | 190,139,949 | 0.829 | 229,360,614 | 1.0% | 0.008 |
| Multi-family | 793,093,946 | 0.772 | 1,027,323,764 | 4.3% | 0.033 |
| Built before 1950 | 4,082,354,149 | 0.731 | 5,584,615,799 | 23.3% | 0.170 |
| Built 1950s | 2,636,214,818 | 0.845 | 3,119,780,850 | 13.0% | 0.110 |
| Built 1960s | 2,711,035,229 | 0.861 | 3,148,705,260 | 13.1% | 0.113 |
| Built 1970s | 2,561,561,261 | 0.877 | 2,920,822,418 | 12.2% | 0.107 |
| Built 1980s | 2,175,261,937 | 0.884 | 2,460,703,549 | 10.2% | 0.091 |
| Built 1990 thru 1995 | 1,730,041,967 | 0.872 | 1,983,993,081 | 8.3% | 0.072 |
| Built 1996 and newer | 3,122,474,795 | 0.882 | 3,540,220,856 | 14.7% | 0.130 |
| Total | 20,002,178,051 | | 24,015,526,192 | 100.0% | 83.3% |

## Table 10. Sales Ratio Analysis: Stratified by Town and Rural Lots

| | | Strata | | |
|---|---|---|---|---|
| | | Rural Lots | Town Lots | Overall Un-weighted |
| Number of Sales | | 162 | 13097 | 13259 |
| Median | | .840 | .864 | .864 |
| 95% Confidence Interval for Median | Lower Bound | .817 | .861 | .861 |
| | Upper Bound | .861 | .868 | .867 |
| Weighted Mean | | .832 | .836 | .836 |
| 95% Confidence Interval for | Lower Bound | .802 | .831 | .831 |
| Weighted Mean | Upper Bound | .862 | .841 | .840 |
| Minimum | | .343 | .250 | .250 |
| Maximum | | 1.447 | 2.353 | 2.353 |
| Std. Deviation | | .170 | .249 | .249 |
| Price Related Differential | | 1.022 | 1.068 | 1.067 |
| Coefficient of Dispersion | | .150 | .194 | .194 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 27.2% | 28.3% | 28.3% |

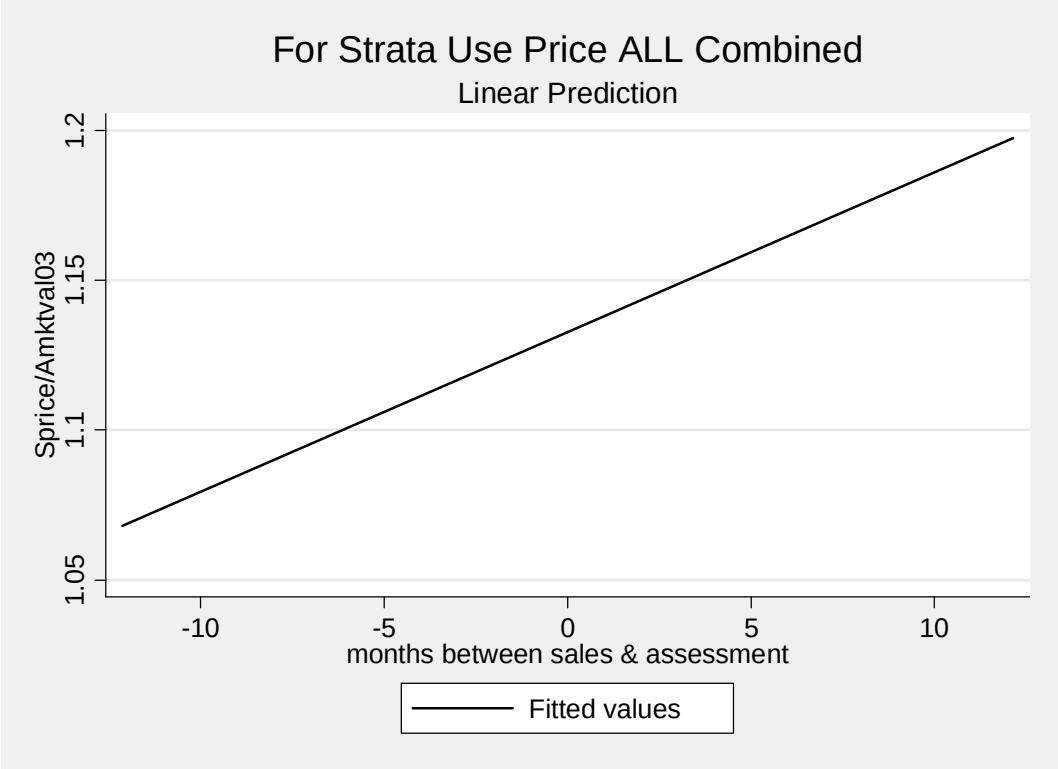
## Table 11. Combined Results – Post Stratification and Weighting

| | Population Assessor's Value | Median | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Town Lot | 19,289,369,217 | 0.864 | 22,325,658,816 | 96.3% | 0.832 |
| Rural Lot | 712,808,834 | 0.84 | 848,581,945 | 3.7% | 0.031 |
| Total | 20,002,178,051 | | 23,174,240,761 | 100.0% | 86.3% |

| | Population Assessor's Value | Weighted Mean | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Town Lot | 19,289,369,217 | 0.836 | 23,073,408,154 | 96.4% | 0.806 |
| Rural Lot | 712,808,834 | 0.832 | 856,741,387 | 3.6% | 0.030 |
| Total | 20,002,178,051 | | 23,930,149,541 | 100.0% | 83.6% |

**Graph 1. Single Family Property Price Trend**

A thorough analysis of price-time trends by price strata determined that adjusting reported prices was desirable for all single family properties combined. The prices for these strata ranged from $10,000 - $3,000,000. The resultant trend and statistical analysis is shown below.




**Price Trend Regression Statistics**

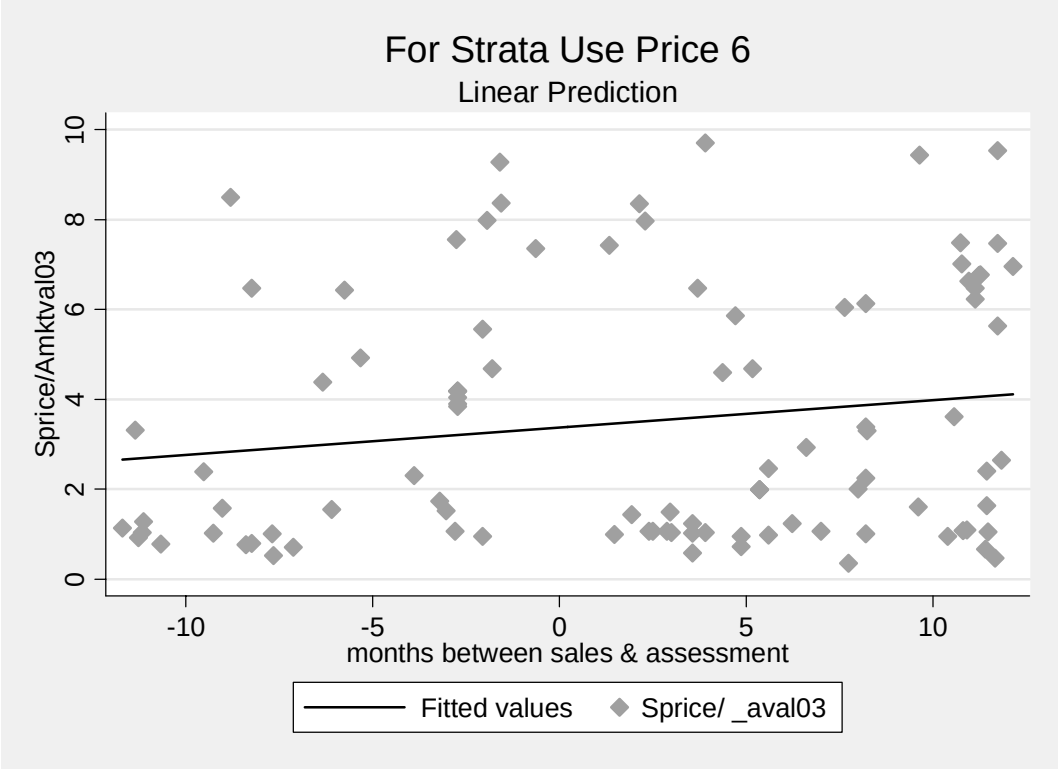
| Source | SS | df | MS | | |
|---|---|---|---|---|---|
| Model | 16.7947538 | 1 | 16.7947538 | Number of obs = 12526 | R-squared = 0.0198 |
| Residual | 829.956632 | 12524 | .066269293 | F( 1, 12524) = 253.43 | Adj R-squared= 0.0198 |
| Total | 846.751385 | 12525 | .067604901 | Prob > F = 0.0000 | Root MSE = .25743 |

| _aratio | Coef. | Std. Err. | t | P> t | [80% Conf. Interval] | |
|---|---|---|---|---|---|---|
| _adjperiod | .0053278 | .0003347 | 15.92 | 0.000 | .0048989 | .0057567 |
| _cons | 1.132808 | .0023005 | 492.42 | 0.000 | 1.12986 | 1.135756 |

Monthly adjustment rate=.00470318 | Annualized adjustment rate=.05643816

**Graph 2. Unimproved Property Price Trend**

A thorough analysis of price-time trends by price strata determined that adjusting reported prices was desirable for unimproved properties. The prices for this stratum ranged from $4,000 - $1,900,000. The resultant trend and statistical analysis is shown below.



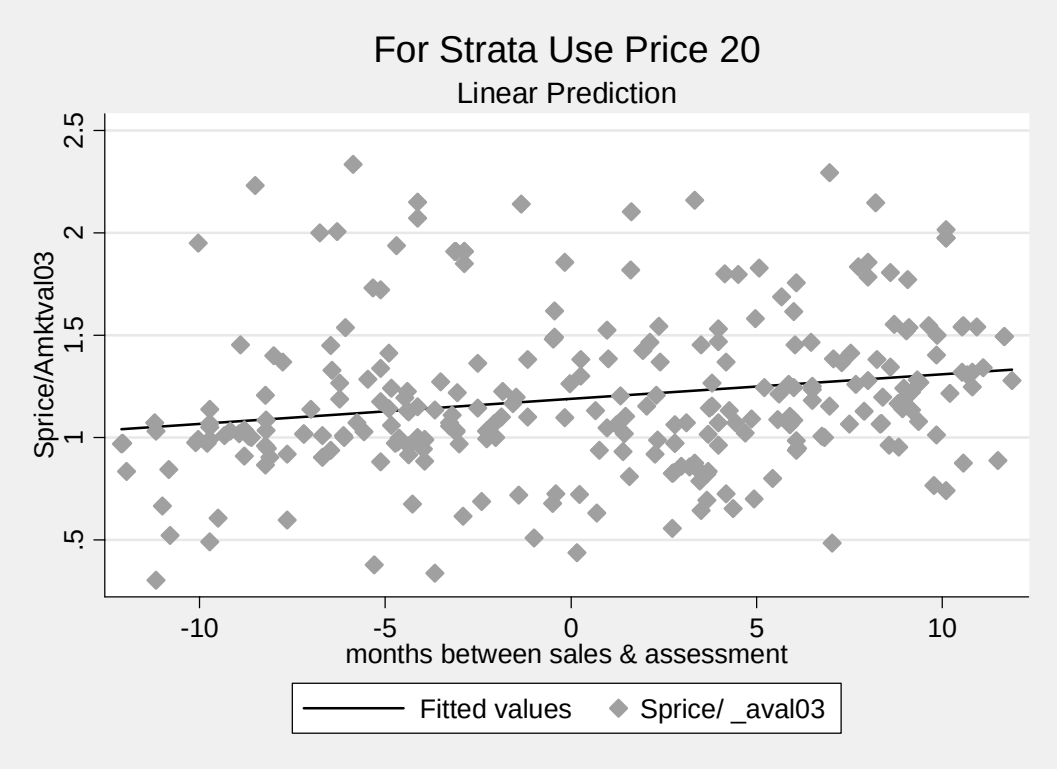

**Price Trend Regression Statistics**

| Source | SS | df | MS | | |
|---|---|---|---|---|---|
| Model | 19.2060678 | 1 | 19.2060678 | Number of obs = 98 | R-squared = 0.0257 |
| Residual | 728.147145 | 96 | 7.58486609 | F( 1, 96) = 2.53 | Adj R-squared= 0.0155 |
| Total | 747.353212 | 97 | 7.70467229 | Prob > F = 0.1148 | Root MSE = 2.7541 |

| _aratio | Coef. | Std. Err. | t | P> t | [80% Conf. Interval] | |
|---|---|---|---|---|---|---|
| _adjperiod | .061116 | .038407 | 1.59 | 0.115 | .0115545 | .1106776 |
| _cons | 3.369056 | .2909911 | 11.58 | 0.000 | 2.993552 | 3.744561 |
| Monthly adjustment rate=.01814039 | | | | Annualized adjustment rate=.21768468 | | |

**Graph 3. Multi-family Property Price Trend**

A thorough analysis of price-time trends by price strata determined that adjusting reported prices was desirable for multi-family properties. The prices for this stratum ranged from $20,000 - $585,000. The resultant trend and statistical analysis is shown below.




**Price Trend Regression Statistics**

| Source | SS | df | MS | | |
|---|---|---|---|---|---|
| Model | 1.71922329 | 1 | 1.71922329 | Number of obs = 274 | R-squared = 0.0434 |
| Residual | 37.8606245 | 272 | .139193473 | F( 1, 272) = 12.35 | Adj R-squared= 0.0399 |
| Total | 39.5798478 | 273 | .144981128 | Prob > F = 0.0005 | Root MSE = .37309 |

| _aratio | Coef. | Std. Err. | t | P> t | [80% Conf. Interval] | |
|---|---|---|---|---|---|---|
| _adjperiod | .0121628 | .0034608 | 3.51 | 0.001 | .0077168 | .0166088 |
| _cons | 1.188856 | .0225968 | 52.61 | 0.000 | 1.159826 | 1.217885 |
| Monthly adjustment rate=.01023068 | | | | Annualized adjustment rate=.12276816 | | |

# Chapter 13. Jefferson County

## 1. Significant Findings

1.1 Assessment Level: Jefferson County's 2003 residential property assessments were approximately 66% of market value (Section 3.5). The results from the corresponding STC study are invalid because the STC's appraisals did not meet the requirement that they reflect market values (Section 4.3). Furthermore, the STC's sample is not representative of residential property for the county (Section 4.2).

1.2 Assessment Equity: Lower-valued and older properties are assessed less uniformly and at lower levels than higher-valued and newer properties respectively (Section 3.6 and Tables 4 & 8).

1.3 Reassessment History: Two indicators of market value changes suggest that all four biennial reassessments have produced lower value increases than the market. Cumulatively, the reassessments from 1997 through 2003 produced only 32% of the expected rise in assessments. The net change in assessments in 2003 raises questions regarding whether any serious revaluation occurred (Section 5.1)

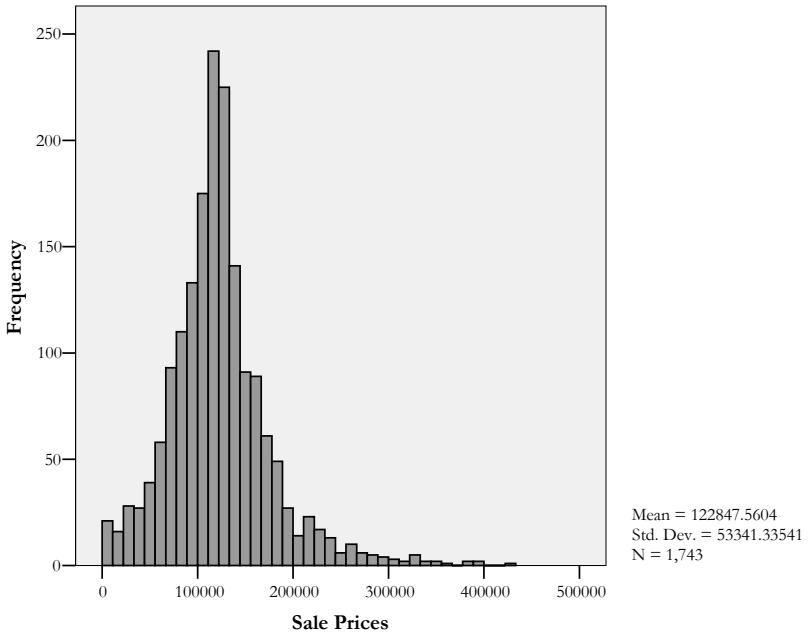
1.4 Sales Validation: The Jefferson County Assessor provided detailed results that our sample included sales that Jefferson County did not use in their models, particularly a number of manufactured homes assessed as personal property. We tested whether the exclusion of these sales would produce a material effect and found none. Therefore, we included these sales for consistency reasons.

## 2. Data and Related Issues

2.1 Assessment Data: Sales and assessment information was available in electronic format. Sales were matched using a combination of computer techniques and software and then screened. The assessor answered all questions regarding the contents and coding of data when requested. The files received contained information allowing us to identify properties affected by new construction and to screen as appropriate.

2.2 Sales and Ratio Data: The distribution of sale prices used is reflected in the following histogram.

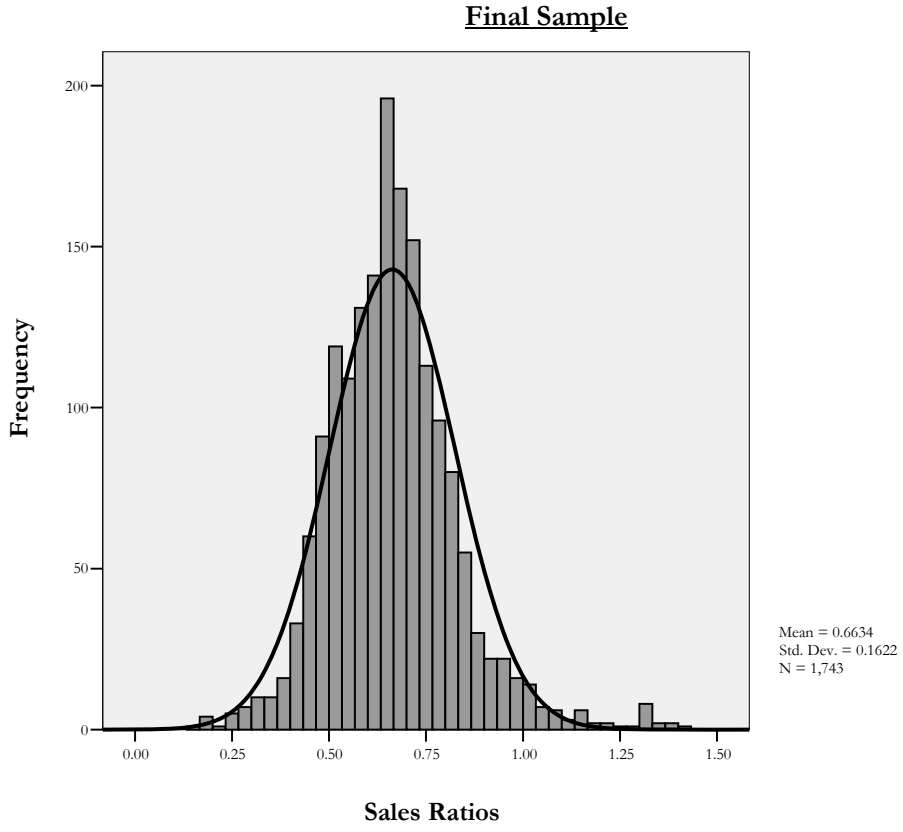
**Sale Prices for Final Sale Sample**



The next table reports results of the data screening and trimming process. The "screened sales" represent the initial screened sample. The screened sales that were excluded from the final analysis because their ratios were deemed unrepresentative are identified as high or low trims. The "remaining ratios" represent the sample on which all the study's results are based.

| Trimming of Outliers | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Single Family <$47,700 | Single Family >=$47,700 & <$64,700 | Single Family >=$64,700 & <$85,700 | Single Family >=$85,700 &<$118,600 | Single Family >=$118,600 | Un-improved Properties | Multi-family | Total |
| **Remaining Sales** | | 293 | 329 | 426 | 433 | 237 | 65 | 36 | 1,819 |
| Excluded | High Trims | 17 | 17 | 10 | 5 | 3 | 11 | 3 | 66 |
| | Low Trims | 1 | 0 | 1 | 0 | 2 | 5 | 1 | 10 |
| **Remaining Ratios** | | **275** | **312** | **415** | **428** | **232** | **49** | **32** | **1,743** |

The histogram below shows the distribution of the ratios for the sample.




2.3 Population: Since a complete copy of the 2004 assessment rolls in electronic form was available, we were able to analyze the county's population in detail. This allowed us to stratify and weight sales on a variety of property and location characteristics.

## 3. Ratio Study Results

3.1 The Sample: The following table shows that four of the strata, the three highest valued single-family strata and the multi-family stratum, vary from 3.9% to 8.8% from the population. Initially, this exhibits excessive variability from the sample to the population. Upon closer examination, this variation has a cumulative material effect on the overall assessment level and thus we conclude that the un-stratified sample is insufficiently representative of the population.

| Comparing Representivity | | | | | | |
|---|---|---|---|---|---|---|
| | Population Distribution | | | PPRC 2003 Sale Sample | | |
| Strata | N | $ | $ Weight | N | $ | $ Weight |
| Single Family <$47,700 | 12,266 | 381,242,632 | 6.8% | 275 | 9,936,316 | 7.0% |
| Single Family >=$47,700 & <$64,700 | 12,242 | 687,948,947 | 12.2% | 312 | 17,585,263 | 12.5% |
| Single Family >=$64,700 & <$85,700 | 12,324 | 918,913,684 | 16.3% | 415 | 31,120,526 | 22.1% |
| Single Family >=$85,700 & <$118,600 | 12,256 | 1,234,399,999 | 21.9% | 428 | 42,684,737 | 30.3% |
| Single Family >=$118,600 | 12,304 | 1,941,443,685 | 34.5% | 232 | 36,298,421 | 25.7% |
| Unimproved Properties | 17,202 | 248,499,998 | 4.4% | 49 | 656,842 | 0.5% |
| Multi-family | 1,719 | 211,640,526 | 3.8% | 32 | 2,733,684 | 1.9% |
| Total | 80,313 | 5,624,089,471 | | 1,743 | 141,015,789 | |

3.2 Representing the Population with the Sample: Since the un-stratified sample is insufficiently representative of the population (Section 3.1), the use of stratification and weighting is essential. Furthermore, stratification provides additional analytical benefits.

3.3 Sales Chasing: There was no indication of sales chasing.

3.4 Study Validity: Once the sample has been stratified and weighted, all requirements for producing valid inferences about the county's population of residential properties are met.

3.5 Assessment Level: Measures of the assessment level are summarized below. For the purposes of this study, the weighted mean from combined stratification is the preferred measure as long as the both of the requirements from using the weighted mean are met. In this case, weighting is not compromised by the use of seriously undersized samples but the distributions are not sufficiently normal (Figure 3). Since both requirements are not met, we focus on the median, though taking notice of the weighted mean, to conclude that the County's assessments for 2003 reflect approximately 66% of market value.

| Assessment Level (Based on Percent of Market Value) | | | | |
|---|---|---|---|---|
| | Stratification and Weighting | Reference | Weighted Mean | Median |
| **Overall Un-weighted** | None | Table 2 | 65.9% | 65.6% |
| **Combined** | By Property Use | Table 3 | 65.6% | 65.8% |
| **Combined** | By Property Use and Value Range | Table 5 | 66.1% | 66.8% |
| **Combined** | By Property Location | Table 7 | 65.6% | 65.3% |
| **Combined** | By Property Age | Table 9 | 65.0% | 64.9% |
| **Combined** | By Property Town Lots and Rural Lots | Table 11 | 65.8% | 65.6% |

3.6 Equity Measures and Evaluation:

i. Uniformity within Strata: Tables 2, 4, 6, 8 & 10 show results for individual strata of sufficient sample size for evaluation. The following strata represent problem areas for internal uniformity.

| Strata with Inadequate Uniformity | |
|---|---|
| **Property Strata** | **COD** |
| Unimproved Properties | 39.3% |
| SF <$47,700 | 34.1% |
| CW-R3&R2 | 23.6% |
| S-73,R7,R9SF&WC | 21.6% |
| Built before 1950 | 31.3% |
| Built 1950's | 26.2% |

ii. Uniformity between Strata: Another form of inequity exists when different strata are assessed at different levels. The IAAO has established guidelines for identifying such inequity, but compliance can be heavily affected by sample size and uniformity. Therefore, we confine our remarks to identifying where assessment levels differ markedly from the norm. It is notable that assessment levels (medians) increase with property value (Table 4) and as age decreases (Table 8).

iii. Vertical Equity: The final form of potential inequity examined is vertical equity. The PRD for the overall sample of 1.007 complies with the IAAO standard.

## 4. STC Study

4.1 Comparative Results: The following table contrasts our results with those from the STC study. The STC found the level of assessment adequate, while ours does not. The STC reports substandard measures for horizontal and vertical equity, while our analysis finds otherwise. We have already demonstrated that the PPRC study meets the criteria for achieving valid results. The rest of Section 4 examines the validity of the STC's study.

| Comparison of Study Results | | | |
|---|---|---|---|
| **Measure** | **STC Study*** | **PPRC Study*** | **PPRC Study Combined**** |
| Assessment Level - median | 91.2% | 65.6% | 66.8% |
| Assessment Level - weighted mean | 80.9% | 65.9% | 66.1% |
| COD | 36.6% | 18.4% | |
| PRD | 1.32 | 1.01 | |
| Sample Size | 39 | 1,743 | |
| Relative Precision | 1.00 | 6.69 | |
| * Overall sample (un-stratified and un-weighted) | | | |
| ** Stratification and weighting by Property Use and Value Range | | | |
| Note: Actual value used for the Equivalent Sale Ratio from the 2003/2004 cycle: 92%, which was the mid point. | | | |

4.2 Representing the Population with the Sample: The STC does not examine the representivity of its sample, nor does it have the necessary sample size or information to do so. Therefore, in the following table, we provide that missing analysis. In this case, the table shows that four of the strata in the STC sample, three of the single-family strata and the unimproved property stratum, vary from 3.2% to 26.0%. Initially, this exhibits excessive variability from the sample to the population. Upon

closer examination, this variation has a cumulative material effect on the overall assessment level and thus we conclude that the STC sample is insufficiently representative of the population.

| Comparing Representivity | | | | | | |
|---|---|---|---|---|---|---|
| | Population | | | STC 2003 Appraisals | | |
| Strata | N | $ | % | N | $ | % |
| Single Family <$47,700 | 12,266 | 381,242,632 | 6.8% | 2 | 76,842 | 3.6% |
| Single Family >=$47,700 & <$64,700 | 12,242 | 687,948,947 | 12.2% | 4 | 217,895 | 10.2% |
| Single Family >=$64,700 & <$85,700 | 12,324 | 918,913,684 | 16.3% | 11 | 801,053 | 37.5% |
| Single Family >=$85,700 & <$118,600 | 12,256 | 1,234,399,999 | 21.9% | 6 | 596,316 | 27.9% |
| Single Family >=$118,600 | 12,304 | 1,941,443,685 | 34.5% | 1 | 182,632 | 8.5% |
| Unimproved Properties | 17,202 | 248,499,998 | 4.4% | 14 | 176,316 | 8.2% |
| Multi-family | 1,719 | 211,640,526 | 3.8% | 1 | 86,842 | 4.1% |
| Total | 80,313 | 5,624,089,471 | | 39 | 2,137,895 | |

4.3 Market Value: The final requirement for producing a valid appraisal study is that appraisals must represent market values. As discussed in the introduction for this Section II, and in greater depth in the Procedure Manual (Section III), we use 4 tests to make this determination. The results of each test are reported in the following tables.

| Mann-Whitney Test | | | | |
|---|---|---|---|---|
| For the Entire Sample | | | | |
| Study | Observations | Rank sum | Expected | Ho: Ratios (39 STC Appraisals)=Ratios (1743 Sales)<br>z = 6.796<br>Prob > \|z\| = 0.0000 |
| 0 | 39 | 56367.5 | 34768.5 | |
| 1 | 1743 | 1532285.5 | 1553884.5 | |
| Combined | 1782 | 1588653 | 1588653 | |
| For Single Family Properties Only | | | | |
| Study | Observations | Rank sum | Expected | Ho : Ratios (24 STC Appraisals)=Ratios (1662 Sales)<br>z = 4.135<br>Prob > \|z\| = 0.0000 |
| 0 | 24 | 30037 | 20244 | |
| 1 | 1662 | 1392104 | 1401897 | |
| Combined | 1686 | 1422141 | 1422141 | |

| K-Sample Test | | | | |
|---|---|---|---|---|
| For the Entire Sample | | | | |
| Study | Not Greater than the median | Greater than the median | Total | Ho: Ratios (39 STC Appraisals)=Ratios (1743 Sales)<br>Pearson chi2(1) = 16.3842 Pr = 0.000<br>Continuity corrected:<br>Pearson chi2(1) = 15.0997 Pr = 0.000 |
| 0 | 7 | 32 | 39 | |
| 1 | 884 | 859 | 1743 | |
| Total | 891 | 891 | 1782 | |
| For Single Family Properties Only | | | | |
| Study | Not Greater than the median | Greater than the median | Total | Ho: Ratios (24 STC Appraisals)=Ratios (1662 Sales)<br>Pearson chi2(1) = 6.0866 Pr = 0.014<br>Continuity corrected:<br>Pearson chi2(1) = 5.1145 Pr = 0.024 |
| 0 | 6 | 18 | 24 | |
| 1 | 837 | 825 | 1662 | |
| Total | 843 | 843 | 1686 | |

All four tests lead to the conclusion that the STC appraisals do not represent market values (all with 95% statistical confidence). Therefore, the STC study is invalid and its reported results are unreliable.

## 5. Additional Analysis and Findings

5.1 Analysis of Reassessment History: The following table provides a comparison of actual assessment changes (net of new construction) to those that might have been expected for each of the last four reassessments as well as the six-year period leading up to 2003. None of the reassessments produced changes in line with the market indicator. In our study, previous assessment information was available for Jefferson County, so we were able to test for the real reassessment rate. Using this information, we found evidence that a real reassessment did not take place in 2003.

| Actual Value Changes from Reassessment vs. Expected Value Change | | | | | |
|---|---|---|---|---|---|
| Biennial Year | % Net Assessment Change | Missouri OFHEO Index | % Value Change: Actual vs. Expected | St. Louis MSA OFHEO Index | % Value Change: Actual vs. Expected |
| 1999 | 3.3 | 8.4 | 39% | 9.6 | 34% |
| 2001 | 6.7 | 11.4 | 59% | 13.5 | 50% |
| 2003 | 1.0 | 11.8 | 8% | 12.9 | 7% |
| 2005 | 9.3 | 12.4 | 75% | 16.8 | 56% |
| Cumulative 1997 - 2003 | 11.3 | 35.0 | 32% | 40.4 | 28% |

## 6. Figures and Tables

**Table 1. STC's Appraisal Ratio Studies**

| | | Group | | | |
|---|---|---|---|---|---|
| | | 1999 | 2001 | 2003 | 2005* |
| Number of Appraisals | | 36 | 39 | 39 | 35 |
| Median | | 1.007 | .986 | .912 | .930 |
| 95% Confidence Interval for Median | Lower Bound | .984 | .788 | .793 | .887 |
| | Upper Bound | 1.053 | 1.025 | 1.044 | 1.014 |
| Weighted Mean | | .933 | .878 | .809 | .904 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .865 | .809 | .744 | .848 |
| | Upper Bound | 1.002 | .947 | .874 | .960 |
| Minimum | | .720 | .361 | .521 | .515 |
| Maximum | | 4.577 | 3.509 | 5.263 | 1.795 |
| Std. Deviation | | .645 | .585 | .786 | .211 |
| Price Related Differential | | 1.225 | 1.195 | 1.316 | 1.045 |
| Coefficient of Dispersion | | .252 | .320 | .366 | .146 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 61.1% | 28.2% | 33.3% | 51.4% |

*The STC has not completed its studies for the 2005 reassessment cycle. These results may not represent final values.

**Figure 1. Ratios before Outlier Trimming**

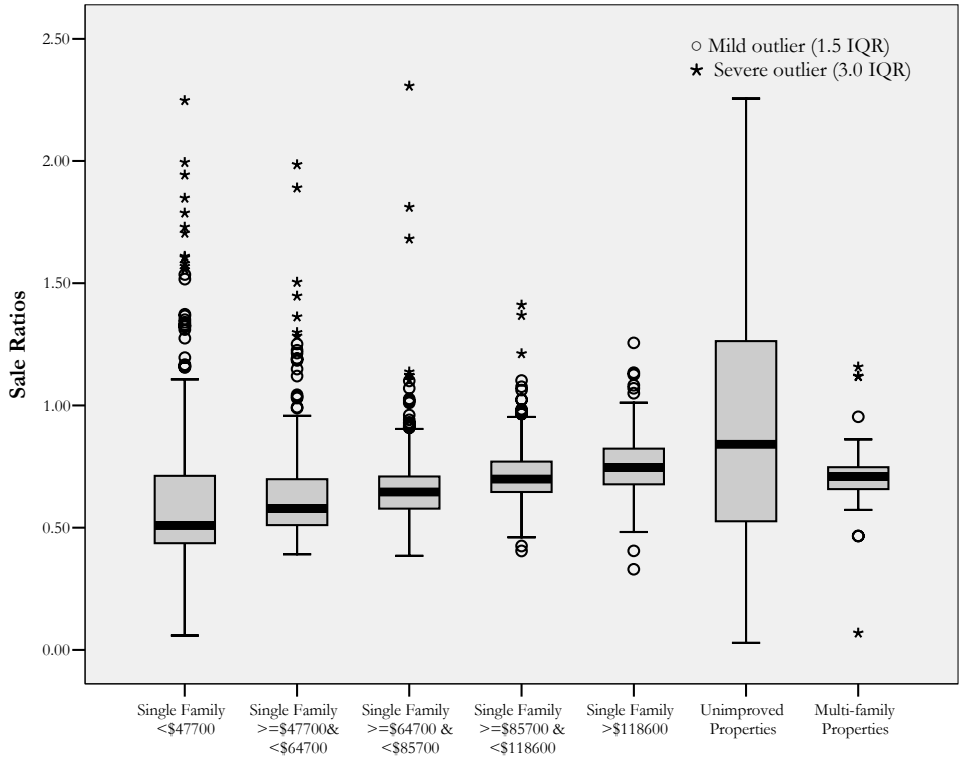
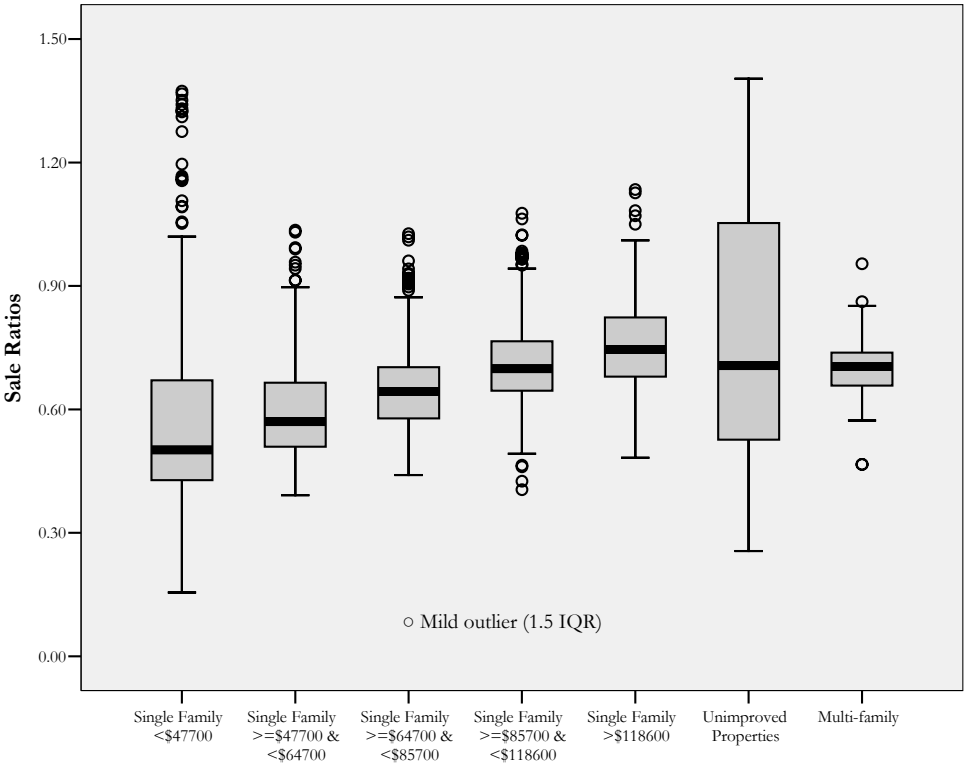
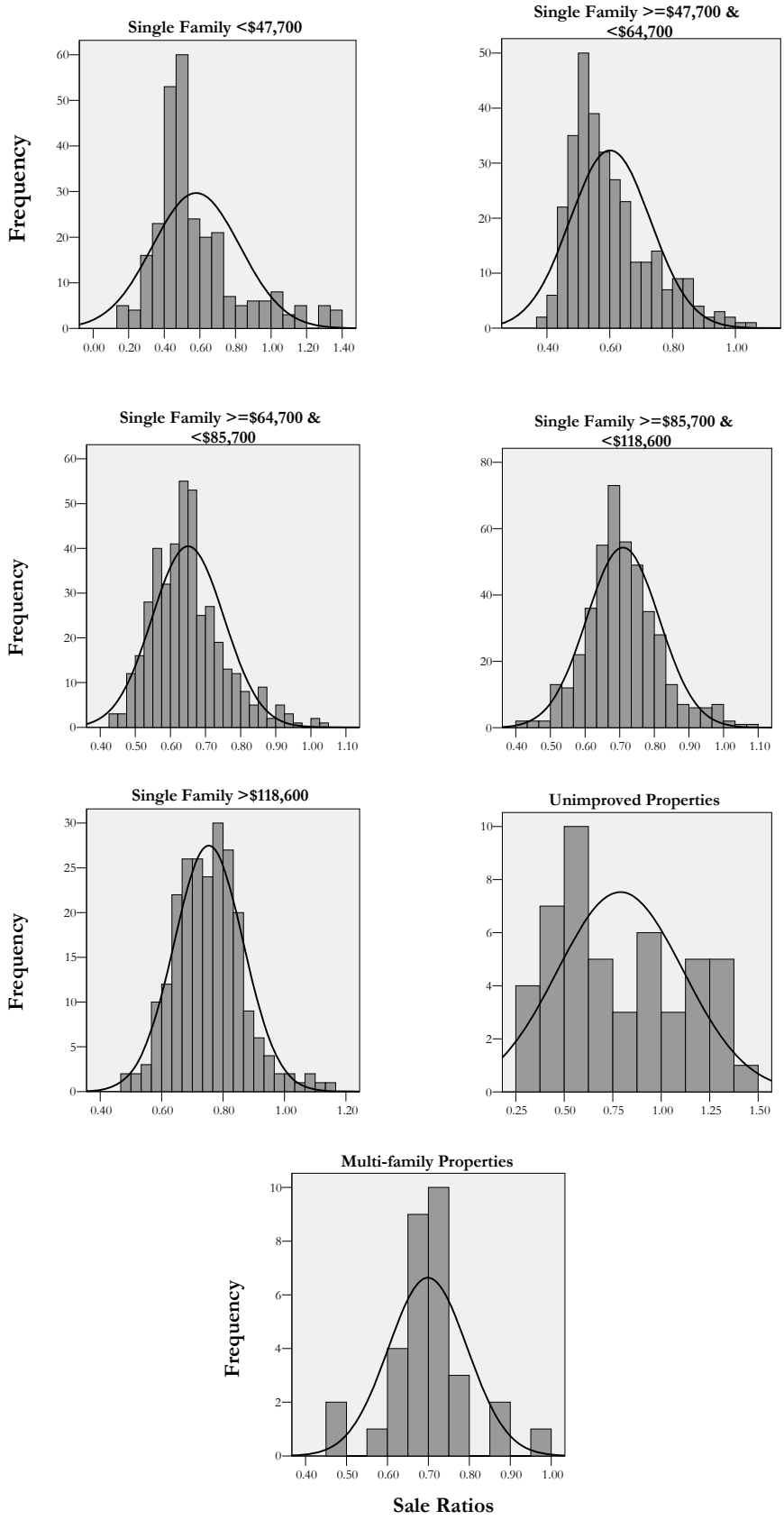



**Figure 2. Ratios after Outlier Trimming**



## Figure 3. Distribution of Final Sale Ratios



## Figure 3 (cont.). Distribution of Final Sale Ratios

**Shapiro-Francia W' Tests for Normality for Various Strata**

| Strata | Observations | W' | V' | z | Prob* |
|---|---|---|---|---|---|
| Single Family | 1,662 | 0.97518 | 24.014 | 6.185 | 0.00001 |
| Multi-family | 32 | 0.91815 | 3.015 | 2.020 | 0.02169 |
| Unimproved Properties | 49 | 0.95925 | 2.080 | 1.393 | 0.08183 |
| Single Family <$47,700 | 275 | 0.87804 | 25.784 | 6.647 | 0.00001 |
| Single Family >=$47,700 & <$64,700 | 312 | 0.92231 | 18.332 | 6.033 | 0.00001 |
| Single Family >=$64,700 & <$85,700 | 415 | 0.96001 | 12.143 | 5.287 | 0.00001 |
| Single Family >=$85,700 & <$118,600 | 428 | 0.98039 | 6.123 | 3.895 | 0.00005 |
| Single Family >=$118,600 | 232 | 0.98267 | 3.165 | 2.427 | 0.00760 |
| Overall Un-weighted | 1,743 | 0.96483 | 34.945 | 6.652 | 0.00001 |

*This value represents the indicated probability that the underlying population is normally distributed. A value of less than .05 indicates a distribution that is not normal.

## Table 2. Sales Ratio Analysis: Stratified by Property Use

| | | Strata | | | |
|---|---|---|---|---|---|
| | | Single Family | Unimproved Properties | Multi-family | Overall Un-weighted |
| Number of Sales | | 1,662 | 49 | 32 | 1,743 |
| Median | | .654 | .706 | .704 | .656 |
| 95% Confidence Interval for Median | Lower Bound | .647 | .573 | .658 | .649 |
| | Upper Bound | .661 | .936 | .733 | .663 |
| Weighted Mean | | .658 | .588 | .687 | .659 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .652 | .495 | .652 | .652 |
| | Upper Bound | .665 | .681 | .723 | .665 |
| Minimum | | .155 | .256 | .466 | .155 |
| Maximum | | 1.373 | 1.404 | .954 | 1.404 |
| Std. Deviation | | .154 | .325 | .096 | .162 |
| Price Related Differential | | 1.001 | 1.341 | 1.017 | 1.007 |
| Coefficient of Dispersion | | .178 | .393 | .095 | .184 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 4.7% | 16.3% | 3.1% | 5.0% |

## Table 3. Combined Results – Post Stratification and Weighting

| | Population Assessor's Value | Median | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Single Family | 5,163,948,947 | 0.654 | 7,895,946,402 | 92.4% | 0.604 |
| Unimproved Properties | 248,499,998 | 0.706 | 351,983,000 | 4.1% | 0.029 |
| Multi-family | 211,640,526 | 0.704 | 300,625,748 | 3.5% | 0.025 |
| Total | 5,624,089,471 | | 8,548,555,149 | 100.0% | 65.8% |

| | Population Assessor's Value | Weighted Mean | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Single Family | 5,163,948,947 | 0.658 | 7,847,946,728 | 91.5% | 0.602 |
| Unimproved Properties | 248,499,998 | 0.588 | 422,619,044 | 4.9% | 0.029 |
| Multi-family | 211,640,526 | 0.687 | 308,064,813 | 3.6% | 0.025 |
| Total | 5,624,089,471 | | 8,578,630,584 | 100.0% | 65.6% |

## Table 4. Sales Ratio Analysis: Stratified by Use and Value

| | | Strata | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Single Family <$47,700 | Single Family >=$47,700 &<$64700 | Single Family >=$64,700 &<$85,700 | Single Family >=$85,700 & $118,600 | Single Family >=$118,600 | Un-improved Properties | Multi-family | Overall Un-weighted |
| Number of Sales | | 275 | 312 | 415 | 428 | 232 | 49 | 32 | 1,743 |
| Median | | .501 | .570 | .643 | .699 | .746 | .706 | .704 | .656 |
| 95% Confidence Interval for Median | Lower Bound | .487 | .548 | .634 | .691 | .730 | .573 | .658 | .649 |
| | Upper Bound | .522 | .586 | .649 | .708 | .776 | .936 | .733 | .663 |
| Weighted Mean | | .513 | .578 | .638 | .696 | .739 | .588 | .687 | .659 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .492 | .566 | .628 | .686 | .724 | .495 | .652 | .652 |
| | Upper Bound | .534 | .590 | .647 | .706 | .754 | .681 | .723 | .665 |
| Minimum | | .155 | .392 | .440 | .405 | .483 | .256 | .466 | .155 |
| Maximum | | 1.373 | 1.036 | 1.027 | 1.077 | 1.134 | 1.404 | .954 | 1.404 |
| Std. Deviation | | .246 | .128 | .102 | .105 | .112 | .325 | .096 | .162 |
| Price Related Differential | | 1.130 | 1.040 | 1.020 | 1.019 | 1.019 | 1.341 | 1.017 | 1.007 |
| Coefficient of Dispersion | | .341 | .172 | .120 | .113 | .118 | .393 | .095 | .184 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 6.2% | 2.9% | 2.9% | 5.4% | 7.3% | 16.3% | 3.1% | 5.0% |

## Table 5. Combined Results – Post Stratification and Weighting

| | Population Assessor's Value | Median | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Single Family <$47,700 | 381,242,632 | 0.501 | 760,963,336 | 9.0% | 0.045 |
| Single Family >=$47,700 & <$64,700 | 687,948,947 | 0.57 | 1,206,927,978 | 14.3% | 0.082 |
| Single Family >=$64,700 & <$85,700 | 918,913,684 | 0.643 | 1,429,103,708 | 17.0% | 0.109 |
| Single Family >=$85,700 & <$118,600 | 1,234,399,999 | 0.699 | 1,765,951,358 | 21.0% | 0.147 |
| Single Family >=$118,600 | 1,941,443,685 | 0.746 | 2,602,471,428 | 30.9% | 0.231 |
| Unimproved Properties | 248,499,998 | 0.706 | 351,983,000 | 4.2% | 0.030 |
| Multi-family | 211,640,526 | 0.704 | 300,625,748 | 3.6% | 0.025 |
| Total | 5,624,089,471 | | 8,418,026,555 | 100.0% | 66.8% |

| | Population Assessor's Value | Weighted Mean | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Single Family <$47,700 | 381,242,632 | 0.513 | 743,163,024 | 8.7% | 0.045 |
| Single Family >=$47,700 & <$64,700 | 687,948,947 | 0.578 | 1,190,223,092 | 14.0% | 0.081 |
| Single Family >=$64,700 & <$85,700 | 918,913,684 | 0.638 | 1,440,303,580 | 16.9% | 0.108 |
| Single Family >=$85,700 & <$118,600 | 1,234,399,999 | 0.696 | 1,773,563,217 | 20.9% | 0.145 |
| Single Family >=$118,600 | 1,941,443,685 | 0.739 | 2,627,122,713 | 30.9% | 0.228 |
| Unimproved Properties | 248,499,998 | 0.588 | 422,619,044 | 5.0% | 0.029 |
| Multi-family | 211,640,526 | 0.687 | 308,064,813 | 3.6% | 0.025 |
| Total | 5,624,089,471 | | 8,505,059,484 | 100.0% | 66.1% |

## Table 6. Sales Ratio Analysis: Stratified by Location

| | | Strata | | | | | |
|---|---|---|---|---|---|---|---|
| | | NW-R1,RW&MV | NE-C6 | E-C1,R5,47,56,R6 | CW-R3&R2 | S-73,R7,R9SF&WC | Overall Un-weighted |
| Number of Sales | | 302 | 536 | 497 | 192 | 216 | 1,743 |
| Median | | .630 | .660 | .666 | .660 | .648 | .656 |
| 95% Confidence Interval for Median | Lower Bound | .602 | .650 | .655 | .642 | .624 | .649 |
| | Upper Bound | .646 | .671 | .685 | .692 | .676 | .663 |
| Weighted Mean | | .636 | .656 | .677 | .659 | .653 | .659 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .620 | .646 | .665 | .635 | .631 | .652 |
| | Upper Bound | .653 | .666 | .689 | .683 | .675 | .665 |
| Minimum | | .155 | .283 | .195 | .176 | .228 | .155 |
| Maximum | | 1.373 | 1.351 | 1.167 | 1.404 | 1.325 | 1.404 |
| Std. Deviation | | .161 | .128 | .153 | .221 | .188 | .162 |
| Price Related Differential | | .995 | .997 | .988 | 1.074 | 1.034 | 1.007 |
| Coefficient of Dispersion | | .192 | .146 | .183 | .236 | .216 | .184 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 3.6% | 2.1% | 5.8% | 9.4% | 8.3% | 5.0% |

## Table 7. Combined Results – Post Stratification and Weighting

| | **Population Assessor's Value** | **Median** | **Estimated Actual Value** | **% of Total Est. Mkt. Value** | **Subtotal** |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| NW-R1, RW&MV | 1,257,497,894 | 0.63 | 1,996,028,403 | 23.2% | 0.146 |
| NE-C6 | 1,816,161,052 | 0.66 | 2,751,759,170 | 32.0% | 0.211 |
| E-C1,R5,47,56,R6 | 1,283,971,578 | 0.666 | 1,927,885,252 | 22.4% | 0.149 |
| CW-R3&R2 | 691,225,263 | 0.66 | 1,047,311,005 | 12.2% | 0.080 |
| S-73,R7,R9SF&WC | 575,233,684 | 0.648 | 887,706,303 | 10.3% | 0.067 |
| Total | 5,624,089,471 | | 8,610,690,133 | 100.0% | 65.3% |

| | **Population Assessor's Value** | **Weighted Mean** | **Estimated Actual Value** | **% of Total Est. Mkt. Value** | **Subtotal** |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| NW-R1, RW&MV | 1,257,497,894 | 0.636 | 1,977,197,947 | 23.1% | 0.147 |
| NE-C6 | 1,816,161,052 | 0.656 | 2,768,538,189 | 32.3% | 0.212 |
| E-C1,R5,47,56,R6 | 1,283,971,578 | 0.677 | 1,896,560,677 | 22.1% | 0.150 |
| CW-R3&R2 | 691,225,263 | 0.659 | 1,048,900,247 | 12.2% | 0.081 |
| S-73,R7,R9SF&WC | 575,233,684 | 0.653 | 880,909,164 | 10.3% | 0.067 |
| Total | 5,624,089,471 | | 8,572,106,224 | 100.0% | 65.6% |

## Table 8. Sales Ratio Analysis: Stratified by Age

| | | Strata | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Un-improved Property | Multi-family | Un-known Age | Built before 1950 | Built 1950s | Built 1960s | Built 1970s | Built 1980s | Built 1990 thru 1995 | Built 1996 and newer | Overall Un-weighted |
| Number of Sales | | 49 | 32 | 17 | 123 | 139 | 229 | 338 | 289 | 265 | 262 | 1743 |
| Median | | .706 | .704 | .372 | .493 | .563 | .566 | .601 | .675 | .699 | .740 | .656 |
| 95% Confidence Interval for Median | Lower Bound | .573 | .658 | .245 | .466 | .522 | .544 | .586 | .663 | .692 | .717 | .649 |
| | Upper Bound | .936 | .733 | .685 | .522 | .600 | .582 | .610 | .690 | .712 | .753 | .663 |
| Weighted Mean | | .588 | .687 | .401 | .507 | .569 | .579 | .613 | .679 | .712 | .733 | .659 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .495 | .652 | .272 | .473 | .543 | .564 | .601 | .664 | .700 | .720 | .652 |
| | Upper Bound | .681 | .723 | .530 | .540 | .595 | .594 | .625 | .693 | .725 | .746 | .665 |
| Minimum | | .256 | .466 | .155 | .176 | .283 | .371 | .272 | .394 | .515 | .405 | .155 |
| Maximum | | 1.404 | .954 | 1.367 | 1.325 | 1.330 | 1.351 | 1.158 | 1.373 | 1.050 | 1.134 | 1.404 |
| Std. Deviation | | .325 | .096 | .389 | .215 | .205 | .158 | .120 | .115 | .091 | .110 | .162 |
| Price Related Differential | | 1.341 | 1.017 | 1.356 | 1.090 | 1.077 | 1.045 | 1.018 | 1.015 | 1.002 | 1.018 | 1.007 |
| Coefficient of Dispersion | | .393 | .095 | .801 | .313 | .262 | .197 | .147 | .126 | .099 | .116 | .184 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 16.3% | 3.1% | 5.9% | 4.9% | 6.5% | 4.8% | 3.3% | 3.5% | 3.8% | 7.6% | 5.0% |

## Table 9. Combined Results – Post Stratification and Weighting

| | Population Assessor's Value | Median | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Unimproved Properties | 248,499,998 | 0.706 | 351,983,000 | 4.1% | 0.029 |
| Multi-family | 211,640,526 | 0.704 | 300,625,748 | 3.5% | 0.024 |
| Unknown Age | 51,404,737 | 0.372 | 138,184,776 | 1.6% | 0.006 |
| Built before 1950 | 234,972,105 | 0.493 | 476,616,846 | 5.5% | 0.027 |
| Built 1950's | 317,668,947 | 0.563 | 564,243,245 | 6.5% | 0.037 |
| Built 1960's | 559,577,368 | 0.566 | 988,652,594 | 11.4% | 0.065 |
| Built 1970's | 864,788,947 | 0.601 | 1,438,916,718 | 16.6% | 0.100 |
| Built 1980's | 811,062,105 | 0.675 | 1,201,573,489 | 13.9% | 0.094 |
| Built 1990 through 1995 | 781,273,685 | 0.699 | 1,117,701,981 | 12.9% | 0.090 |
| Built 1996 and newer | 1,543,201,053 | 0.74 | 2,085,406,828 | 24.1% | 0.178 |
| Total | 5,624,089,471 | | 8,663,905,225 | 100.0% | 64.9% |
| | **Population Assessor's Value** | **Weighted Mean** | **Estimated Actual Value** | **% of Total Est. Mkt. Value** | **Subtotal** |
| **Strata** | | | | | |
| Unimproved Properties | 248,499,998 | 0.588 | 422,619,044 | 4.9% | 0.029 |
| Multi-family | 211,640,526 | 0.687 | 308,064,813 | 3.6% | 0.024 |
| Unknown Age | 51,404,737 | 0.401 | 128,191,364 | 1.5% | 0.006 |
| Built before 1950 | 234,972,105 | 0.507 | 463,455,829 | 5.4% | 0.027 |
| Built 1950's | 317,668,947 | 0.569 | 558,293,405 | 6.5% | 0.037 |
| Built 1960's | 559,577,368 | 0.579 | 966,454,867 | 11.2% | 0.065 |
| Built 1970's | 864,788,947 | 0.613 | 1,410,748,691 | 16.3% | 0.100 |
| Built 1980's | 811,062,105 | 0.679 | 1,194,495,000 | 13.8% | 0.094 |
| Built 1990 through 1995 | 781,273,685 | 0.712 | 1,097,294,501 | 12.7% | 0.090 |
| Built 1996 and newer | 1,543,201,053 | 0.733 | 2,105,322,037 | 24.3% | 0.178 |
| Total | 5,624,089,471 | | 8,654,939,549 | 100.0% | 65.0% |

## Table 10. Sales Ratio Analysis: Stratified by Town Lots and Rural Lots

| | | Strata | | |
|---|---|---|---|---|
| | | Town Lot | Rural Lot | Overall Un-weighted |
| Number of Sales | | 488 | 1,255 | 1,743 |
| Median | | .643 | .660 | .656 |
| 95% Confidence Interval for Median | Lower Bound | .619 | .654 | .649 |
| | Upper Bound | .655 | .670 | .663 |
| Weighted Mean | | .647 | .662 | .659 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .634 | .655 | .652 |
| | Upper Bound | .660 | .670 | .665 |
| Minimum | | .195 | .155 | .155 |
| Maximum | | 1.325 | 1.404 | 1.404 |
| Std. Deviation | | .165 | .161 | .162 |
| Price Related Differential | | .995 | 1.013 | 1.007 |
| Coefficient of Dispersion | | .202 | .176 | .184 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 5.5% | 4.8% | 5.0% |

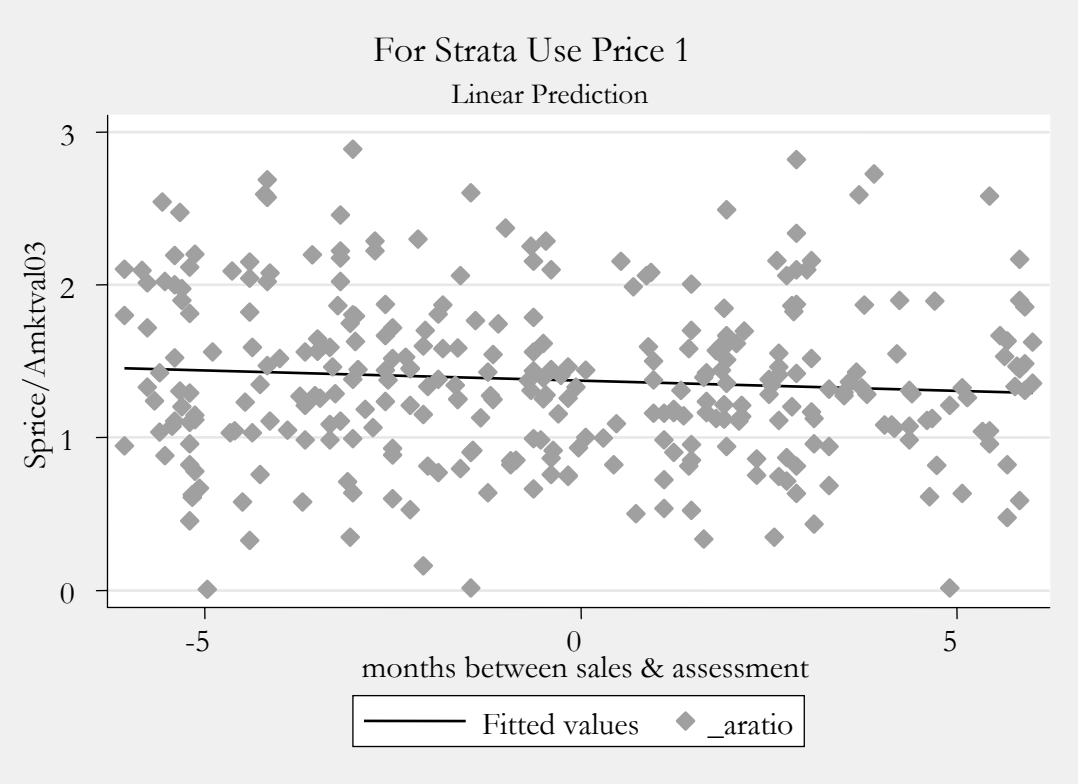
## Table 11. Combined Results – Post Stratification and Weighting

| | Population Assessor's Value | Median | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Town Lot | 1,345,223,683 | 0.643 | 2,092,105,261 | 24.4% | 0.157 |
| Rural Lot | 4,278,865,788 | 0.66 | 6,483,129,982 | 75.6% | 0.499 |
| Total | 5,624,089,471 | | 8,575,235,243 | 100.0% | 65.6% |

| | Population Assessor's Value | Weighted Mean | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Town Lot | 1,345,223,683 | 0.647 | 2,079,171,071 | 24.3% | 0.157 |
| Rural Lot | 4,278,865,788 | 0.662 | 6,463,543,486 | 75.7% | 0.501 |
| Total | 5,624,089,471 | | 8,542,714,558 | 100.0% | 65.8% |

**Graph 1. Single Family Property Price Trend**

A thorough analysis of price-time trends by price strata determined that adjusting reported prices was desirable for the lowest valued single family properties. The prices for this stratum ranged from $1,000 - $83,000. The resultant trend and statistical analysis is shown below.



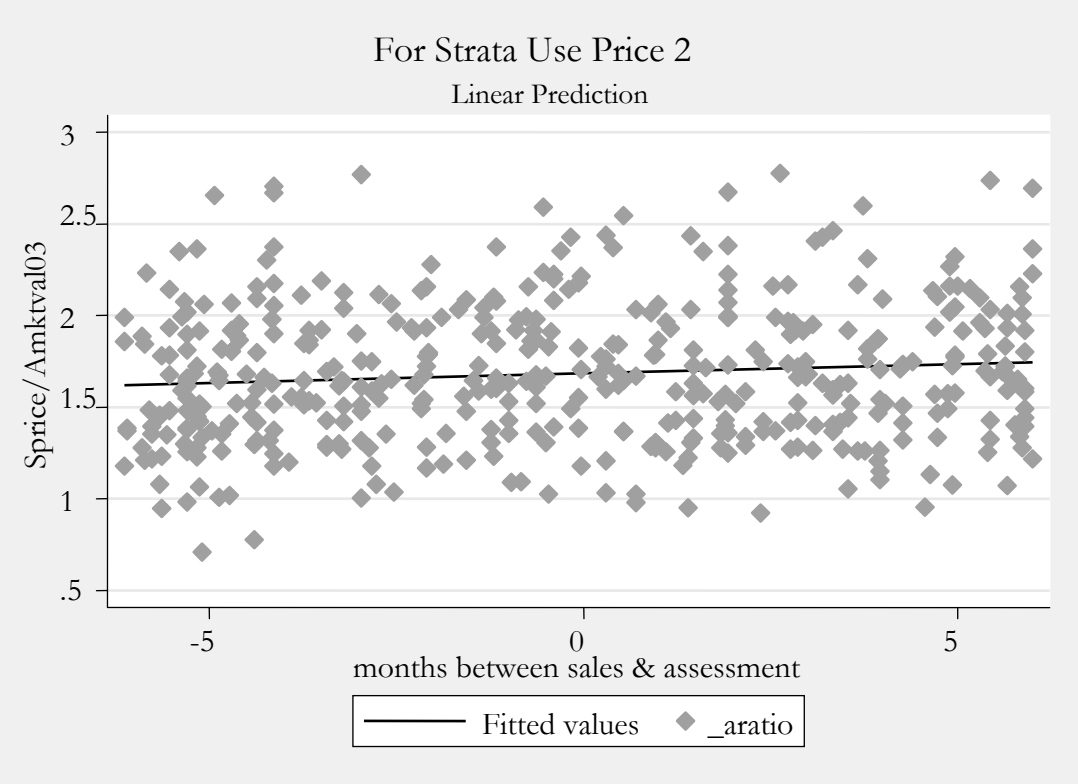

**Price Trend Regression Statistics**

| Source | SS | df | MS | | |
|---|---|---|---|---|---|
| Model | .660949795 | 1 | .660949795 | Number of obs = 311 | R-squared = 0. 0072 |
| Residual | 90.7187282 | 309 | .293588117 | F( 1, 309) = 2.25 | Adj R-squared= 0. 0040 |
| Total | 91.379678 | 310 | .294773155 | Prob > F = 0. 1345 | Root MSE = .54184 |

| _aratio | Coef. | Std. Err. | t | P> t | [80% Conf. Interval] | |
|---|---|---|---|---|---|---|
| _adjperiod | -.013454 | .0089668 | -1.50 | 0.135 | -.0249701 | -.001938 |
| _cons | 1.371231 | .030922 | 44.34 | 0.000 | 1.331518 | 1.410944 |
| Monthly adjustment rate=-.00981162 | | | | Annualized adjustment rate=-.11773944 | | |

**Graph 2. Single Family Property Price Trend**

A thorough analysis of price-time trends by price strata determined that adjusting reported prices was desirable for the second single family property stratum. The prices for this stratum ranged from $83,400 - $115,000. The resultant trend and statistical analysis is shown below.



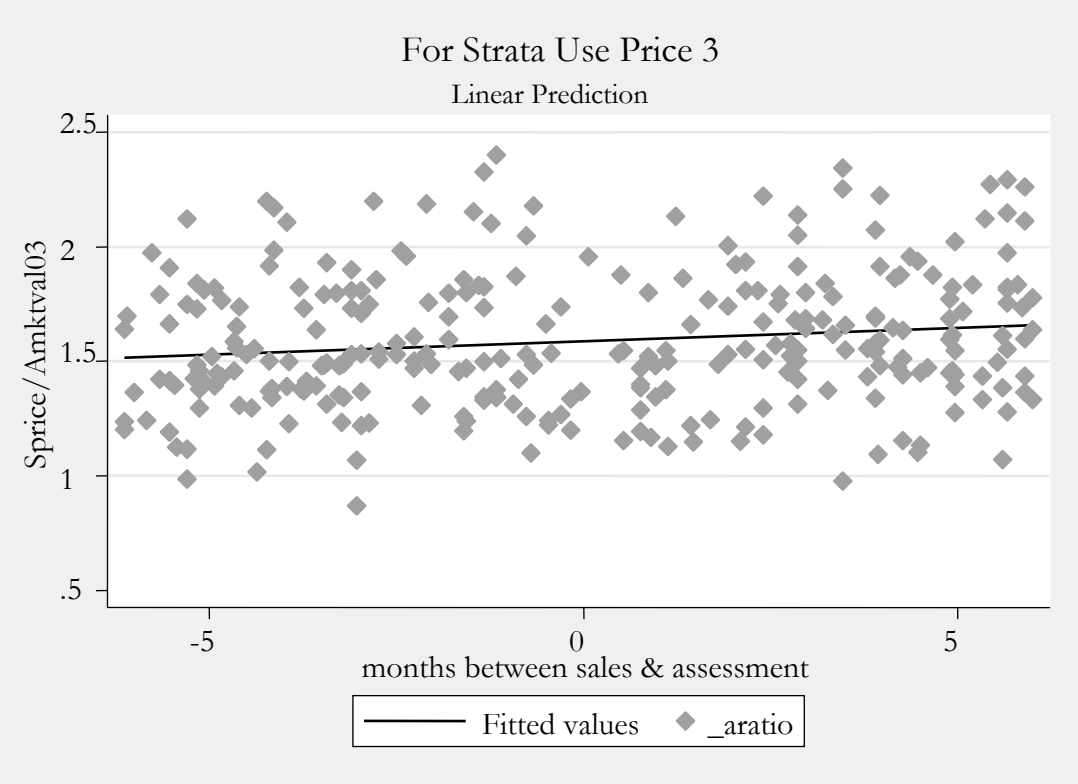

**Price Trend Regression Statistics**

| Source | SS | df | MS | | |
|---|---|---|---|---|---|
| Model | .645390876 | 1 | .645390876 | Number of obs = 442 | R-squared = 0. 0102 |
| Residual | 62.8539969 | 440 | .142849993 | F( 1, 440) = 4.52 | Adj R-squared= 0. 0079 |
| Total | 63.4993877 | 441 | .143989541 | Prob > F = 0. 0341 | Root MSE = .37796 |

| _aratio | Coef. | Std. Err. | t | P> t | [80% Conf. Interval] | |
|---|---|---|---|---|---|---|
| _adjperiod | .0103437 | .0048663 | 2.13 | 0.034 | .0040978 | .0165895 |
| _cons | 1.683367 | .0180304 | 93.36 | 0.000 | 1.660226 | 1.706509 |
| Monthly adjustment rate=.00614465 | | | | Annualized adjustment rate=.0737358 | | |

**Graph 3. Single Family Property Price Trend**

A thorough analysis of price-time trends by price strata determined that adjusting reported prices was desirable for the third single family property stratum. The prices for this stratum ranged from $115,250 - $129,000. The resultant trend and statistical analysis is shown below.



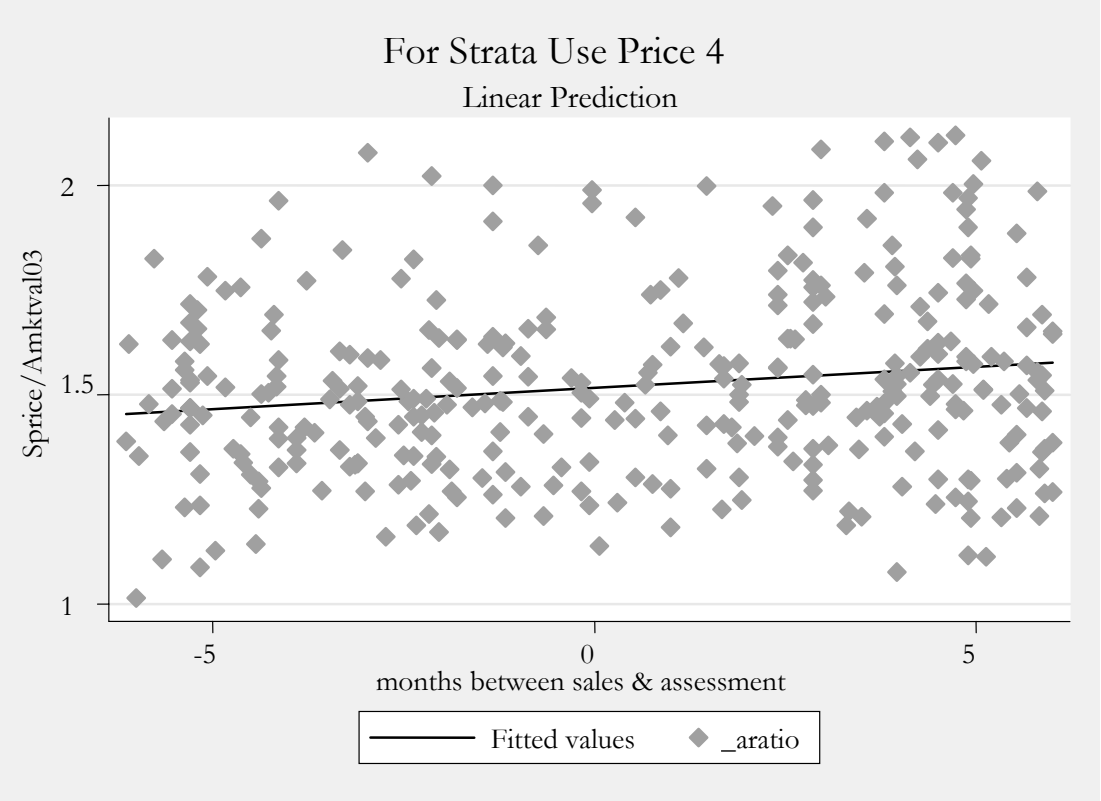

**Price Trend Regression Statistics**

| Source | SS | df | MS | | |
|---|---|---|---|---|---|
| Model | .552095994 | 1 | .552095994 | Number of obs = 286 | R-squared = 0. 0218 |
| Residual | 24.8196399 | 284 | .087393098 | F( 1, 284) = 6.32 | Adj R-squared= 0. 0183 |
| Total | 25.3717359 | 285 | .089023635 | Prob > F = 0. 0125 | Root MSE = .29562 |

| _aratio | Coef. | Std. Err. | t | P> t | [80% Conf. Interval] | |
|---|---|---|---|---|---|---|
| _adjperiod | .0118 | .0046948 | 2.51 | 0.013 | .0057694 | .0178307 |
| _cons | 1.587517 | .0174808 | 90.81 | 0.000 | 1.565062 | 1.609972 |
| Monthly adjustment rate=.00743299 | | | | Annualized adjustment rate=.08919588 | | |

**Graph 4. Single Family Property Price Trend**

A thorough analysis of price-time trends by price strata determined that adjusting reported prices was desirable for the fourth single family property stratum. The prices for this stratum ranged from $129,001 - $160,000. The resultant trend and statistical analysis is shown below.



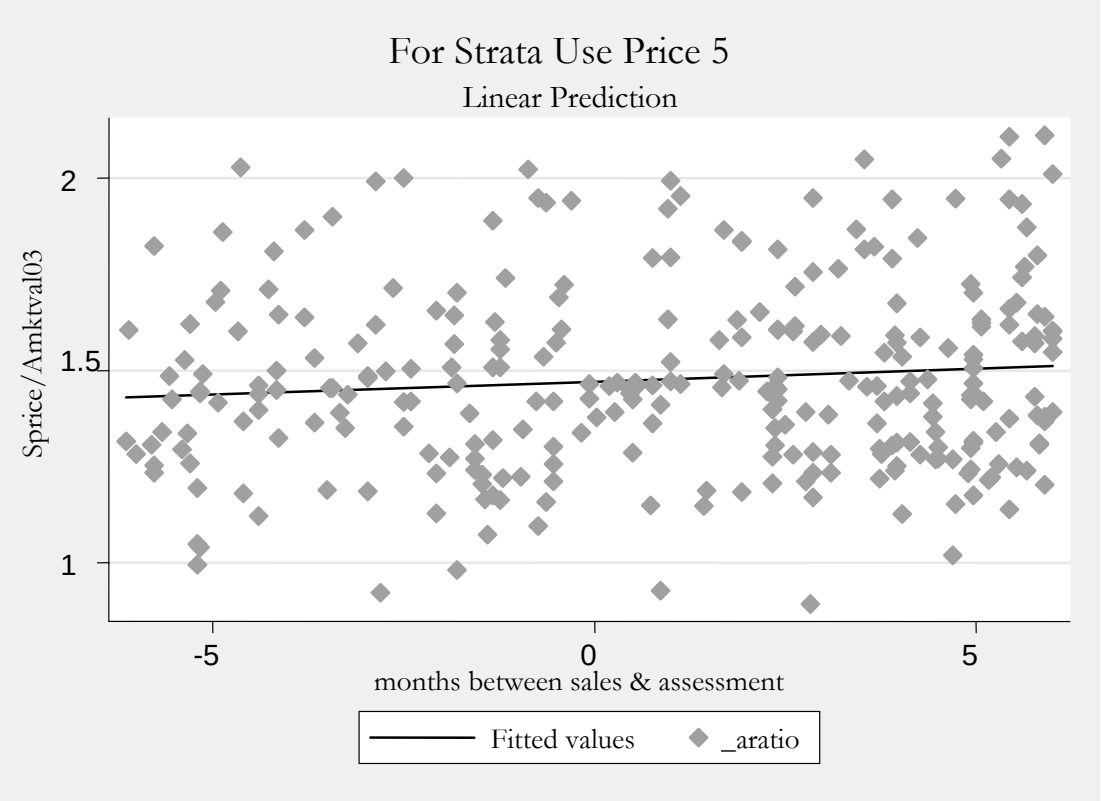

**Price Trend Regression Statistics**

| Source | SS | df | MS | | |
|---|---|---|---|---|---|
| Model | .483752701 | 1 | .483752701 | Number of obs = 341 | R-squared = 0. 0289 |
| Residual | 16.2514552 | 339 | .047939396 | F( 1, 339) = 10.09 | Adj R-squared= 0. 0260 |
| Total | 16.7352079 | 340 | .0492212 | Prob > F = 0. 0016 | Root MSE = .21895 |

| _aratio | Coef. | Std. Err. | t | P> t | [80% Conf. Interval] | |
|---|---|---|---|---|---|---|
| _adjperiod | .0101459 | .0031939 | 3.18 | 0.002 | .0060447 | .014247 |
| _cons | 1.516079 | .0119652 | 126.71 | 0.000 | 1.500715 | 1.531443 |
| Monthly adjustment rate=.0066922 | | | | Annualized adjustment rate=.0803064 | | |

**Graph 5. Single Family Property Price Trend**

A thorough analysis of price-time trends by price strata determined that adjusting reported prices was desirable for the highest valued single family properties. The prices for this stratum ranged from $160,800 - $415,000. The resultant trend and statistical analysis is shown below.




**Price Trend Regression Statistics**

| Source | SS | df | MS | | |
|---|---|---|---|---|---|
| Model | .172551233 | 1 | .172551233 | Number of obs = 286 | R-squared = 0.0102 |
| Residual | 16.674557 | 284 | .058713229 | F( 1, 284) = 2.94 | Adj R-squared= 0.0068 |
| Total | 16.8471082 | 285 | .05911266 | Prob > F = 0.0876 | Root MSE = .24231 |

| _aratio | Coef. | Std. Err. | t | P> t | [80% Conf. Interval] | |
|---|---|---|---|---|---|---|
| _adjperiod | .0067412 | .0039323 | 1.71 | 0.088 | .00169 | .0117923 |
| _cons | 1.47057 | .0148198 | 99.23 | 0.000 | 1.451533 | 1.489606 |
| Monthly adjustment rate=.00458407 | | | | Annualized adjustment rate=.05500884 | | |

# Chapter 14. Johnson County

## 1. Significant Findings

1.1 Assessment Level: Johnson County's 2003 residential property assessments were approximately 75% of market value (Section 3.5). The results from the corresponding STC study are invalid because the STC's appraisals did not meet the requirement that they reflect market values (Section 4.3). Furthermore, and the STC's sample is not representative of residential property for the county (Section 4.2).

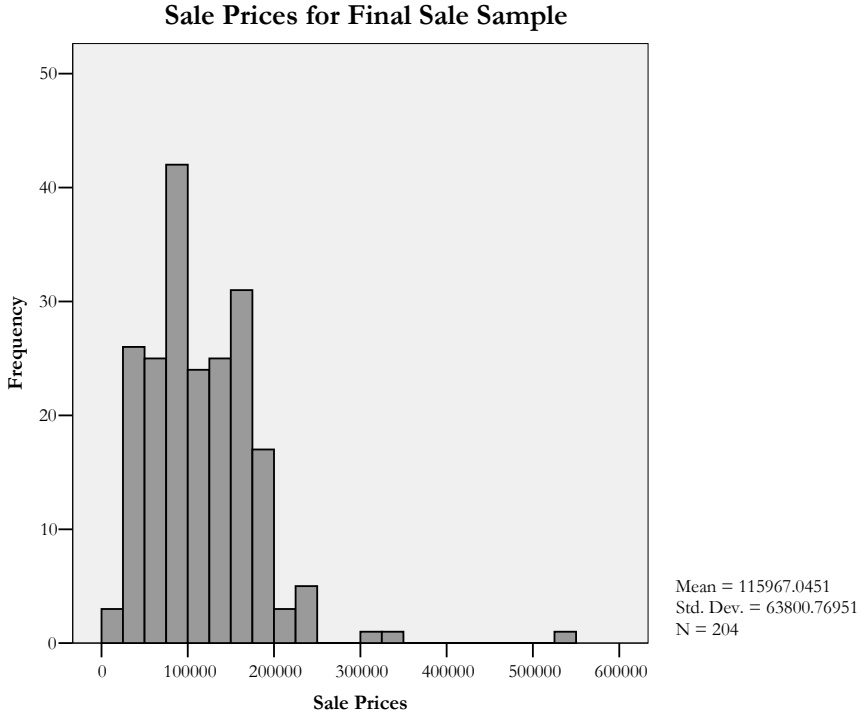
1.2 Assessment Equity: Lower-valued properties and properties in the Holden and Kingsville area are assessed less uniformly and at lower levels than other strata (Section 3.6 and Tables 3 & 5).

1.3 Reassessment History: Two indicators of market value changes suggest that the past four biennial reassessments have produced lower value increases than the market. Cumulatively, the reassessments from 1997 through 2003 produced only 21% of the expected rise in assessments. The net change in assessments in 1999 and 2003 raises questions regarding whether any serious revaluation occurred (Section 5.1).

## 2. Data and Related Issues

2.1 Assessment Data: Sales and assessment information were matched at the county offices. Subsequently, the assessor reviewed the matched parcels and provided further information that assisted our screening process.

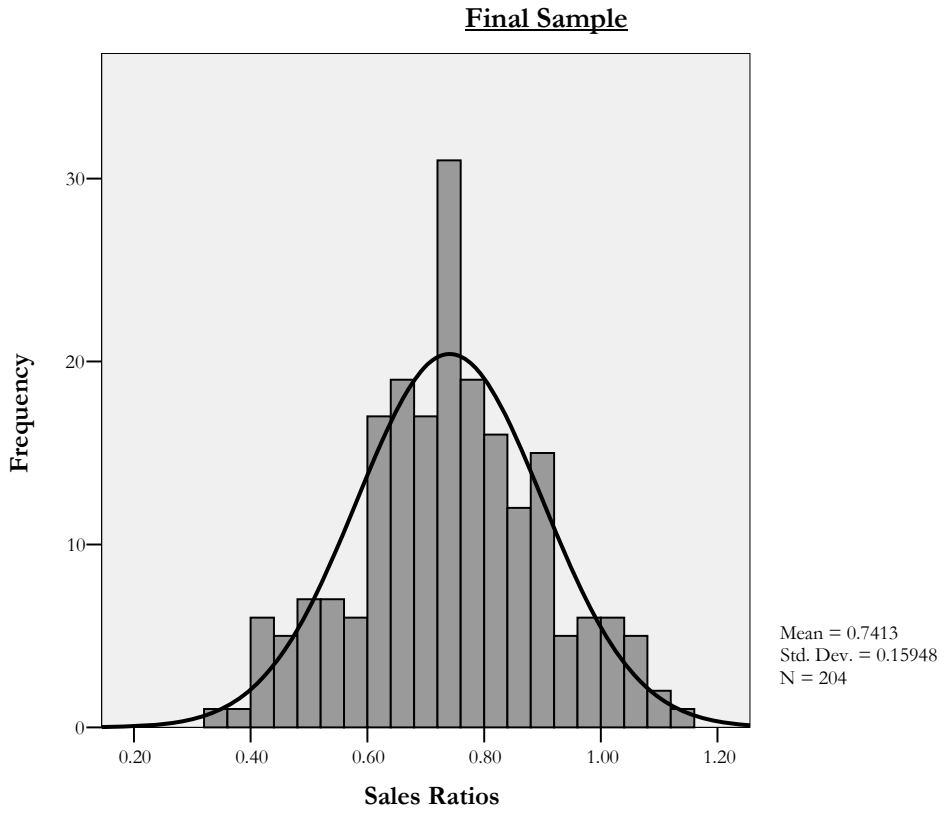
2.2 Sales and Ratio Data: The distribution of sale prices used is reflected in the following histogram.



The next table reports results of the data screening and trimming process. The "screened sales" represent the initial screened sample. The screened sales that were excluded from the final analysis because their ratios were deemed unrepresentative are identified as high or low trims. The "remaining ratios" represent the sample on which all the study's results are based.

| Trimming of Outliers | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | Improved Properties <=$37,000 | Improved Properties >$37,000 & <=$66,500 | Improved Properties >$66,500 & <=$90,500 | Improved Properties >$90,500 & <=$121,000 | Improved Properties >$121,000 | Total |
| **Screened Sales** | | 45 | 44 | 42 | 43 | 43 | 217 |
| Excluded | High Trims | 7 | 3 | 2 | 1 | 0 | 13 |
| | Low Trims | 0 | 0 | 0 | 0 | 0 | 0 |
| **Remaining Ratios** | | **38** | **41** | **40** | **42** | **43** | **204** |

The histogram below shows the distribution of the ratios for the sample.




2.3 Population: Since a complete copy of the assessment rolls in electronic form was not available, we used the best available alternative as a pseudo-population (hereinafter, "the population"), i.e. three random samples that were drawn and used by the STC.

## 3. Ratio Study Results

3.1 The Sample: The following table shows that three of the improved property strata vary from 7.7% to 15.0% from the population. Initially, this exhibits excessive variability from the sample to the

population. However, upon closer examination, this variation has no material effect and thus we conclude that the un-stratified sample is sufficiently representative of the population.

| Comparing Representivity | | | | | | |
|---|---|---|---|---|---|---|
| | Population Distribution | | | PPRC 2003 Sale Sample | | |
| Strata | N | $ | $ Weight | N | $ | $ Weight |
| Improved Properties <=$37,000 | 22 | 478,274 | 7.2% | 38 | 1,049,765 | 5.9% |
| Improved Properties >$37,000 & <=$66,500 | 36 | 1,843,553 | 27.7% | 41 | 2,243,182 | 12.7% |
| Improved Properties >$66,500 & <=$90,500 | 16 | 1,230,253 | 18.5% | 40 | 3,149,977 | 17.8% |
| Improved Properties >$90,500 & <=121,000 | 11 | 1,124,353 | 16.9% | 42 | 4,358,341 | 24.6% |
| Improved Properties >$121,000 | 13 | 1,912,242 | 28.7% | 43 | 6,924,877 | 39.1% |
| Unimproved Properties | 16 | 66,568 | 1.0% | 0 | 0 | 0.0% |
| Total | 114 | 6,655,242 | | 204 | 17,726,142 | |

3.2 Representing the Population with the Sample: Since the un-stratified sample is sufficiently representative of the population (Section 3.1), the use of stratification and weighting is not essential. Nevertheless, we used stratification because it produces additional analytical benefits and further optimizes representivity.

3.3 Sales Chasing: There was no indication of sales chasing.

3.4 Study Validity: The sample meets the requirements for producing valid inferences about the county's population of residential properties.

3.5 Assessment Level: Measures of the assessment level are summarized below. For the purposes of this study, the weighted mean from combined stratification is the preferred measure as long as both of the requirements for using the weighted mean are met. In this case, the distributions are approximately normal (Figure 3) and weighting is not severely compromised by the use of seriously undersized samples. Since both requirements are met, we focus on the weighted mean, though taking notice of the median, to conclude that the County's assessments for 2003 reflect approximately 75% of market value.

| Assessment Level (Based on Percent of Market Value) | | | | |
|---|---|---|---|---|
| | Stratification and Weighting | Reference | Weighted Mean | Median |
| **Overall Un-weighted** | None | Table 3 | 74.9% | 74.6% |
| **Combined** | By Property Use and Value Range | Table 4 | 73.6% | 73.5% |

3.6 Equity Measures and Evaluation:

i. Uniformity within Strata: Tables 2, 3 and 5 show results for individual strata of sufficient sample size for evaluation. The following strata represent problem areas for internal uniformity.

| Strata with Inadequate Uniformity | |
|---|---|
| **Property Strata** | **COD** |
| Improved Properties <= $37,000 | 27.5% |

ii. Uniformity between Strata: Another form of inequity exists when different strata are assessed at different levels. The IAAO has established guidelines for identifying such inequity, but compliance can be heavily affected by sample size and uniformity. Therefore, we confine our remarks to identifying where assessment levels differ markedly from the norm. We find the difference in medians between lower and higher valued improved property strata (55% versus 70-80% respectively, Table 3) and that properties in the Holden and Kinsgville areas are assessed lower than other areas of the county (68% and 75% versus 81% respectively, Table 5) notable.

iii. Vertical Equity: The final form of potential inequity examined is vertical equity. The PRD for the overall sample of 0.989 complies with the IAAO standard.

## 4. STC Study

4.1 Comparative Results: The following table contrasts our results with those from the STC study. The STC found the level of assessment adequate, while ours does not. The STC reports a substandard horizontal equity measure and a poor measure for vertical equity, while our results find no such problems. We have already demonstrated that the PPRC study meets the criteria for achieving valid results. The rest of Section 4 examines the validity of the STC's study.

| Comparison of Study Results | | | |
|---|---|---|---|
| **Measure** | **STC Study*** | **PPRC Study*** | **PPRC Study Combined**** |
| Assessment Level - median | 96.8% | 74.6% | 73.5% |
| Assessment Level - wtd. mean | 93.7% | 74.9% | 73.6% |
| COD | 25.2% | 16.6% | |
| PRD | 1.06 | .99 | |
| Sample Size | 34 | 204 | |
| Relative Precision | 1.00 | 2.45 | |
| * Overall sample (un-stratified and un-weighted) | | | |
| ** Stratification and weighting by Property Use and Value Range | | | |

4.2 Representing the Population with the Sample: The STC does not examine the representivity of its sample, nor does it have the necessary sample size or information to do so. Therefore, in the following table, we provide that missing analysis. In this case, the table shows that five of the strata in the STC sample, all five improved property strata, vary from 3.7% to 10.5%. Initially, this exhibits excessive variability from the sample to the population. Upon closer examination, this variation has a cumulative material effect on the overall assessment level and thus we conclude that the STC sample is insufficiently representative of the population.

| Comparing Representivity | | | | | | |
|---|---|---|---|---|---|---|
| | **Population** | | | **STC 2003 Appraisals** | | |
| **Strata** | **N** | **$** | **%** | **N** | **$** | **%** |
| Improved Properties <=$37,000 | 22 | 478,274 | 7.2% | 3 | 65,026 | 2.9% |
| Improved Properties >$37,000 & <=$66,500 | 36 | 1,843,553 | 27.7% | 10 | 534,174 | 24.0% |
| Improved Properties >$66,500 & <=$90,500 | 16 | 1,230,253 | 18.5% | 7 | 532,542 | 23.9% |
| Improved Properties >$90,500 & <=121,000 | 11 | 1,124,353 | 16.9% | 2 | 195,826 | 8.8% |
| Improved Properties >$121,000 | 13 | 1,912,242 | 28.7% | 6 | 872,837 | 39.2% |
| Unimproved Properties | 16 | 66,568 | 1.0% | 6 | 27,147 | 1.2% |
| Total | 114 | 6,655,242 | | 34 | 2,227,553 | |

4.3 Market Value: The final requirement for producing a valid appraisal study is that appraisals must represent market values. As discussed in the introduction for this Section II, and in greater depth in the Procedure Manual (Section III), we use 4 tests to make this determination. The results of each test are reported in the following tables.

| Mann-Whitney Test | | | | |
|---|---|---|---|---|
| For the Entire Sample | | | | |
| Study | Observations | Rank sum | Expected | Ho: Ratios (34 STC Appraisals)=Ratios (204 Sales)<br>z = 5.494<br>Prob > \|z\| = 0.0000 |
| 0 | 34 | 6105 | 4063 | |
| 1 | 204 | 22336 | 24378 | |
| Combined | 238 | 28441 | 28441 | |
| For Single Family Properties Only | | | | |
| Study | Observations | Rank sum | Expected | Ho : Ratios (28 STC Appraisals)=Ratios (203 Sales)<br>z = 5.584<br>Prob > \|z\| = 0.0000 |
| 0 | 28 | 5099 | 3248 | |
| 1 | 203 | 21697 | 23548 | |
| Combined | 231 | 26796 | 26796 | |

| K-Sample Test | | | | |
|---|---|---|---|---|
| For the Entire Sample | | | | |
| Study | Not Greater than the median | Greater than the median | Total | Ho: Ratios (34 STC Appraisals)=Ratios(204 Sales)<br>Pearson chi2(1) = 19.7647 Pr = 0.000<br>Continuity corrected:<br>Pearson chi2(1) = 18.1520 Pr = 0.000 |
| 0 | 5 | 29 | 34 | |
| 1 | 114 | 90 | 204 | |
| Total | 119 | 119 | 238 | |
| For Single Family Properties Only | | | | |
| Study | Not Greater than the median | Greater than the median | Total | Ho: Ratios (28 STC Appraisals)=Ratios(203 Sales)<br>Pearson chi2(1) = 19.8877 Pr = 0.000<br>Continuity corrected:<br>Pearson chi2(1) = 18.1302 Pr = 0.000 |
| 0 | 3 | 25 | 28 | |
| 1 | 113 | 90 | 203 | |
| Total | 116 | 115 | 231 | |

All four tests lead to the conclusion that the STC appraisals do not represent market values (all with 99% statistical confidence). Therefore, the STC study is invalid and its reported results are unreliable.

## 5. Additional Analysis and Findings

5.1 Analysis of Reassessment History: The following table provides a comparison of actual assessment changes (net of new construction) to those that might have been expected for each of the last four reassessments as well as the six-year period leading up to 2003. None of the reassessments produced changes in line with the market indicator.

| Actual Value Changes from Reassessment vs. Expected Value Change | | | | | |
|---|---|---|---|---|---|
| Biennial Year | % Net Assessment Change | Missouri OFHEO Index | % Value Change: Actual vs. Expected | KC MSA OFHEO Index | % Value Change: Actual vs. Expected |
| 1999 | 0.9% | 8.4 | 10% | 12.3 | 7% |
| 2001 | 5.2% | 11.4 | 46% | 13.0 | 40% |
| 2003 | 1.1% | 11.8 | 9% | 9.9 | 11% |
| 2005 | 5.0% | 12.4 | 41% | 10.5 | 48% |
| Cumulative 1997 - 2003 | 7.3% | 35.0 | 21% | 39.5 | 18% |

## 6. Figures and Tables

**Table 1. STC's Appraisal Ratio Studies**

| | | Group | | |
|---|---|---|---|---|
| | | 1999 | 2001 | 2003 |
| Number of Appraisals | | 38 | 42 | 34 |
| Median | | 1.004 | .994 | .968 |
| 95% Confidence Interval for Median | Lower Bound | .943 | .934 | .862 |
| | Upper Bound | 1.083 | 1.025 | 1.070 |
| Weighted Mean | | .993 | .974 | .937 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .907 | .912 | .870 |
| | Upper Bound | 1.079 | 1.035 | 1.004 |
| Minimum | | .167 | .512 | .139 |
| Maximum | | 7.260 | 1.553 | 2.598 |
| Std. Deviation | | 1.055 | .210 | .410 |
| Price Related Differential | | 1.205 | 1.012 | 1.064 |
| Coefficient of Dispersion | | .348 | .152 | .252 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 47.4% | 50.0% | 41.2% |

**Figure 1. Ratios before Outlier Trimming**

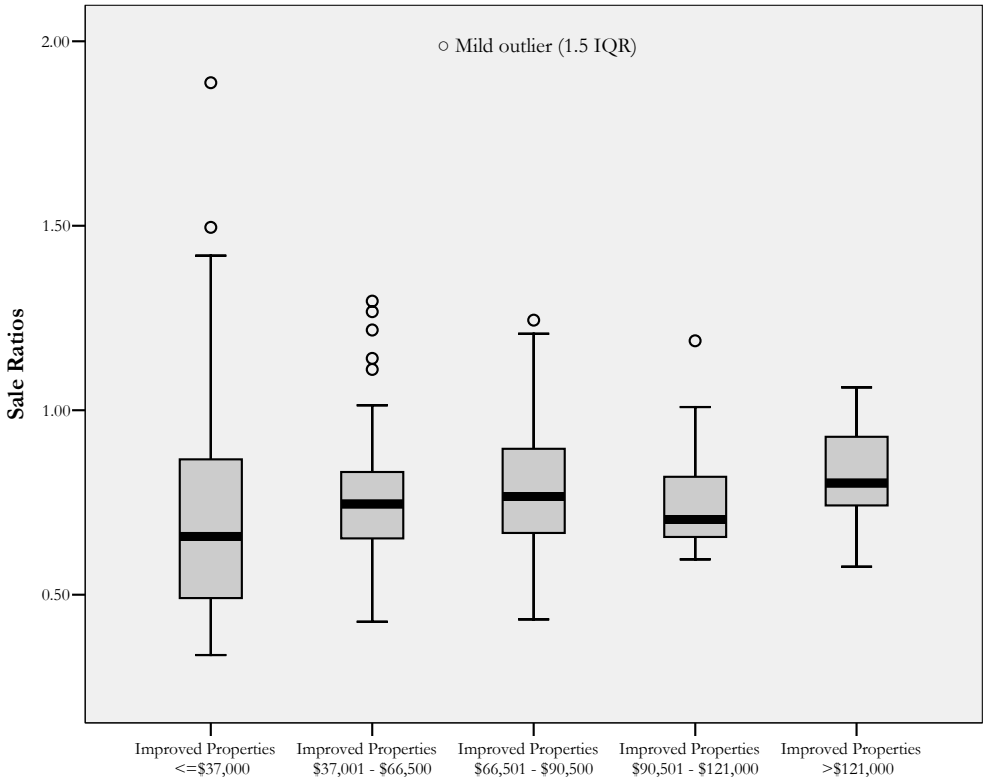
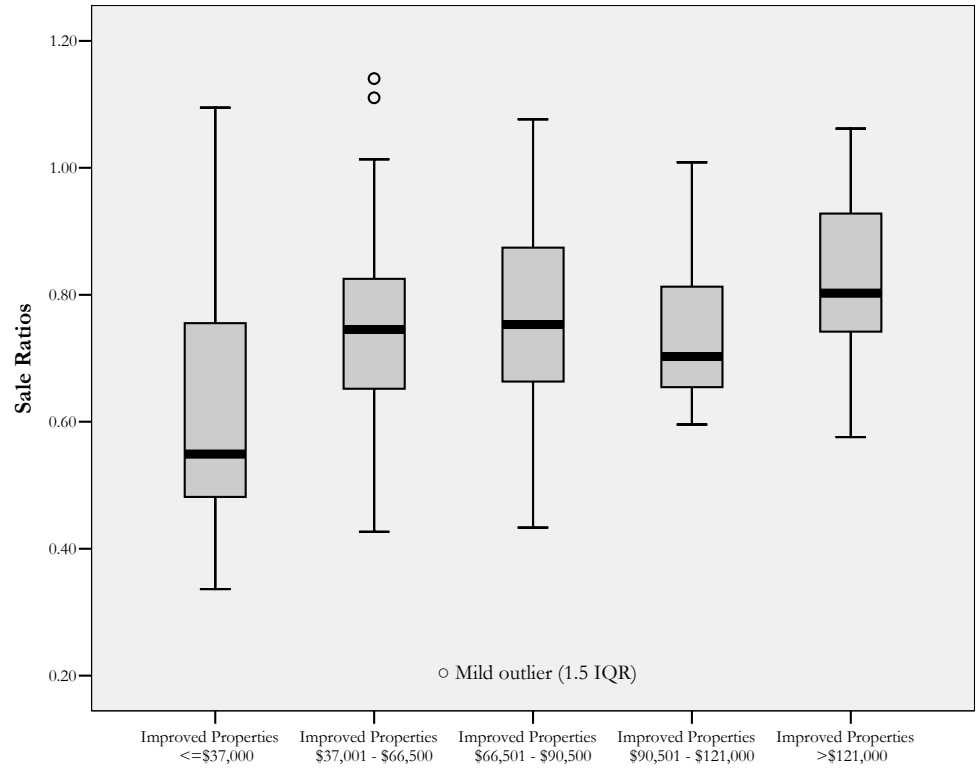
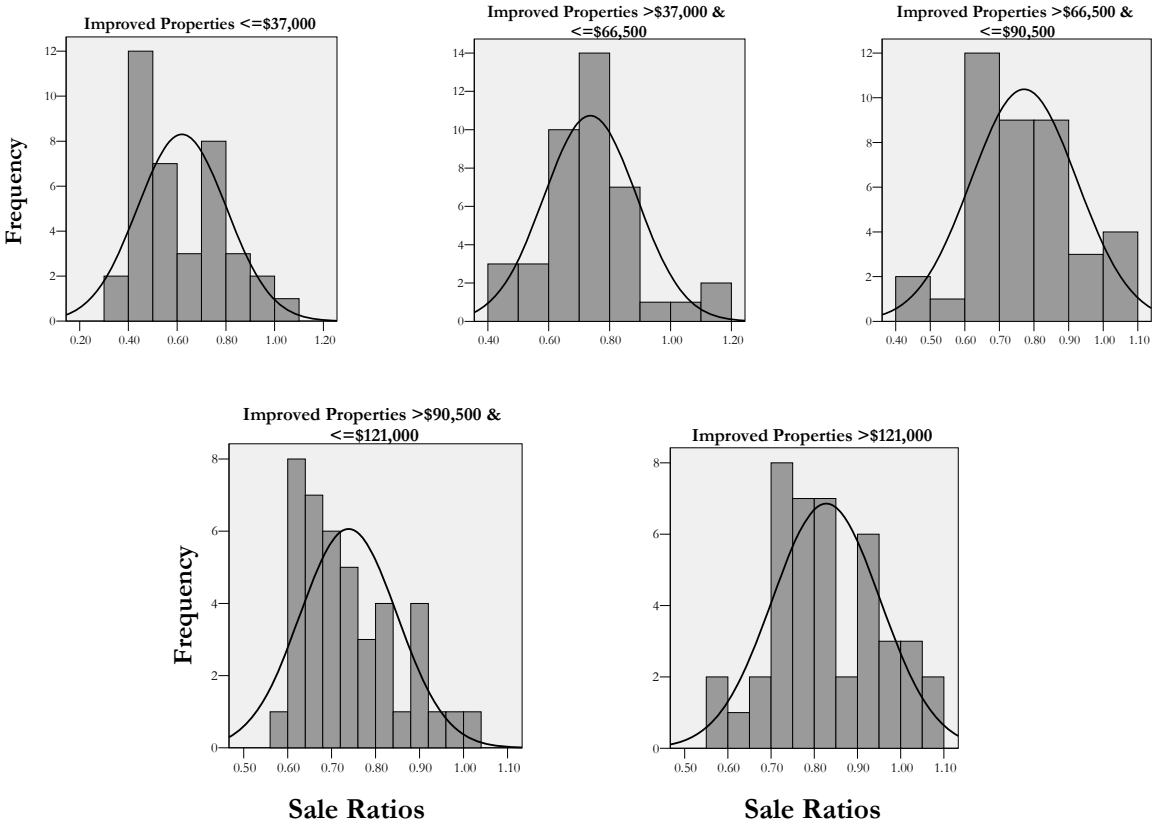



**Figure 2. Ratios after Outlier Trimming**



## Figure 3. Distribution of Final Sale Ratios




## Shapiro-Francia W' Tests for Normality for Various Strata

| Strata | Observations | W' | V' | z | Prob* |
|---|---|---|---|---|---|
| Single Family | 203 | 0.99377 | 1.016 | 0.034 | 0.48650 |
| Multi-family | 1 | . | . | . | . |
| Improved Properties | 204 | 0.99406 | 0.972 | -0.061 | 0.52445 |
| Improved Properties <=$37,000 | 38 | 0.93438 | 2.753 | 1.877 | 0.03023 |
| Improved Properties >$37,000 & <=$66,500 | 41 | 0.96118 | 1.726 | 1.029 | 0.15182 |
| Improved Properties >$66,500 & <=$90,500 | 40 | 0.98101 | 0.829 | -0.360 | 0.64059 |
| Improved Properties >$90,500 & <=$121,000 | 42 | 0.93952 | 2.739 | 1.881 | 0.02995 |
| Improved Properties >$121,000 | 43 | 0.97203 | 1.290 | 0.485 | 0.31369 |
| Overall Un-weighted | 204 | 0.99406 | 0.972 | -0.061 | 0.52445 |

*This value represents the indicated probability that the underlying population is normally distributed. A value of less than .05 indicates a distribution that is not normal.

## Table 2. Sales Ratio Analysis: Stratified by Property Use

| | | Strata | | |
|---|---|---|---|---|
| | | Single Family | Multi-family | Overall Un-weighted |
| Number of Sales | | 203 | 1 | 204 |
| Median | | .745 | .939 | .746 |
| 95% Confidence Interval for Median | Lower Bound | .727 | . | .727 |
| | Upper Bound | .758 | . | .760 |
| Weighted Mean | | .745 | .939 | .749 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .724 | . | .727 |
| | Upper Bound | .766 | . | .772 |
| Minimum | | .336 | .939 | .336 |
| Maximum | | 1.140 | .939 | 1.140 |
| Std. Deviation | | .159 | . | .159 |
| Price Related Differential | | .994 | 1.000 | .989 |
| Coefficient of Dispersion | | .166 | .000 | .166 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 14.3% | 100.0% | 14.7% |

## Table 3. Sales Ratio Analysis: Stratified by Use and Value

| | | Strata | | | | | |
|---|---|---|---|---|---|---|---|
| | | Improved Properties <=$37,000 | Improved Properties $37,001 - $66,500 | Improved Properties $66,501 - $90,500 | Improved Properties $90,501 - $121,000 | Improved Properties >$121,000 | Overall Un-weighted |
| Number of Sales | | 38 | 41 | 40 | 42 | 43 | 204 |
| Median | | .549 | .745 | .753 | .703 | .803 | .746 |
| 95% Confidence Interval for Median | Lower Bound | .492 | .671 | .680 | .677 | .757 | .727 |
| | Upper Bound | .740 | .767 | .829 | .766 | .880 | .760 |
| Weighted Mean | | .588 | .711 | .741 | .722 | .822 | .749 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .536 | .667 | .688 | .690 | .781 | .727 |
| | Upper Bound | .641 | .755 | .794 | .753 | .862 | .772 |
| Minimum | | .336 | .427 | .433 | .596 | .576 | .336 |
| Maximum | | 1.095 | 1.140 | 1.077 | 1.009 | 1.062 | 1.140 |
| Std. Deviation | | .183 | .152 | .154 | .111 | .125 | .159 |
| Price Related Differential | | 1.053 | 1.036 | 1.041 | 1.023 | 1.007 | .989 |
| Coefficient of Dispersion | | .275 | .149 | .161 | .128 | .126 | .166 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 7.9% | 4.9% | 17.5% | 9.5% | 32.6% | 14.7% |

## Table 4. Combined Results – Post Stratification and Weighting

| | Population Assessor's Value | Median | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Improved Properties <=$37,000 | 478,274 | 0.549 | 871,172 | 9.7% | 0.053 |
| Improved Properties >$37,000 & <=$66,500 | 1,843,553 | 0.745 | 2,474,567 | 27.6% | 0.206 |
| Improved Properties >$66,500 & <=$90,500 | 1,230,253 | 0.753 | 1,633,802 | 18.2% | 0.137 |
| Improved Properties >$90,500 & <=$121,000 | 1,124,353 | 0.703 | 1,599,364 | 17.8% | 0.125 |
| Improved Properties >$121,000 | 1,912,242 | 0.803 | 2,381,372 | 26.6% | 0.213 |
| Total | 6,588,674 | | 8,960,278 | 100.0% | 73.5% |

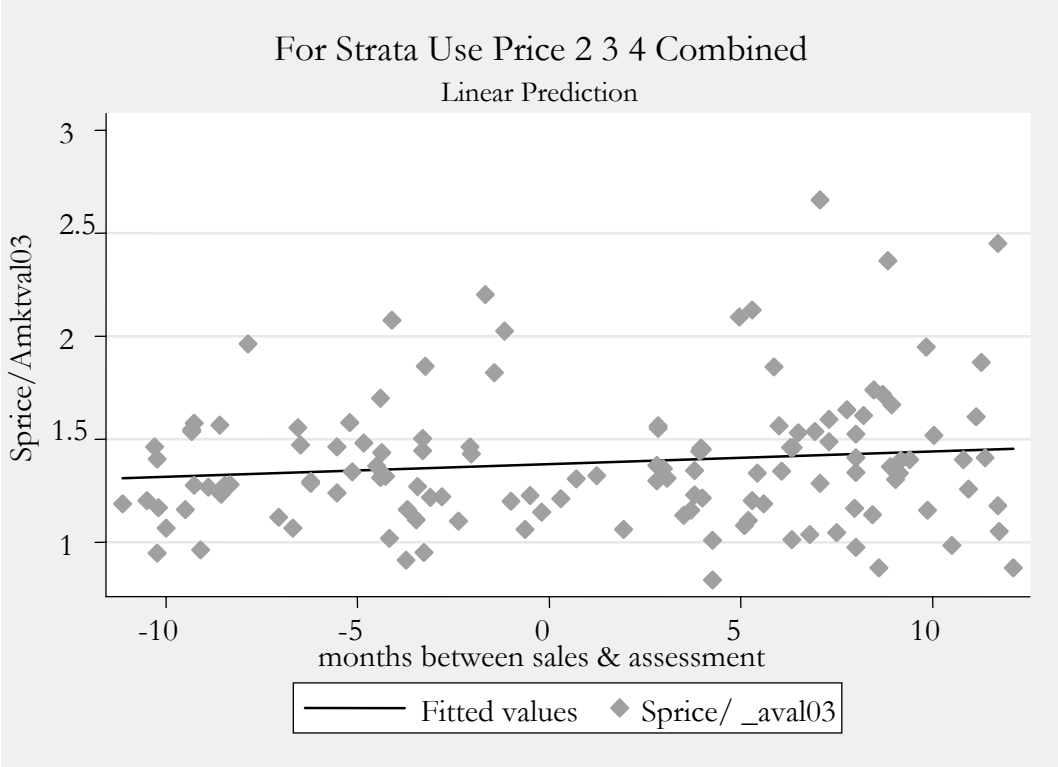
| | Population Assessor's Value | Weighted Mean | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Improved Properties <=$37,000 | 478,274 | 0.588 | 813,391 | 9.1% | 0.053 |
| Improved Properties >$37,000 & <=$66,500 | 1,843,553 | 0.711 | 2,592,901 | 29.0% | 0.206 |
| Improved Properties >$66,500 & <=$90,500 | 1,230,253 | 0.741 | 1,660,260 | 18.6% | 0.137 |
| Improved Properties >$90,500 & <=$121,000 | 1,124,353 | 0.722 | 1,557,275 | 17.4% | 0.126 |
| Improved Properties >$121,000 | 1,912,242 | 0.822 | 2,326,329 | 26.0% | 0.214 |
| Total | 6,588,674 | | 8,950,155 | 100.0% | 73.6% |

## Table 5. Sales Ratio Analysis: Stratified by Location

| | | Strata | | | |
|---|---|---|---|---|---|
| | | Holden Area | Kinsgville Area | All other areas | Overall Un-weighted |
| Number of Sales | | 78 | 66 | 60 | 204 |
| Median | | .745 | .681 | .805 | .746 |
| 95% Confidence Interval for Median | Lower Bound | .705 | .656 | .746 | .727 |
| | Upper Bound | .775 | .745 | .863 | .760 |
| Weighted Mean | | .743 | .720 | .788 | .749 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .709 | .682 | .747 | .727 |
| | Upper Bound | .778 | .758 | .829 | .772 |
| Minimum | | .336 | .431 | .427 | .336 |
| Maximum | | 1.095 | 1.062 | 1.140 | 1.140 |
| Std. Deviation | | .159 | .151 | .154 | .159 |
| Price Related Differential | | .982 | .973 | 1.017 | .989 |
| Coefficient of Dispersion | | .158 | .171 | .155 | .166 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 12.8% | 10.6% | 21.7% | 14.7% |

**Graph 1: Improved Property Price Trend**

A thorough analysis of price-time trends by price strata determined that adjusting reported prices was desirable for the middle valued improved property strata. The prices for these strata ranged from $55,000 - $160,500. The resultant trend and statistical analysis is shown below.




**Price Trend Regression Statistics**

| Source | SS | df | MS | | |
|---|---|---|---|---|---|
| Model | .2346757 | 1 | .2346757 | Number of obs = 129 | R-squared = 0. 00174 |
| Residual | 13.2875263 | 127 | .065713681 | F( 1, 127) = 2.24 | Adj R-squared= 0. 0096 |
| Total | 13.522202 | 128 | .105642203 | Prob > F = 0.1367 | Root MSE = .32346 |

| _aratio | Coef. | Std. Err. | t | P> t | [80% Conf. Interval] | |
|---|---|---|---|---|---|---|
| _adjperiod | .0062163 | .0041507 | 1.50 | 0.137 | .0008692 | .0115634 |
| _cons | 1.379577 | .028977 | 47.61 | 0.000 | 1.342248 | 1.416907 |

Monthly adjustment rate=.00450595 | Annualized adjustment rate=.0540714

# Chapter 15. Lafayette County

## 1. Significant Findings

1.1 Assessment Level: Lafayette County's 2003 residential property assessments were approximately 71% of market value (Section 3.5). The results from the corresponding STC study are invalid because the STC's appraisals did not meet the requirement that they reflect market values (Section 4.3). Furthermore, the STC's sample is not representative of residential property for the county (Section 4.2).

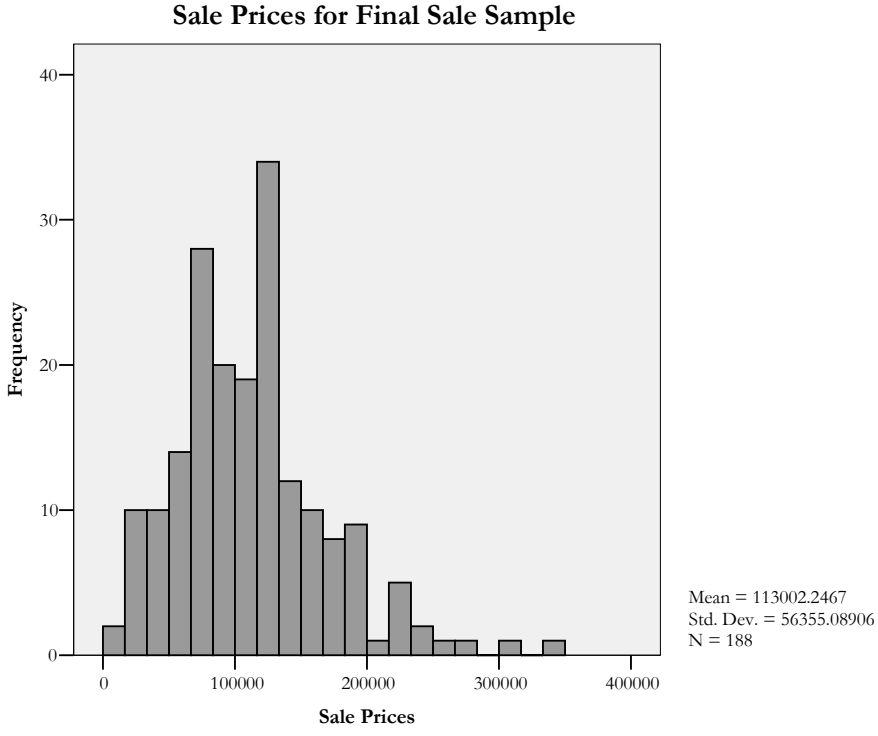
1.2 Assessment Equity: Lower valued properties are assessed less uniformly and at lower levels than higher valued properties (Section 3.6 and Table 3).

1.3 Reassessment History: Two indicators of market value changes suggest that three of the past four biennial reassessments have produced lower value increases than the market. Cumulatively, the reassessments from 1997 through 2003 produced 82% of the expected rise in assessments, primarily due to the large increase in 2001. The net change in assessments in 1999 and 2003 raises questions regarding whether any serious revaluation occurred (Section 5.1).

## 2. Data and Related Issues

2.1 Assessment Data: Sales and assessment information were matched at the county offices. Subsequently, the assessor reviewed the matched parcels and provided further information that assisted our screening process.

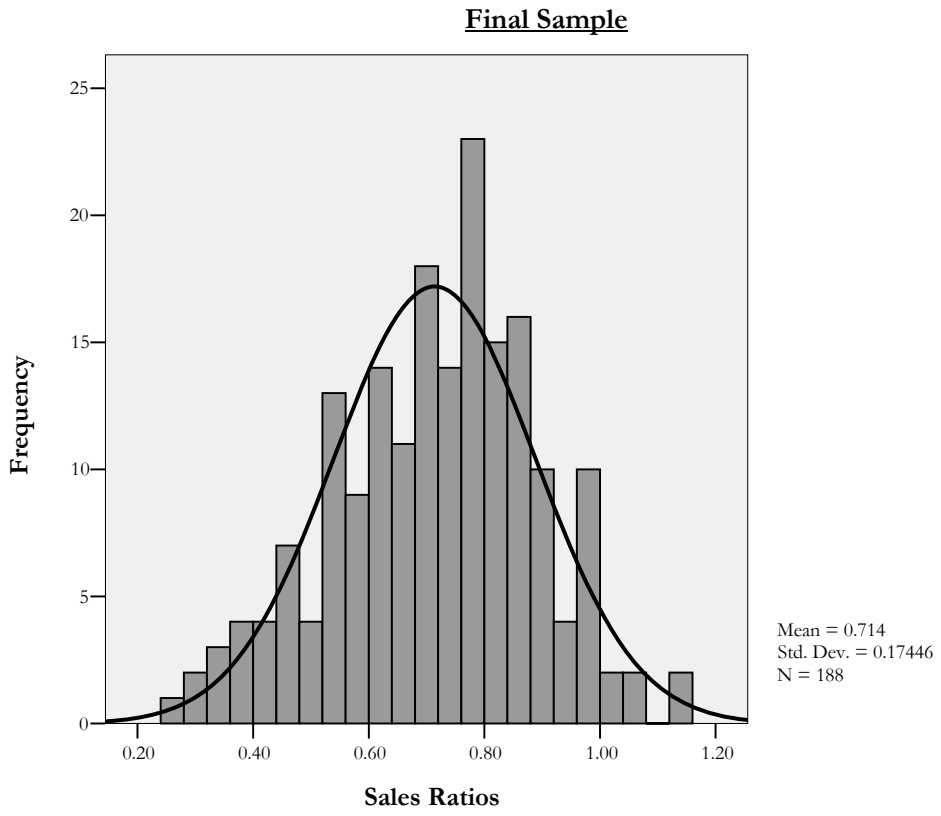
2.2 Sales and Ratio Data: The distribution of sale prices used is reflected in the following histogram.



The next table reports results of the data screening and trimming process. The "screened sales" represent the initial screened sample. The screened sales that were excluded from the final analysis because their ratios were deemed unrepresentative are identified as high or low trims. The "remaining ratios" represent the sample on which all the study's results are based.

| Trimming of Outliers | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Improved Properties <=$45,000 | Improved Properties >$45,000 & <=$63,000 | Improved Properties >$63,000 & <=$85,000 | Improved Properties >$85,000 & <=$113,500 | Improved Properties >$113,500 | Unimproved Properties | Total |
| **Screened Sales** | | 40 | 42 | 39 | 40 | 38 | 6 | 205 |
| Excluded | Value Outliers | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| | High Trims | 3 | 3 | 1 | 0 | 3 | 2 | 12 |
| | Low Trims | 4 | 0 | 0 | 0 | 0 | 0 | 4 |
| **Remaining Ratios** | | **33** | **39** | **38** | **40** | **35** | **3** | **188** |

The histogram below shows the distribution of the ratios for the sample.




2.3 Population: Since a complete copy of the assessment rolls in electronic form was not available, we used the best available alternative as a pseudo-population (hereinafter, "the population"), i.e. four random samples that were drawn and used by the STC.

## 3. Ratio Study Results

3.1 The Sample: The following table shows that three of our improved property value strata vary from 4.0% to 14.1% from the population. Initially, this exhibits excessive variability from the sample to the population. Upon closer examination, this variation has a cumulative material effect on the overall assessment level and thus we conclude that the un-stratified sample is insufficiently representative of the population.

| Comparing Representivity | | | | | | |
|---|---|---|---|---|---|---|
| | Population Distribution | | | PPRC 2003 Sale Sample | | |
| Strata | N | $ | $ Weight | N | $ | $ Weight |
| Improved Properties <=$45,000 | 69 | 1,803,589 | 20.9% | 33 | 980,771 | 6.6% |
| Improved Properties >$45,000 & <=$63,000 | 22 | 1,178,853 | 13.6% | 39 | 2,149,880 | 14.5% |
| Improved Properties >$63,000 & <=$85,000 | 28 | 2,000,158 | 23.1% | 38 | 2,834,850 | 19.1% |
| Improved Properties >$85,000 & <=$113,500 | 20 | 1,951,221 | 22.6% | 40 | 3,973,076 | 26.7% |
| Improved Properties >$113,500 | 10 | 1,387,395 | 16.1% | 35 | 4,880,040 | 32.8% |
| Unimproved Properties | 47 | 322,942 | 3.7% | 3 | 52,150 | 0.4% |
| Total | 196 | 8,644,158 | | 188 | 14,870,767 | |

3.2 Representing the Population with the Sample: Since the un-stratified sample is insufficiently representative of the population (Section 3.1), the use of stratification and weighting is essential. Furthermore, stratification provides additional analytical benefits.

3.3 Sales Chasing: There was no indication of sales chasing.

3.4 Study Validity: Once the sample has been stratified and weighted, all requirements for producing valid inferences about the county's population of residential properties are met.

3.5 Assessment Level: Measures of the assessment level are summarized below. For the purposes of this study, the weighted mean from combined stratification is the preferred measure as long as both of the requirements from using the weighted mean are met. In this case, the distributions are normal (Figure 3) and weighting is compromised by the use of seriously undersized samples. Since both requirements are not met, we focus on the median, though taking notice of the weighted mean, to conclude that the County's assessments for 2003 reflect approximately 71% of market value.

| Assessment Level (Based on Percent of Market Value) | | | | |
|---|---|---|---|---|
| | Stratification and Weighting | Reference | Weighted Mean | Median |
| **Overall Un-weighted** | None | Table 3 | 70.0% | 72.9% |
| **Combined** | By Property Use and Value Range | Table 4 | 67.3% | 69.9% |

3.6 Equity Measures and Evaluation:

i. Uniformity within Strata: Tables 2, 3 and 5 show results for individual strata of sufficient sample size for evaluation. The following strata represent problem areas for internal uniformity.

| Strata with Inadequate Uniformity | |
|---|---|
| **Property Strata** | **COD** |
| Improved Properties <= $45,000 | 32.0% |
| Improved Properties >$45,000 & <=$63,000 | 21.5% |
| All Other Areas | 23.3% |

ii. Uniformity between Strata: Another form of inequity exists when different strata are assessed at different levels. The IAAO has established guidelines for identifying such inequity, but compliance can be heavily affected by sample size and uniformity. Therefore, we confine our remarks to identifying where assessment levels differ markedly from the norm. The difference in assessment level (medians) between the lowest and the higher valued improved property strata (56% versus 69-77% respectively, Table 3) is substantial.

iii. Vertical Equity: The final form of potential inequity examined is vertical equity. The PRD for the overall sample of 1.02 complies with the IAAO standard.

## 4. STC Study

4.1 Comparative Results: The following table contrasts our results with those from the STC study. The STC found the level of assessment adequate, while ours does not. The STC reports a substandard horizontal equity measure and a poor measure for vertical equity, while our results find no such problems. We have already demonstrated that the PPRC study meets the criteria for achieving valid results. The rest of Section 4 examines the validity of the STC's study.

| Comparison of Study Results | | | |
|---|---|---|---|
| **Measure** | **STC Study*** | **PPRC Study*** | **PPRC Study Combined**** |
| Assessment Level - median | 101.8% | 72.9% | 69.9% |
| Assessment Level - wtd. mean | 96.7% | 70.0% | 67.3% |
| COD | 63.8% | 19.2% | |
| PRD | 1.53 | 1.02 | |
| Sample Size | 40 | 188 | |
| Relative Precision | 1.00 | 2.17 | |
| * Overall sample (un-stratified and un-weighted) | | | |
| ** Stratification and weighting by Property Use and Value Range | | | |

4.2 Representing the Population with the Sample: The STC does not examine the representivity of its sample, nor does it have the necessary sample size or information to do so. Therefore, in the following table, we provide that missing analysis. In this case, the table shows that four of the improved property strata vary from 4.0% to 7.6%. Initially, this exhibits excessive variability from the sample to the population. Upon closer examination, this variation has a cumulative material effect on the overall assessment level and thus we conclude that the STC sample is insufficiently representative of the population.

| Comparing Representivity | | | | | | |
|---|---|---|---|---|---|---|
| | Population | | | STC 2003 Appraisals | | |
| Strata | N | $ | % | N | $ | % |
| Improved Properties <=$45,000 | 69 | 1,803,589 | 20.9% | 11 | 275,932 | 13.9% |
| Improved Properties >$45,000 & <=$63,000 | 22 | 1,178,853 | 13.6% | 8 | 461,711 | 23.2% |
| Improved Properties >$63,000 & <=$85,000 | 28 | 2,000,158 | 23.1% | 6 | 433,011 | 21.8% |
| Improved Properties >$85,000 & <=$113,500 | 20 | 1,951,221 | 22.6% | 3 | 300,163 | 15.1% |
| Improved Properties >$113,500 | 10 | 1,387,395 | 16.1% | 3 | 400,058 | 20.1% |
| Unimproved Properties | 47 | 322,942 | 3.7% | 9 | 116,116 | 5.8% |
| Total | 196 | 8,644,158 | | 40 | 1,986,989 | |

4.3 Market Value: The final requirement for producing a valid appraisal study is that appraisals must represent market values. As discussed in the introduction for this Section II, and in greater depth in the Procedure Manual (Section III), we use 4 tests to make this determination. The results of each test are reported in the following tables.

| Mann-Whitney Test | | | | |
|---|---|---|---|---|
| For the Entire Sample | | | | |
| Study | Observations | Rank sum | Expected | Ho: Ratios (40 STC Appraisals)=Ratios (188 Sales)<br>z = 7.112<br>Prob > \|z\| = 0.0000 |
| 0 | 40 | 7274 | 4580 | |
| 1 | 188 | 18832 | 21526 | |
| Combined | 228 | 26106 | 26106 | |
| For Single Family Properties Only | | | | |
| Study | Observations | Rank sum | Expected | Ho : Ratios (31 STC Appraisals)=Ratios (181 Sales)<br>z = 5.819<br>Prob > \|z\| = 0.0000 |
| 0 | 31 | 5138 | 3301.5 | |
| 1 | 181 | 17440 | 19276.5 | |
| Combined | 212 | 22578 | 22578 | |

| K-Sample Test | | | | |
|---|---|---|---|---|
| For the Entire Sample | | | | |
| Study | Not Greater than the median | Greater than the median | Total | Ho: Ratios (40 STC Appraisals)=Ratios(188 Sales)<br>Pearson chi2(1) = 27.2872 Pr = 0.000<br>Continuity corrected:<br>Pearson chi2(1) = 25.4984 Pr = 0.000 |
| 0 | 5 | 35 | 40 | |
| 1 | 109 | 79 | 188 | |
| Total | 114 | 114 | 228 | |
| For Single Family Properties Only | | | | |
| Study | Not Greater than the median | Greater than the median | Total | Ho: Ratios (31 STC Appraisals)=Ratios(181 Sales)<br>Pearson chi2(1) = 19.9872 Pr = 0.000<br>Continuity corrected:<br>Pearson chi2(1) = 18.2869 Pr = 0.000 |
| 0 | 4 | 27 | 31 | |
| 1 | 102 | 79 | 181 | |
| Total | 106 | 106 | 212 | |

All four tests lead to the conclusion that the STC appraisals do not represent market values (all with 99% statistical confidence). Therefore, the STC study is invalid and its reported results are unreliable.

## 5. Additional Analysis and Findings

5.1 Analysis of Reassessment History: The following table provides a comparison of actual assessment changes (net of new construction) to those that might have been expected for each of the last four reassessments as well as the six-year period leading up to 2003. None of the reassessments produced changes in line with the market indicator.

| Actual Value Changes from Reassessment vs. Expected Value Change | | | | | |
|---|---|---|---|---|---|
| Biennial Year | % Net Assessment Change | Missouri OFHEO Index | % Value Change: Actual vs. Expected | KC MSA OFHEO Index | % Value Change: Actual vs. Expected |
| 1999 | 0.7 | 8.4 | 9% | 12.3 | 6% |
| 2001 | 26.9 | 11.4 | 236% | 13.0 | 207% |
| 2003 | 0.7 | 11.8 | 6% | 9.9 | 7% |
| 2005 | 4.2 | 12.4 | 34% | 10.5 | 40% |
| Cumulative 1997 - 2003 | 28.7 | 35.0 | 82% | 39.5 | 73% |

## 6. Figures and Tables

**Table 1. STC's Appraisal Ratio Studies**

| | | Group | | | |
|---|---|---|---|---|---|
| | | 1999 | 2001 | 2003 | 2005* |
| Number of Appraisals | | 81 | 41 | 40 | 34 |
| Median | | .902 | .968 | 1.018 | .821 |
| 95% Confidence Interval for Median | Lower Bound | .830 | .832 | .895 | .732 |
| | Upper Bound | .964 | 1.080 | 1.381 | .973 |
| Weighted Mean | | .877 | .912 | .967 | .800 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .759 | .848 | .846 | .721 |
| | Upper Bound | .995 | .976 | 1.088 | .879 |
| Minimum | | .109 | .526 | .489 | .081 |
| Maximum | | 11.858 | 2.500 | 5.800 | 3.996 |
| Std. Deviation | | 1.745 | .446 | 1.189 | .603 |
| Price Related Differential | | 1.701 | 1.159 | 1.534 | 1.162 |
| Coefficient of Dispersion | | .853 | .290 | .638 | .342 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 18.5% | 26.8% | 20.0% | 17.6% |

*The STC has not completed its studies for the 2005 reassessment cycle. These results may not represent final values.

**Figure 1. Ratios before Outlier Trimming**

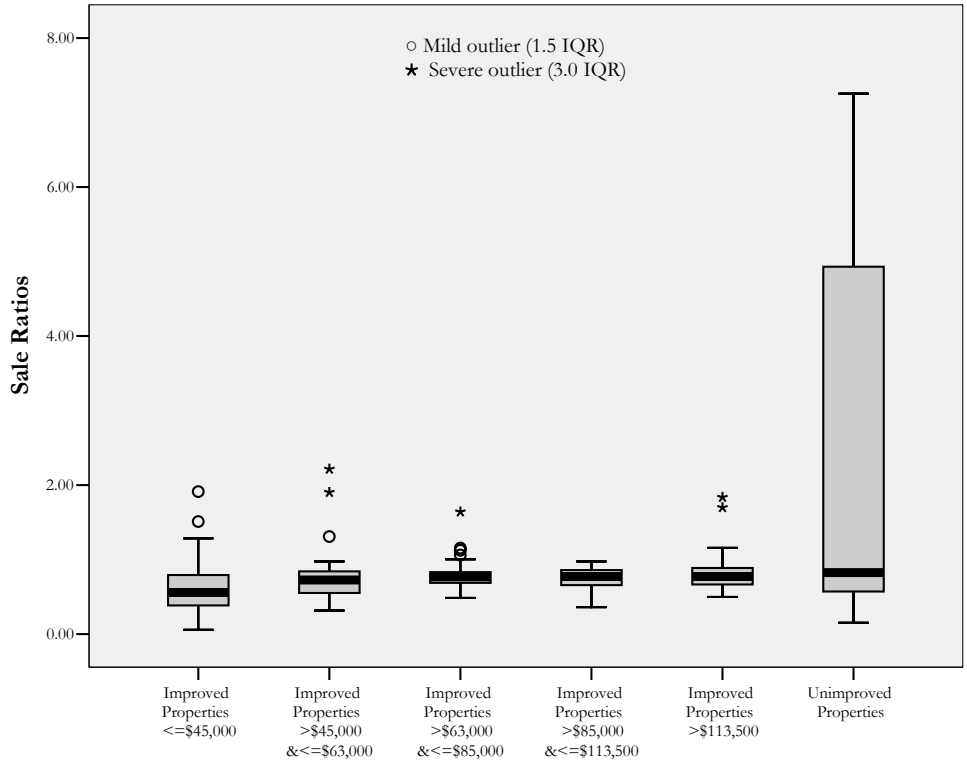
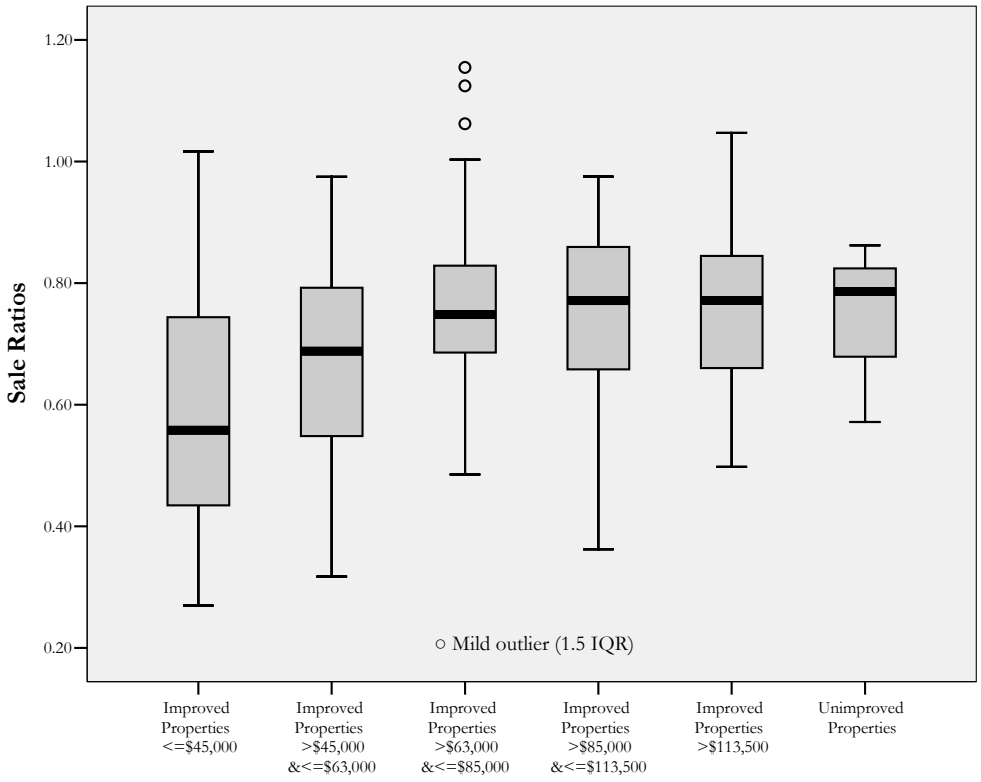
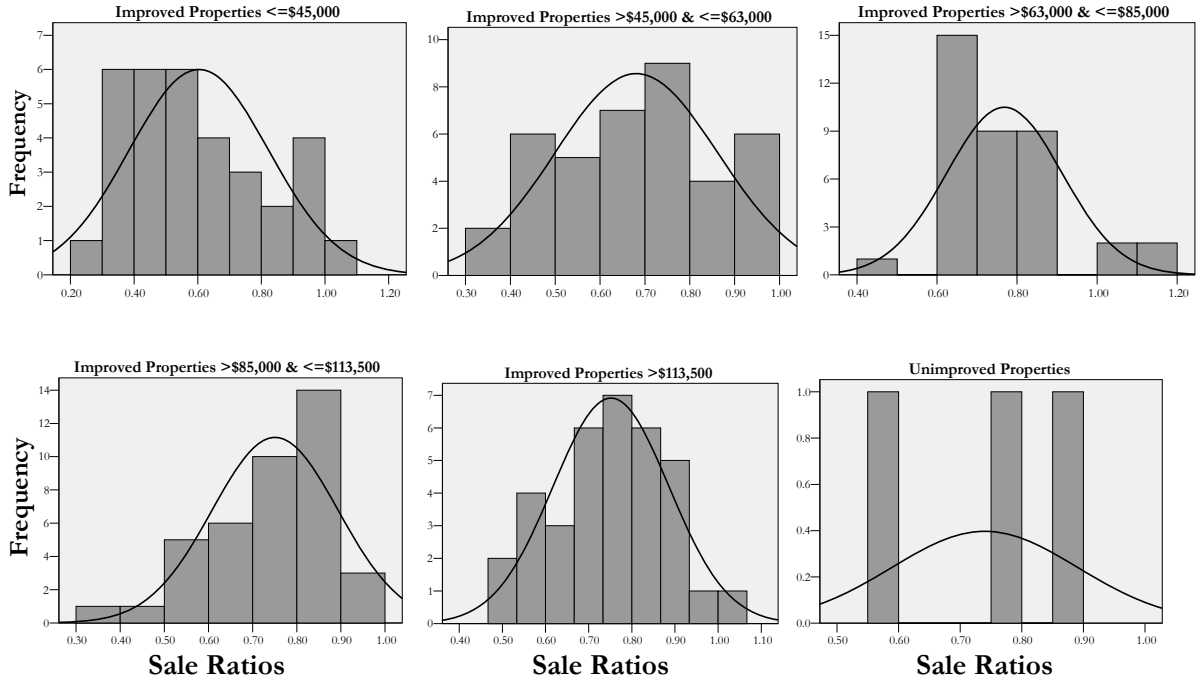



**Figure 2. Ratios after Outlier Trimming**



## Figure 3. Distribution of Final Sale Ratios




## Shapiro-Francia W' Tests for Normality for Various Strata

| Strata | Observations | W' | V' | z | Prob* |
|---|---|---|---|---|---|
| Single Family | 181 | 0.99237 | 1.128 | 0.256 | 0.39890 |
| Multi-family | 4 | . | . | . | . |
| Unimproved Properties | 3 | . | . | . | . |
| Improved Properties | 185 | 0.99127 | 1.315 | 0.580 | 0.28104 |
| Improved Properties<=$45,000 | 33 | 0.94885 | 1.928 | 1.214 | 0.11236 |
| Improved Properties>$45,000 & <=$63,000 | 39 | 0.97992 | 0.859 | -0.290 | 0.61405 |
| Improved Properties>$63,000 & <=$85,000 | 38 | 0.92780 | 3.029 | 2.050 | 0.02017 |
| Improved Properties>$85,000 & <=$113,500 | 40 | 0.95115 | 2.131 | 1.416 | 0.07834 |
| Improved Properties>$113,500 | 35 | 0.98942 | 0.417 | -1.676 | 0.95310 |
| Overall Un-weighted | 188 | 0.99106 | 1.365 | 0.659 | 0.25502 |

*This value represents the indicated probability that the underlying population is normally distributed. A value of less than .05 indicates a distribution that is not normal.

## Table 2. Sales Ratio Analysis: Stratified by Property Use

| | | Strata (all properties) | | | |
|---|---|---|---|---|---|
| | | Single Family | Unimproved Properties | Multi-family | Overall Un-weighted |
| Number of Sales | | 181 | 3 | 4 | 188 |
| Median | | .721 | .786 | .870 | .729 |
| 95% Confidence Interval for Median | Lower Bound | .687 | .571 | .767 | .692 |
| | Upper Bound | .762 | .862 | .965 | .765 |
| Weighted Mean | | .696 | .785 | .852 | .700 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .670 | .535 | .716 | .675 |
| | Upper Bound | .721 | 1.036 | .988 | .725 |
| Minimum | | .270 | .571 | .767 | .270 |
| Maximum | | 1.155 | .862 | .965 | 1.155 |
| Std. Deviation | | .175 | .151 | .082 | .174 |
| Price Related Differential | | 1.021 | .942 | 1.018 | 1.020 |
| Coefficient of Dispersion | | .194 | .123 | .067 | .192 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 10.5% | .0% | 25.0% | 10.6% |

## Table 3. Sales Ratio Analysis: Stratified by Use and Value

| | | Strata (without unimproved properties) | | | | | |
|---|---|---|---|---|---|---|---|
| | | Improved Properties <= $45,000 | Improved Properties >$45,000 & <=$63,000 | Improved Properties >$63,000 & <=$85,000 | Improved Properties >$85,000 & <=$113,500 | Improved Properties >$113,500 | Overall Un-weighted |
| Number of Sales | | 33 | 39 | 38 | 40 | 35 | 185 |
| Median | | .558 | .688 | .748 | .771 | .771 | .728 |
| 95% Confidence Interval for Median | Lower Bound | .455 | .584 | .693 | .703 | .674 | .688 |
| | Upper Bound | .679 | .762 | .809 | .847 | .812 | .765 |
| Weighted Mean | | .551 | .636 | .742 | .721 | .730 | .700 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .482 | .573 | .699 | .667 | .680 | .674 |
| | Upper Bound | .620 | .699 | .784 | .776 | .779 | .725 |
| Minimum | | .270 | .317 | .485 | .362 | .498 | .270 |
| Maximum | | 1.016 | .975 | 1.155 | .975 | 1.047 | 1.155 |
| Std. Deviation | | .219 | .182 | .145 | .143 | .135 | .175 |
| Price Related Differential | | 1.095 | 1.070 | 1.036 | 1.041 | 1.030 | 1.020 |
| Coefficient of Dispersion | | .320 | .215 | .145 | .147 | .140 | .192 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 15.2% | 15.4% | 5.3% | 7.5% | 11.4% | 10.8% |

## Table 4. Combined Results – Post Stratification and Weighting

| | Population Assessor's Value | Median | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Improved Properties <= $45,000 | 1,803,589 | 0.558 | 3,232,238 | 26.1% | 0.146 |
| Improved Properties >$45,000 & <=$63,000 | 1,178,853 | 0.688 | 1,713,449 | 13.9% | 0.095 |
| Improved Properties >$63,000 & <=$85,000 | 2,000,158 | 0.748 | 2,674,008 | 21.6% | 0.162 |
| Improved Properties >$85,000 &<=$113,500 | 1,951,221 | 0.771 | 2,530,767 | 20.5% | 0.158 |
| Improved Properties >$113,500 | 1,387,395 | 0.771 | 1,799,475 | 14.6% | 0.112 |
| Unimproved Properties | 322,942 | 0.786 | 410,868 | 3.3% | 0.026 |
| Total | 8,644,158 | | 12,360,805 | 100.0% | 69.9% |

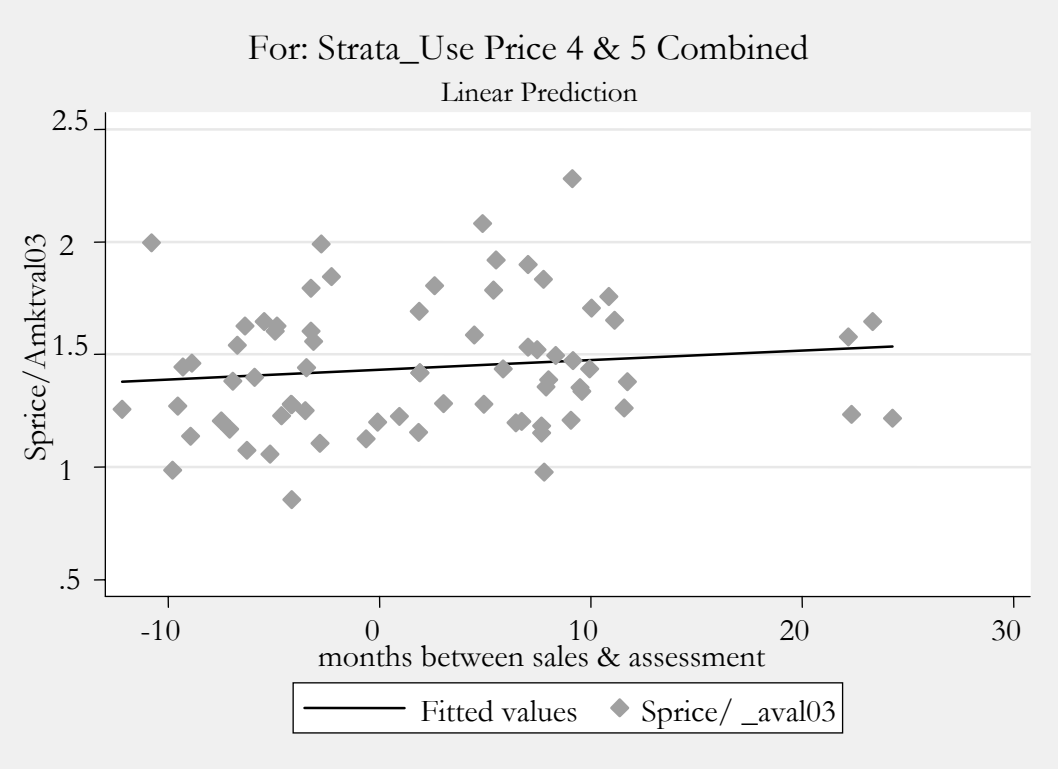
| | Population Assessor's Value | Weighted Mean | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Improved Properties <= $45,000 | 1,803,589 | 0.551 | 3,273,301 | 25.5% | 0.140 |
| Improved Properties >$45,000 & <=$63,000 | 1,178,853 | 0.636 | 1,853,542 | 14.4% | 0.092 |
| Improved Properties >$63,000 & <=$85,000 | 2,000,158 | 0.742 | 2,695,631 | 21.0% | 0.156 |
| Improved Properties >$85,000 &<=$113,500 | 1,951,221 | 0.721 | 2,706,270 | 21.1% | 0.152 |
| Improved Properties >$113,500 | 1,387,395 | 0.730 | 1,900,541 | 14.8% | 0.108 |
| Unimproved Properties | 322,942 | 0.785 | 411,391 | 3.2% | 0.025 |
| Total | 8,644,158 | | 12,840,676 | 100.0% | 67.3% |

## Table 5. Sales Ratio Analysis: Stratified by Location

| | | Strata | | | |
|---|---|---|---|---|---|
| | | Odessa Area | Higginsville Area | All Other Areas | Overall Un-weighted |
| Number of Sales | | 93 | 33 | 59 | 185 |
| Median | | .730 | .746 | .698 | .728 |
| 95% Confidence Interval for Median | Lower Bound | .692 | .626 | .653 | .688 |
| | Upper Bound | .773 | .809 | .787 | .765 |
| Weighted Mean | | .704 | .707 | .690 | .700 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .670 | .646 | .642 | .674 |
| | Upper Bound | .738 | .768 | .739 | .725 |
| Minimum | | .313 | .477 | .270 | .270 |
| Maximum | | 1.016 | 1.062 | 1.155 | 1.155 |
| Std. Deviation | | .165 | .155 | .202 | .175 |
| Price Related Differential | | 1.004 | 1.034 | 1.035 | 1.020 |
| Coefficient of Dispersion | | .176 | .174 | .233 | .192 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 7.5% | 12.1% | 15.3% | 10.8% |

**Graph 1. Improved Property Price Trend**

A thorough analysis of price-time trends by price strata determined that adjusting reported prices was desirable for highest valued improved property strata. The prices for these strata ranged from $123,000 - $349,900. The resultant trend and statistical analysis is shown below.




**Price Trend Regression Statistics**

| Source | SS | df | MS | | |
|---|---|---|---|---|---|
| Model | .094199593 | 1 | .094199593 | Number of obs = 72 | R-squared = 0.0161 |
| Residual | 5.74830201 | 70 | .0821186 | F( 1, 70) = 1.15 | Adj R-squared= 0.0021 |
| Total | 5.8425016 | 71 | .082288755 | Prob > F = 0.2878 | Root MSE = .28656 |

| _aratio | Coef. | Std. Err. | t | P> t | [80% Conf. Interval] | |
|---|---|---|---|---|---|---|
| _adjperiod | .0043208 | .0040342 | 1.07 | 0.288 | -.0008985 | .0095402 |
| _cons | 1.431475 | .034953 | 40.95 | 0.000 | 1.386254 | 1.476695 |
| Monthly adjustment rate=.0030184 | | | | Annualized adjustment rate=.0362211 | | |

# Chapter 16. Lincoln County

## 1. Significant Findings

1.1 Assessment Level: Lincoln County's 2003 residential property assessments were approximately 71% of market value (Section 3.5). The results from the corresponding STC study are invalid because the STC's appraisals did not meet the requirement that they reflect market values (Section 4.3).

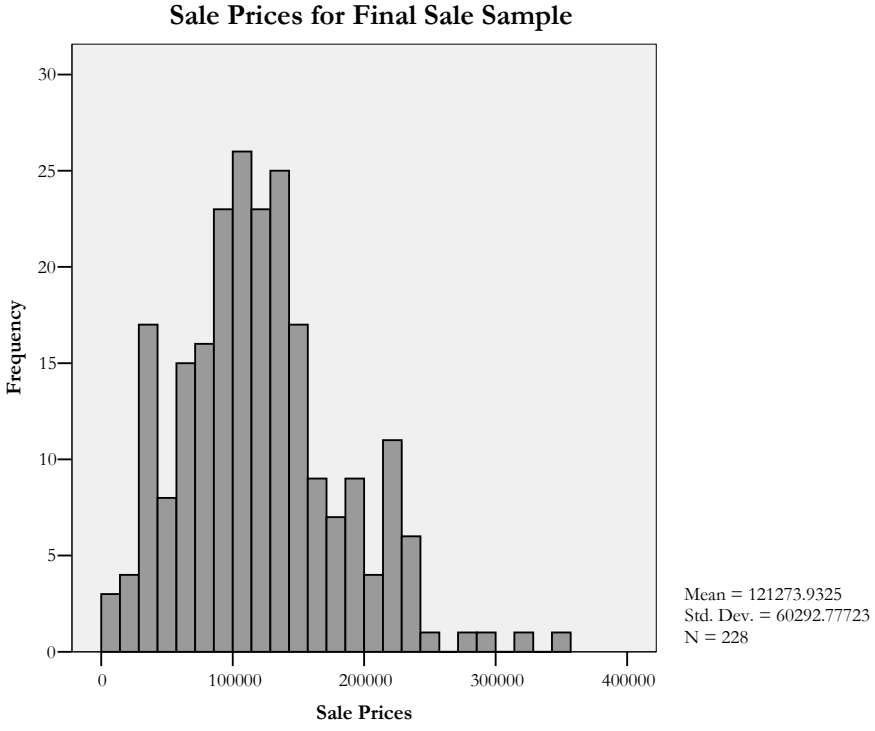
1.2 Assessment Equity: Lower-valued properties and older properties are assessed less uniformly and at lower levels than higher-valued properties and newer properties respectively (Section 3.6 and Tables 4 & 8).

1.3 Reassessment History: Two indicators of market value changes suggest that three of the past four biennial reassessments have produced lower value increases than the market. Cumulatively, the reassessments from 1997 through 2003 produced only 46% of the expected rise in assessments (Section 5.1).

## 2. Data and Related Issues

2.1 Assessment Data: Sales and assessment information was available in electronic format. Sales were matched using a combination of computer techniques and software and then screened. The assessor answered all questions regarding the contents and coding of data when requested. The files received did not contain information allowing us to identify properties affected by new construction and to screen as appropriate.

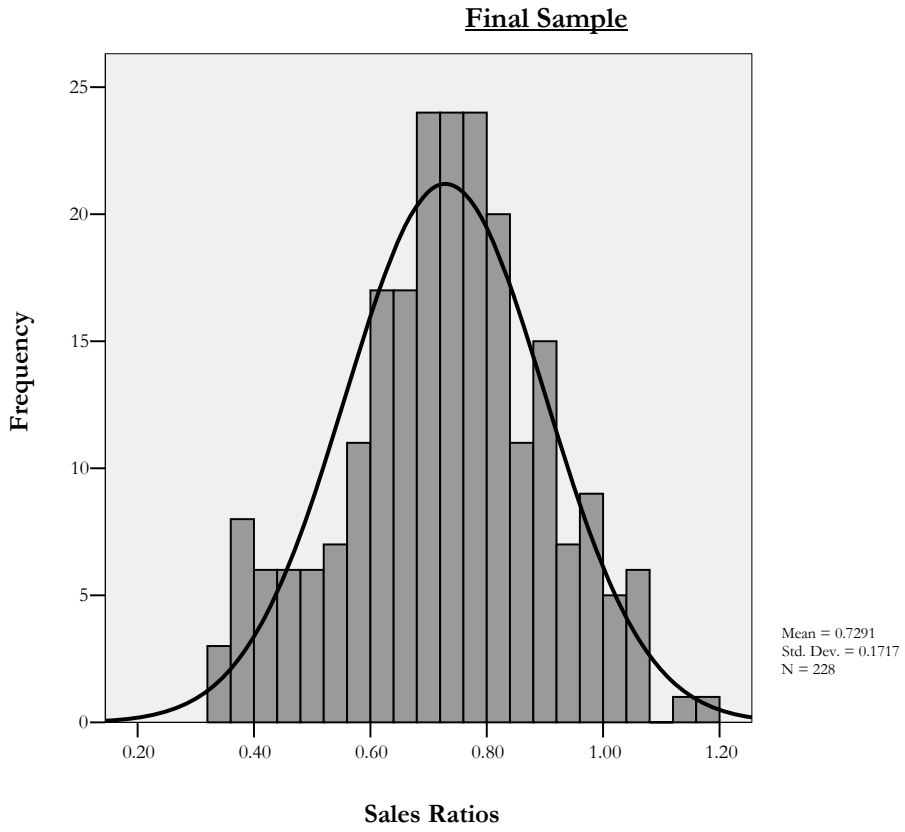
2.2 Sales and Ratio Data: The distribution of sale prices used is reflected in the following histogram.



The next table reports results of the data screening and trimming process. The "screened sales" represent the initial screened sample. The screened sales that were excluded from the final analysis because their ratios were deemed unrepresentative are identified as high or low trims. The "remaining ratios" represent the sample on which all the study's results are based.

| Trimming of Outliers | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Single Family <$51,000 | Single Family >$51,000 & <=$71,000 | Single Family >$71,000 & <=$97,000 | Single Family >$97,000 & <=$121,000 | Single Family >$121,000 | Unimproved Properties | Multi-family | Total |
| **Screened Sales** | | 29 | 32 | 46 | 43 | 56 | 32 | 7 | 245 |
| Excluded | High Trims | 3 | 2 | 1 | 0 | 3 | 5 | 0 | 14 |
| | Low Trims | 0 | 0 | 0 | 0 | 2 | 1 | 0 | 3 |
| **Remaining Ratios** | | **26** | **30** | **45** | **43** | **51** | **26** | **7** | **228** |

The histogram below shows the distribution of the ratios for the sample.




2.3 Population: Since a complete copy of the 2006 assessment rolls in electronic form was available, we were able to analyze the county's population in detail. This allowed us to stratify and weight sales on a variety of property and location characteristics. It is important to note here that the assessment rolls did not have property use information, so we used the best available alternative as a pseudo-population, i.e. four random samples that were drawn and used by the STC for stratification on property use and property use and value only.

## 3. Ratio Study Results

3.1 The Sample: The following table shows that four of the strata, including three of the single family strata and the multi-family stratum, vary from 3% to 11.7% from the population. Initially, this exhibits excessive variability from the sample to the population. Upon closer examination, this variation has a cumulative material effect on the overall assessment level and thus we conclude that the un-stratified sample is insufficiently representative of the population.

| Comparing Representivity | | | | | | |
|---|---|---|---|---|---|---|
| | Population Distribution | | | PPRC 2003 Sale Sample | | |
| Strata | N | $ | $ Weight | N | $ | $ Weight |
| Single Family <$51,00 | 54 | 1,298,632 | 16.4% | 26 | 928,890 | 4.7% |
| Single Family >$51,000 & <=$71,000 | 16 | 935,632 | 11.8% | 30 | 1,757,650 | 8.8% |
| Single Family >$71,000 & <=$97,000 | 15 | 1,218,842 | 15.4% | 45 | 3,548,700 | 17.9% |
| Single Family >$97,000 & <=$121,000 | 16 | 1,703,474 | 21.5% | 43 | 4,493,300 | 22.6% |
| Single Family >$121,000 | 15 | 2,415,316 | 30.5% | 51 | 7,439,040 | 37.4% |
| Unimproved Properties | 34 | 260,684 | 3.3% | 26 | 764,020 | 3.8% |
| Multi-family | 1 | 78,579 | 1.0% | 7 | 944,890 | 4.8% |
| Total | 151 | 7,911,158 | | 228 | 19,876,490 | |

3.2 Representing the Population with the Sample: Since the un-stratified sample is insufficiently representative of the population (Section 3.1), the use of stratification and weighting is essential. Furthermore, stratification provides additional analytical benefits.

3.3 Sales Chasing: There was no indication of sales chasing.

3.4 Study Validity: Once the sample has been stratified and weighted, all requirements for producing valid inferences about the county's population of residential properties are met.

3.5 Assessment Level: Measures of the assessment level are summarized below. For the purposes of this study, the weighted mean from combined stratification is the preferred measure as long as both of the requirements from using the weighted mean are met. In this case, the distributions are not normal (Figure 3) and weighting is compromised by the use of seriously undersized samples. Since both requirements are not met, we focus on the median, though taking notice of the weighted mean, to conclude that the County's assessments for 2003 reflect approximately 71% of market value.

| Assessment Level (Based on Percent of Market Value) | | | | |
|---|---|---|---|---|
| | Stratification and Weighting | Reference | Weighted Mean | Median |
| **Overall Un-weighted** | None | Table 2 | 71.9% | 73.5% |
| **Combined** | By Property Use | Table 3 | 71.4% | 73.1% |
| **Combined** | By Property Use and Value Range | Table 5 | 67.1% | 69.0% |
| **Combined** | By Property Location | Table 7 | 71.0% | 72.6% |
| **Combined** | By Property Age | Table 9 | 71.9% | 74.0% |
| **Combined** | By Property Town and Rural Lots | Table 11 | 70.7% | 70.6% |

3.6 Equity Measures and Evaluation:

i. Uniformity within Strata: Tables 2, 4, 6, 8 & 10 show results for individual strata. Of the 17 of sufficient sample size for evaluation, the following strata represent problem areas for internal uniformity.

| Strata with Inadequate Uniformity | |
|---|---|
| **Property Strata** | **COD** |
| Single Family <=$51,000 | 23.7% |

ii. Uniformity between Strata: Another form of inequity exists when different strata are assessed at different levels. The IAAO has established guidelines for identifying such inequity, but compliance can be heavily affected by sample size and uniformity. Therefore, we confine our remarks to identifying where assessment levels differ markedly from the norm. The differences in assessment levels (medians) between the lowest and higher valued single family strata (50% versus 64-76% respectively, Table 4) and between older and newer properties (64% versus 80-82%, respectively, Table 8) are both substantial.

iii. Vertical Equity: The final form of potential inequity examined is vertical equity. The PRD for the overall sample of 1.014 complies with the IAAO standard.

## 4. STC Study

4.1 Comparative Results: The following table contrasts our results with those from the STC study. The STC found the level of assessment adequate, while ours does not. The STC reports an equally acceptable horizontal equity measure and vertical equity measure. We have already demonstrated that the PPRC study meets the criteria for achieving valid results. The rest of Section 4 examines the validity of the STC's study.

| Comparison of Study Results | | | |
|---|---|---|---|
| **Measure** | **STC Study*** | **PPRC Study*** | **PPRC Study Combined**** |
| Assessment Level - median | 98.1% | 73.5% | 69.0% |
| Assessment Level - weighted mean | 98.9% | 71.9% | 67.1% |
| COD | 11.7% | 18.3% | |
| PRD | 0.99 | 1.01 | |
| Sample Size | 35 | 228 | |
| Relative Precision | 1.00 | 2.55 | |
| * Overall sample (un-stratified and un-weighted) | | | |
| ** Stratification and weighting by Property Use and Value Range | | | |

4.2 Representing the Population with the Sample: The STC does not examine the representivity of its sample, nor does it have the necessary sample size or information to do so. Therefore, in the following table, we provide that missing analysis. In this case, the table shows that two of the single family strata in the STC sample, vary from 11.9% to 13.4%. Initially, this exhibits excessive variability from the sample to the population. However, upon closer examination, this variation has no material effect and thus we conclude that the STC sample is sufficiently representative of the population.

| Comparing Representivity | | | | | | |
|---|---|---|---|---|---|---|
| | Population | | | STC 2003 Appraisals | | |
| Strata | N | $ | % | N | $ | % |
| Single Family <$51,00 | 54 | 1,298,632 | 16.4% | 12 | 321,000 | 15.8% |
| Single Family >$51,000 & <=$71,000 | 16 | 935,632 | 11.8% | 4 | 225,000 | 11.1% |
| Single Family >$71,000 & <=$97,000 | 15 | 1,218,842 | 15.4% | 1 | 71,474 | 3.5% |
| Single Family >$97,000 & <=$121,000 | 16 | 1,703,474 | 21.5% | 4 | 418,211 | 20.6% |
| Single Family >$121,000 | 15 | 2,415,316 | 30.5% | 5 | 890,842 | 43.9% |
| Unimproved Properties | 34 | 260,684 | 3.3% | 9 | 100,474 | 5.0% |
| Multi-family | 1 | 78,579 | 1.0% | 0 | 0 | 0.0% |
| Total | 151 | 7,911,158 | | 35 | 2,027,000 | |

4.3 Market Value: The final requirement for producing a valid appraisal study is that appraisals must represent market values. As discussed in the introduction for this Section II, and in greater depth in the Procedure Manual (Section III), we use 4 tests to make this determination. The results of each test are reported in the following tables.

| Mann-Whitney Test | | | | |
|---|---|---|---|---|
| For the Entire Sample | | | | |
| Study | Observations | Rank sum | Expected | Ho: Ratios (35 STC Appraisals)=Ratios (228 Sales)<br>z = 6.885<br>Prob > \|z\| = 0.0000 |
| 0 | 35 | 7505 | 4620 | |
| 1 | 228 | 27211 | 30096 | |
| Combined | 263 | 34716 | 34716 | |
| For Single Family Properties Only | | | | |
| Study | Observations | Rank sum | Expected | Ho : Ratios (26 STC Appraisals)=Ratios (195 Sales)<br>z = 6.841<br>Prob > \|z\| = 0.0000 |
| 0 | 26 | 4981 | 2886 | |
| 1 | 195 | 19550 | 21645 | |
| Combined | 221 | 24531 | 24531 | |

| K-Sample Test | | | | |
|---|---|---|---|---|
| For the Entire Sample | | | | |
| Study | Not Greater than the median | Greater than the median | Total | Ho: Ratios (35 STC Appraisals)=Ratios (228 Sales)<br>Pearson chi2(1) = 20.8186 Pr = 0.000<br>Continuity corrected:<br>Pearson chi2(1) = 19.1948 Pr = 0.000 |
| 0 | 5 | 30 | 35 | |
| 1 | 127 | 101 | 228 | |
| Total | 132 | 131 | 263 | |
| For Single Family Properties Only | | | | |
| Study | Not Greater than the median | Greater than the median | Total | Ho: Ratios (26 STC Appraisals)=Ratios (195 Sales)<br>Pearson chi2(1) = 21.3241 Pr = 0.000<br>Continuity corrected:<br>Pearson chi2(1) = 19.4395 Pr = 0.000 |
| 0 | 2 | 24 | 26 | |
| 1 | 109 | 86 | 195 | |
| Total | 111 | 110 | 221 | |

All four tests lead to the conclusion that the STC appraisals do not represent market values (all with 99% statistical confidence).

## 5. Additional Analysis and Findings

5.1 Analysis of Reassessment History: The following table provides a comparison of actual assessment changes (net of new construction) to those that might have been expected for each of the last four reassessments as well as the six-year period leading up to 2003. Only one of the reassessments produced changes in line with the market indicator.

| Actual Value Changes from Reassessment vs. Expected Value Change | | | | | |
|---|---|---|---|---|---|
| Biennial Year | % Net Assessment Change | Missouri OFHEO Index | % Value Change: Actual vs. Expected | St. Louis MSA OFHEO Index | % Value Change: Actual vs. Expected |
| 1999 | 8.1 | 8.4 | 96% | 9.6 | 84% |
| 2001 | 2.9 | 11.4 | 25% | 13.5 | 21% |
| 2003 | 4.5 | 11.8 | 38% | 12.9 | 34% |
| 2005 | 7.1 | 12.4 | 57% | 16.8 | 42% |
| Cumulative 1997 - 2003 | 16.1 | 35.0 | 46% | 40.4 | 40% |

## 6. Figures and Tables

**Table 1. STC's Appraisal Ratio Studies**

| | | Group | | | |
|---|---|---|---|---|---|
| | | 1999 | 2001 | 2003 | 2005* |
| Number of Appraisals | | 40 | 41 | 35 | 35 |
| Median | | .975 | .999 | .981 | .941 |
| 95% Confidence Interval for Median | Lower Bound | .931 | .987 | .957 | .848 |
| | Upper Bound | 1.014 | 1.028 | 1.053 | 1.000 |
| Weighted Mean | | .969 | .987 | .989 | .914 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .936 | .936 | .951 | .836 |
| | Upper Bound | 1.002 | 1.038 | 1.026 | .992 |
| Minimum | | .111 | .737 | .481 | .238 |
| Maximum | | 1.645 | 1.281 | 1.309 | 1.909 |
| Std. Deviation | | .254 | .113 | .165 | .286 |
| Price Related Differential | | .986 | 1.019 | .991 | 1.017 |
| Coefficient of Dispersion | | .159 | .077 | .117 | .206 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 57.5% | 73.2% | 71.4% | 40.0% |
| *The STC has not completed its studies for the 2005 reassessment cycle. These results may not represent final values. | | | | | |

**Figure 1. Ratios before Outlier Trimming**

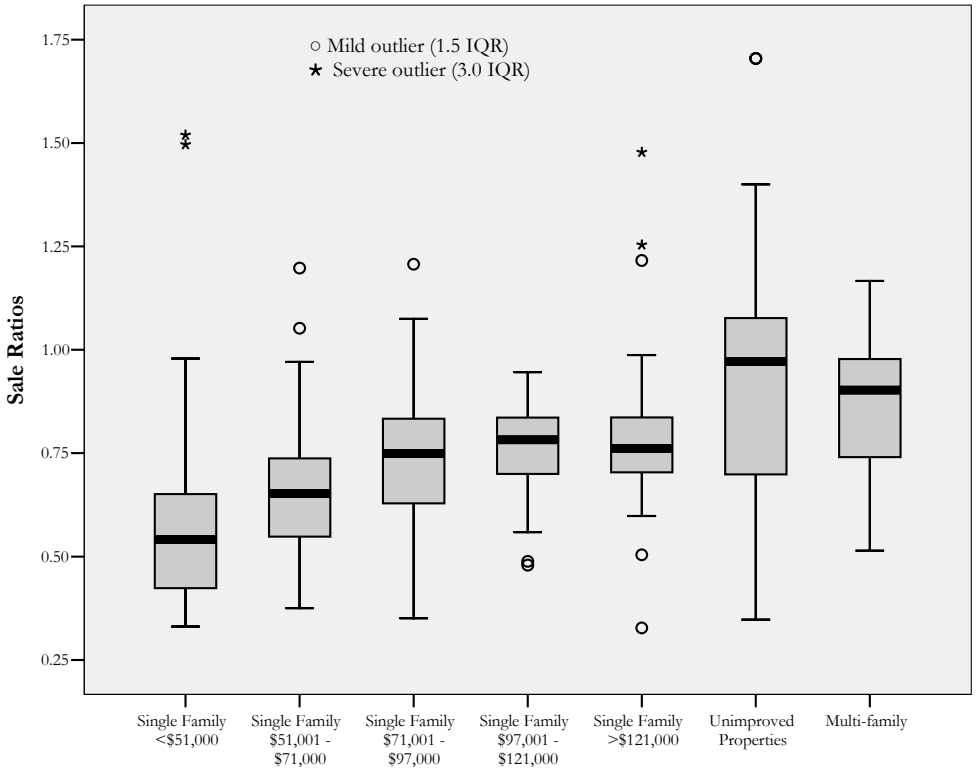
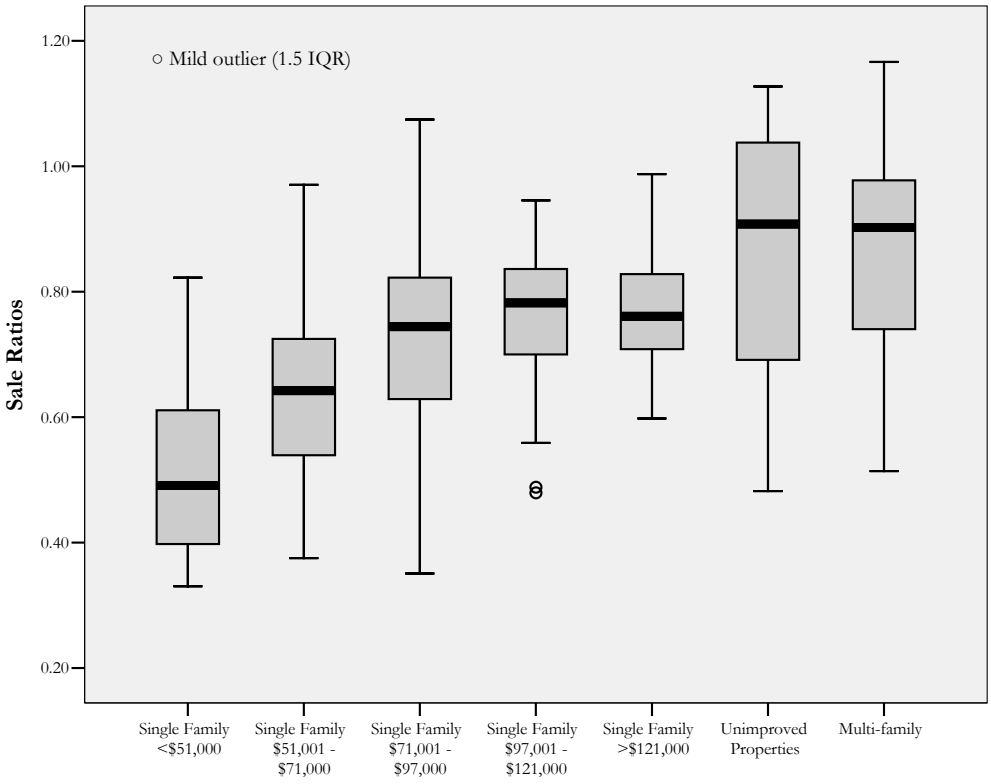
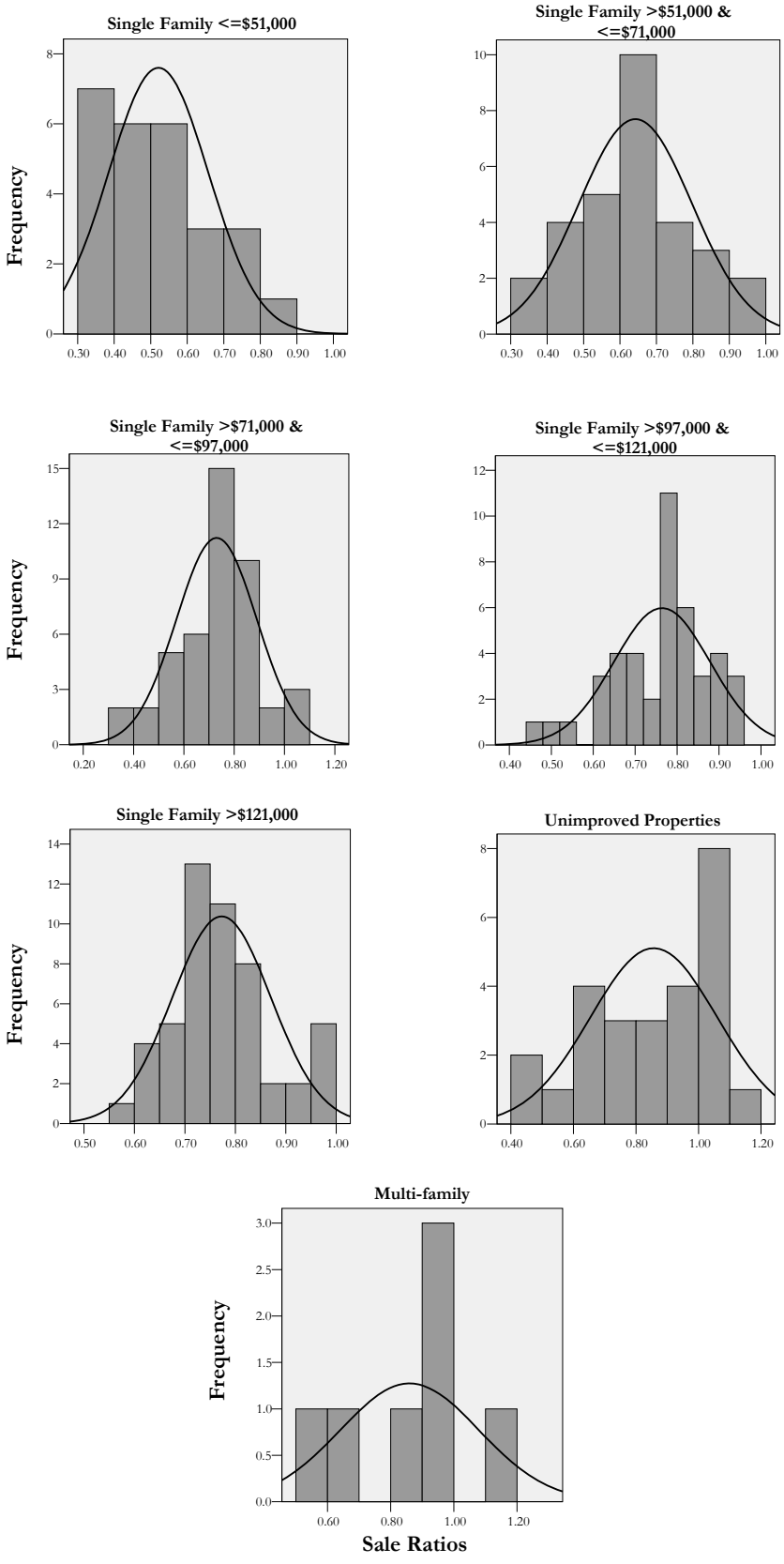



**Figure 2. Ratios after Outlier Trimming**



## Figure 3. Distribution of Final Sale Ratios



## Figure 3 (cont.). Distribution of Final Sale Ratios

**Shapiro-Francia W' Tests for Normality for Various Strata**

| Strata | Observations | W' | V' | z | Prob* |
|---|---|---|---|---|---|
| Single Family | 195 | 0.97947 | 3.234 | 2.445 | 0.00725 |
| Multi-family | 7 | 0.96758 | 0.452 | -1.085 | 0.86098 |
| Unimproved Properties | 26 | 0.92863 | 2.254 | 1.474 | 0.07018 |
| Single Family <=$51,000 | 26 | 0.95326 | 1.476 | 0.709 | 0.23904 |
| Single Family >$51,000 & <=$71,000 | 30 | 0.97182 | 0.989 | -0.020 | 0.50796 |
| Single Family >$71,000 & <=$97,000 | 45 | 0.97936 | 0.986 | -0.027 | 0.51081 |
| Single Family >$97,000 & <=$121,000 | 43 | 0.96555 | 1.589 | 0.878 | 0.18996 |
| Single Family >$121,000 | 51 | 0.97256 | 1.445 | 0.709 | 0.23906 |
| Overall Un-weighted | 228 | 0.99224 | 1.396 | 0.715 | 0.23745 |
| *This value represents the indicated probability that the underlying population is normally distributed. A value of less than .05 indicates a distribution that is not normal. | | | | | |

## Table 2. Sales Ratio Analysis: Stratified by Property Use

| | | Strata | | | |
|---|---|---|---|---|---|
| | | Single Family | Unimproved Properties | Multi-family | Overall Un-weighted |
| Number of Sales | | 195 | 26 | 7 | 228 |
| Median | | .725 | .908 | .902 | .735 |
| 95% Confidence Interval for Median | Lower Bound | .704 | .706 | .514 | .707 |
| | Upper Bound | .750 | 1.029 | 1.166 | .761 |
| Weighted Mean | | .708 | .876 | .854 | .719 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .685 | .792 | .650 | .697 |
| | Upper Bound | .730 | .960 | 1.057 | .741 |
| Minimum | | .331 | .482 | .514 | .331 |
| Maximum | | 1.075 | 1.127 | 1.166 | 1.166 |
| Std. Deviation | | .156 | .203 | .219 | .172 |
| Price Related Differential | | 1.000 | .978 | 1.007 | 1.014 |
| Coefficient of Dispersion | | .168 | .190 | .178 | .183 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 10.3% | 46.2% | 42.9% | 15.4% |

## Table 3. Combined Results – Post Stratification and Weighting

| | Population Assessor's Value | Median | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Single Family | 7,571,895 | 0.725 | 10,443,993 | 96.5% | 0.700 |
| Unimproved Properties | 260,684 | 0.908 | 287,097 | 2.7% | 0.024 |
| Multi-family | 78,579 | 0.902 | 87,116 | 0.8% | 0.007 |
| Total | 7,911,158 | | 10,818,206 | 100.0% | 73.1% |

| | Population Assessor's Value | Weighted Mean | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Single Family | 7,571,895 | 0.708 | 10,694,767 | 96.5% | 0.683 |
| Unimproved Properties | 260,684 | 0.876 | 297,585 | 2.7% | 0.024 |
| Multi-family | 78,579 | 0.854 | 92,013 | 0.8% | 0.007 |
| Total | 7,911,158 | | 11,084,364 | 100.0% | 71.4% |

## Table 4. Sales Ratio Analysis: Stratified by Use and Value

| | | Strata | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Single Family <$51,000 | Single Family $51,001 - $71,000 | Single Family $71,001 - $97,000 | Single Family $97,001 - $121,000 | Single Family >$121,000 | Un-improved Property | Multi-family | Overall Un-weighted |
| Number of Sales | | 26 | 30 | 45 | 43 | 51 | 26 | 7 | 228 |
| Median | | .491 | .642 | .744 | .782 | .761 | .908 | .902 | .735 |
| 95% Confidence Interval for Median | Lower Bound | .424 | .595 | .704 | .734 | .737 | .706 | .514 | .707 |
| | Upper Bound | .594 | .681 | .783 | .814 | .794 | 1.029 | 1.166 | .761 |
| Weighted Mean | | .487 | .611 | .688 | .746 | .767 | .876 | .854 | .719 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .435 | .554 | .629 | .705 | .739 | .792 | .650 | .697 |
| | Upper Bound | .538 | .667 | .746 | .787 | .796 | .960 | 1.057 | .741 |
| Minimum | | .331 | .375 | .351 | .479 | .598 | .482 | .514 | .331 |
| Maximum | | .823 | .970 | 1.075 | .946 | .987 | 1.127 | 1.166 | 1.166 |
| Std. Deviation | | .136 | .156 | .160 | .115 | .098 | .203 | .219 | .172 |
| Price Related Differential | | 1.071 | 1.052 | 1.062 | 1.024 | 1.007 | .978 | 1.007 | 1.014 |
| Coefficient of Dispersion | | .237 | .184 | .161 | .112 | .100 | .190 | .178 | .183 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | .0% | 6.7% | 11.1% | 14.0% | 13.7% | 46.2% | 42.9% | 15.4% |

## Table 5. Combined Results – Post Stratification and Weighting

| | Population Assessor's Value | Median | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Single Family <=$51,000 | 1,298,632 | 0.491 | 2,644,871 | 23.1% | 0.113 |
| Single Family >$51,000 & <=$71,000 | 935,632 | 0.642 | 1,457,370 | 12.7% | 0.082 |
| Single Family >$71,000 & <=$97,000 | 1,218,842 | 0.744 | 1,638,229 | 14.3% | 0.106 |
| Single Family >$97,000 & <=$121,000 | 1,703,474 | 0.782 | 2,178,355 | 19.0% | 0.149 |
| Single Family >$121,000 | 2,415,316 | 0.761 | 3,173,871 | 27.7% | 0.211 |
| Unimproved Properties | 260,684 | 0.908 | 287,097 | 2.5% | 0.023 |
| Multi-family | 78,579 | 0.902 | 87,116 | 0.8% | 0.007 |
| Total | 7,911,158 | | 11,466,909 | 100.0% | 69.0% |

| | Population Assessor's Value | Weighted Mean | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Single Family <=$51,000 | 1,298,632 | 0.487 | 2,666,595 | 22.6% | 0.110 |
| Single Family >$51,000 & <=$71,000 | 935,632 | 0.611 | 1,531,312 | 13.0% | 0.079 |
| Single Family >$71,000 & <=$97,000 | 1,218,842 | 0.688 | 1,771,573 | 15.0% | 0.103 |
| Single Family >$97,000 & <=$121,000 | 1,703,474 | 0.746 | 2,283,477 | 19.4% | 0.144 |
| Single Family >$121,000 | 2,415,316 | 0.767 | 3,149,043 | 26.7% | 0.205 |
| Unimproved Properties | 260,684 | 0.876 | 297,585 | 2.5% | 0.022 |
| Multi-family | 78,579 | 0.854 | 92,013 | 0.8% | 0.007 |
| Total | 7,911,158 | | 11,791,596 | 100.0% | 67.1% |

## Table 6. Sales Ratio Analysis: Stratified by Location

| | | Strata | | | |
|---|---|---|---|---|---|
| | | Troy R-3 school district | Winfield R-4 school district | All other school districts | Overall Un-weighted |
| Number of Sales | | 163 | 38 | 27 | 228 |
| Median | | .753 | .706 | .651 | .735 |
| 95% Confidence Interval for Median | Lower Bound | .732 | .640 | .580 | .707 |
| | Upper Bound | .784 | .774 | .712 | .761 |
| Weighted Mean | | .733 | .677 | .662 | .719 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .706 | .627 | .613 | .697 |
| | Upper Bound | .759 | .726 | .712 | .741 |
| Minimum | | .331 | .338 | .378 | .331 |
| Maximum | | 1.166 | 1.077 | 1.077 | 1.166 |
| Std. Deviation | | .172 | .173 | .157 | .172 |
| Price Related Differential | | 1.013 | 1.064 | .995 | 1.014 |
| Coefficient of Dispersion | | .176 | .186 | .183 | .183 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 17.8% | 10.5% | 7.4% | 15.4% |

## Table 7. Combined Results – Post Stratification and Weighting

| | Population Assessor's Value | Median | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Troy R-3 School District | 1,058,611,650 | 0.753 | 1,405,858,765 | 63.8% | 0.480 |
| Winfield R-4 School District | 283,955,290 | 0.706 | 402,202,960 | 18.2% | 0.129 |
| All other school districts | 258,088,110 | 0.651 | 396,448,710 | 18.0% | 0.117 |
| Total | 1,600,655,050 | | 2,204,510,435 | 100.0% | 72.6% |

| | Population Assessor's Value | Weighted Mean | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Troy R-3 School District | 1,058,611,650 | 0.733 | 1,444,217,804 | 64.1% | 0.470 |
| Winfield R-4 School District | 283,955,290 | 0.677 | 419,431,743 | 18.6% | 0.126 |
| All other school districts | 258,088,110 | 0.662 | 389,861,193 | 17.3% | 0.115 |
| Total | 1,600,655,050 | | 2,253,510,740 | 100.0% | 71.0% |

## Table 8. Sales Ratio Analysis: Stratified by Age

| | | Strata | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Unimproved Properties | Multi-family | Built before 1980 | Built 1980 thru 1989 | Built 1990 thru 1995 | Built 1996 thru 1999 | Built 2000 thru 2002 | Overall Un-weighted |
| Number of Sales | | 26 | 7 | 50 | 44 | 36 | 36 | 29 | 228 |
| Median | | .908 | .902 | .637 | .699 | .710 | .781 | .817 | .735 |
| 95% Confidence Interval for Median | Lower Bound | .706 | .514 | .576 | .646 | .628 | .737 | .790 | .707 |
| | Upper Bound | 1.029 | 1.166 | .673 | .744 | .759 | .833 | .863 | .761 |
| Weighted Mean | | .876 | .854 | .631 | .669 | .680 | .772 | .793 | .719 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .792 | .650 | .584 | .621 | .633 | .736 | .734 | .697 |
| | Upper Bound | .960 | 1.057 | .679 | .718 | .727 | .807 | .852 | .741 |
| Minimum | | .482 | .514 | .369 | .351 | .331 | .425 | .375 | .331 |
| Maximum | | 1.127 | 1.166 | 1.075 | 1.029 | 1.025 | .987 | .970 | 1.166 |
| Std. Deviation | | .203 | .219 | .163 | .144 | .150 | .114 | .138 | .172 |
| Price Related Differential | | .978 | 1.007 | 1.006 | 1.023 | 1.005 | 1.015 | 1.010 | 1.014 |
| Coefficient of Dispersion | | .190 | .178 | .202 | .158 | .150 | .109 | .107 | .183 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 46.2% | 42.9% | 4.0% | 4.5% | 5.6% | 19.4% | 24.1% | 15.4% |

## Table 9. Combined Results – Post Stratification and Weighting

| | Population Assessor's Value | Median | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Unimproved Properties | 764,020 | 0.908 | 841,432 | 3.1% | 0.028 |
| Multi-family | 944,890 | 0.902 | 1,047,550 | 3.9% | 0.035 |
| Built before 1980 | 3,185,110 | 0.637 | 5,000,173 | 18.6% | 0.119 |
| Built 1980 through 1989 | 3,671,270 | 0.699 | 5,252,175 | 19.5% | 0.137 |
| Built 1990 through 1995 | 3,483,070 | 0.71 | 4,905,732 | 18.3% | 0.130 |
| Built 1996 through 1999 | 4,287,400 | 0.781 | 5,489,629 | 20.4% | 0.160 |
| Built 2000 through 2002 | 3,540,730 | 0.817 | 4,333,819 | 16.1% | 0.132 |
| Total | 19,876,490 | | 26,870,509 | 100.0% | 74.0% |

| | Population Assessor's Value | Weighted Mean | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Unimproved Properties | 764,020 | 0.876 | 872,169 | 3.2% | 0.028 |
| Multi-family | 944,890 | 0.854 | 1,106,429 | 4.0% | 0.034 |
| Built before 1980 | 3,185,110 | 0.631 | 5,047,718 | 18.3% | 0.115 |
| Built 1980 through 1989 | 3,671,270 | 0.669 | 5,487,698 | 19.8% | 0.133 |
| Built 1990 through 1995 | 3,483,070 | 0.68 | 5,122,162 | 18.5% | 0.126 |
| Built 1996 through 1999 | 4,287,400 | 0.772 | 5,553,627 | 20.1% | 0.155 |
| Built 2000 through 2002 | 3,540,730 | 0.793 | 4,464,981 | 16.1% | 0.128 |
| Total | 19,876,490 | | 27,654,783 | 100.0% | 71.9% |

## Table 10. Sales Ratio Analysis: Stratified by Town and Rural Lots

| | | Strata | | |
|---|---|---|---|---|
| | | Rural Lots | Town Lots | Overall Un-weighted |
| Number of Sales | | 122 | 106 | 228 |
| Median | | .680 | .782 | .735 |
| 95% Confidence Interval for Median | Lower Bound | .651 | .761 | .707 |
| | Upper Bound | .704 | .800 | .761 |
| Weighted Mean | | .693 | .745 | .719 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .662 | .714 | .697 |
| | Upper Bound | .724 | .775 | .741 |
| Minimum | | .425 | .331 | .331 |
| Maximum | | 1.166 | .966 | 1.166 |
| Std. Deviation | | .184 | .156 | .172 |
| Price Related Differential | | 1.038 | .993 | 1.014 |
| Coefficient of Dispersion | | .207 | .130 | .183 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 23.8% | 5.7% | 15.4% |

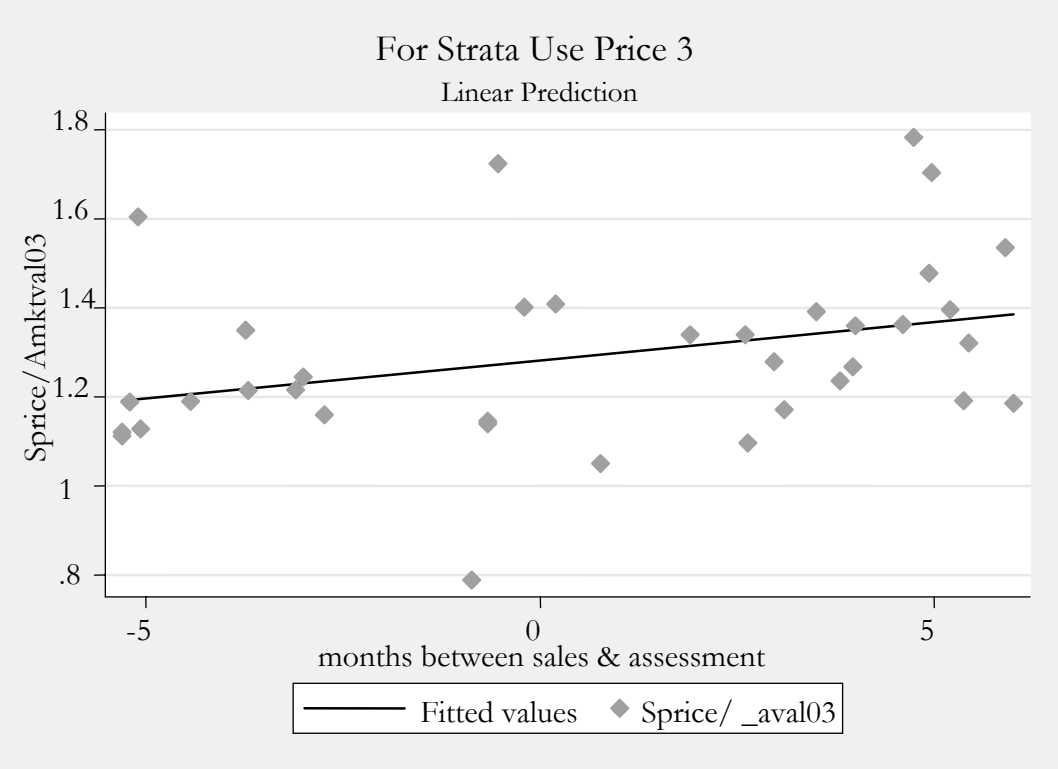
## Table 11. Combined Results – Post Stratification and Weighting

| | Population Assessor's Value | Median | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Town Lot | 452,426,920 | 0.782 | 578,551,049 | 25.5% | 0.200 |
| Rural Lot | 1,148,228,130 | 0.68 | 1,688,570,779 | 74.5% | 0.506 |
| Total | 1,600,655,050 | | 2,267,121,828 | 100.0% | 70.6% |

| | Population Assessor's Value | Weighted Mean | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Town Lot | 452,426,920 | 0.745 | 607,284,456 | 26.8% | 0.200 |
| Rural Lot | 1,148,228,130 | 0.693 | 1,656,894,848 | 73.2% | 0.507 |
| Total | 1,600,655,050 | | 2,264,179,305 | 100.0% | 70.7% |

**Graph 1. Single Family Property Price Trend**

A thorough analysis of price-time trends by price strata determined that adjusting reported prices was desirable for the middle valued single family stratum. Prices for this stratum ranged from $113,000 - $133,000. The resultant trend and statistical analysis is shown below.




**Price Trend Regression Statistics**

| Source | SS | df | MS | | |
|---|---|---|---|---|---|
| Model | .158690834 | 1 | .158690834 | Number of obs = 36 | R-squared = 0. 1110 |
| Residual | 1.27135745 | 34 | .037392866 | F( 1, 34) = 4.24 | Adj R-squared= 0. 0848 |
| Total | 1.43004829 | 35 | .040858522 | Prob > F = 0.0471 | Root MSE = .19337 |

| _aratio | Coef. | Std. Err. | t | P> t | [80% Conf. Interval] | |
|---|---|---|---|---|---|---|
| _adjperiod | .0172462 | .0083717 | 2.06 | 0.047 | .0063048 | .0281875 |
| _cons | 1.282 | .0328332 | 39.05 | 0.000 | 1.239089 | 1.324911 |
| Monthly adjustment rate= .01345257 | | | | Annualized adjustment rate=.16143084 | | |

# Chapter 17. Madison County

## 1. Significant Findings

1.1 Assessment Level: Madison County's 2003 residential property assessments were approximately 96% of market value (Section 3.5). The results from the corresponding STC study are suspect because the STC's sample is not representative of the residential property for the county (Section 4.2).

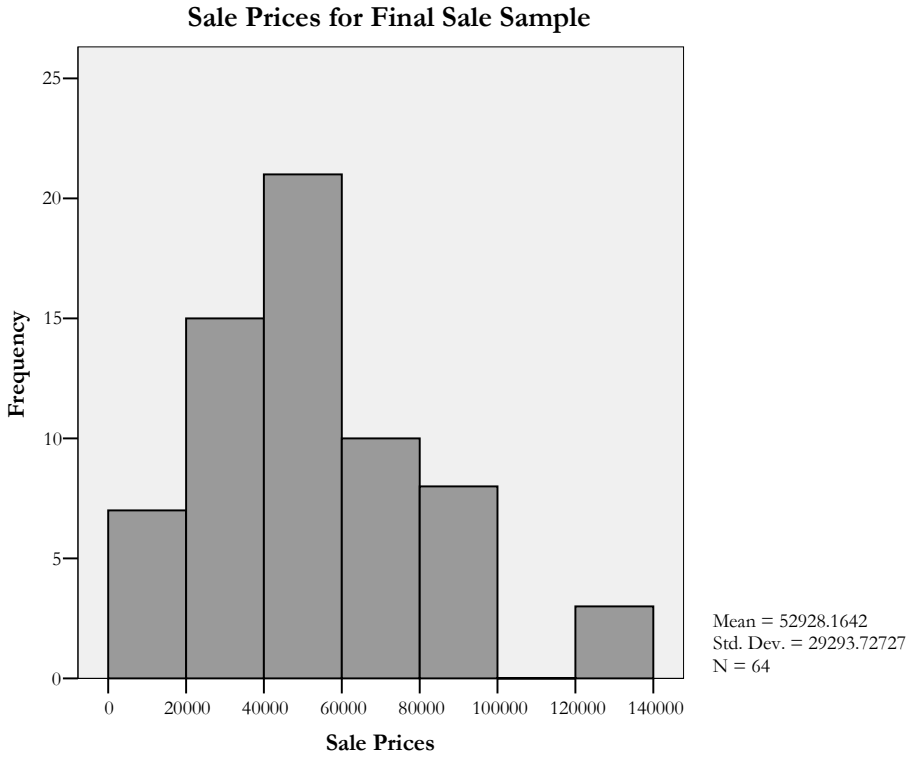
1.2 Assessment Equity: Lower-valued and older properties are assessed at lower levels than other strata (Section 3.6 and Tables 3 & 5).

1.3 Reassessment History: One indicator of market value changes suggests that the first two of the past four biennial reassessments have produced lower value increases than the market. Cumulatively, the reassessments from 1997 through 2003 produced 100% of the expected rise in assessment, primarily due to the large increase in 2003. The net change in assessments in 1997 and 2001 raises questions regarding whether any serious revaluation occurred (Section 5.1).

## 2. Data and Related Issues

2.1 Assessment Data: Sales and assessment information were matched at the county offices. Subsequently, the assessor reviewed the matched parcels and provided further information that assisted our screening process.

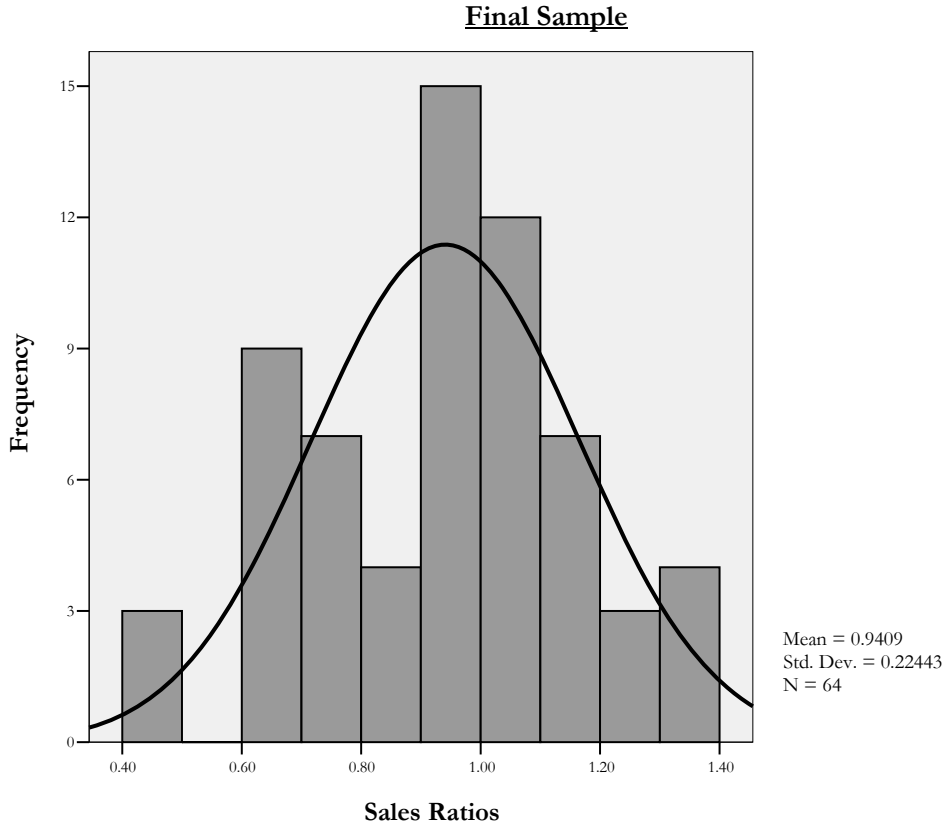
2.2 Sales and Ratio Data: The distribution of sale prices used is reflected in the following histogram.



The next table reports results of the data screening and trimming process. The "screened sales" represent the initial screened sample. The screened sales that were excluded from the final analysis because their ratios were deemed unrepresentative are identified as high or low trims. The "remaining ratios" represent the sample on which all the study's results are based.

| Trimming of Outliers | | | | | |
|---|---|---|---|---|---|
| | | Improved Properties <=$45,000 | Improved Properties >$45,000 | Unimproved Properties | Total |
| **Screened Sales** | | 31 | 34 | 8 | 73 |
| Excluded | High Trims | 5 | 1 | 1 | 7 |
| | Low Trims | 1 | 1 | 0 | 2 |
| **Remaining Ratios** | | **25** | **32** | **7** | **64** |

The histogram below shows the distribution of the ratios for the sample.




2.3 Population: Since a complete copy of the assessment rolls in electronic form was not available, we used the best available alternative as a pseudo-population (hereinafter, "the population"), i.e. four random samples that were drawn and used by the STC.

## 3. Ratio Study Results

3.1 The Sample: The following table shows that the two improved property strata vary from 10.8% to 11.5% from the population. Initially, this exhibits excessive variability from the sample to the

population. Upon closer examination, this variation has no material effect on the overall assessment level and thus we conclude that the un-stratified sample is sufficiently representative of the population.

| Comparing Representivity | | | | | | |
|---|---|---|---|---|---|---|
| | Population Distribution | | | PPRC 2003 Sale Sample | | |
| Strata | N | $ | $ Weight | N | $ | $ Weight |
| Improved Properties <=$45,000 | 124 | 2,826,368 | 37.9% | 25 | 862,947 | 27.1% |
| Improved Properties >$45,000 | 62 | 4,435,263 | 59.4% | 32 | 2,254,421 | 70.9% |
| Unimproved Properties | 54 | 204,526 | 2.7% | 7 | 62,789 | 2.0% |
| Total | 240 | 7,466,158 | | 64 | 3,180,158 | |

3.2 Representing the Population with the Sample: Since the un-stratified sample is sufficiently representative of the population (Section 3.1), the use of stratification and weighting is not essential. Nevertheless, we used stratification because it produces additional analytical benefits and further optimizes representivity.

3.3 Sales Chasing: There was no indication of sales chasing.

3.4 Study Validity: The sample meets the requirements for producing valid inferences about the county's population of residential properties.

3.5 Assessment Level: Measures of the assessment level are summarized below. For the purposes of this study, the weighted mean from combined stratification is the preferred measure as long as both of the requirements for using the weighted mean are met. In this case, the distributions are approximately normal (Figure 3) and weighting is not severely compromised by the use of seriously undersized samples. Since both requirements are met, we focus on the weighted mean, though taking notice of the median, to conclude that the County's assessments for 2003 reflect approximately 96% of market value.

| Assessment Level (Based on Percent of Market Value) | | | | |
|---|---|---|---|---|
| | Stratification and Weighting | Reference | Weighted Mean | Median |
| **Overall Un-weighted** | None | Table 3 | 93.9% | 97.2% |
| **Combined** | By Property Use and Value Range | Table 4 | 92.8% | 96.4% |

3.6 Equity Measures and Evaluation:

i. Uniformity within Strata: Results from Tables 2, 3 & 5 for the strata with sufficient sample size for individual evaluation indicate no problem areas for internal uniformity.

ii. Uniformity between Strata: Another form of inequity exists when different strata are assessed at different levels. The IAAO has established guidelines for identifying such inequity, but compliance can be heavily affected by sample size and uniformity. Therefore, we confine our remarks to identifying where assessment levels differ markedly from the norm. The differences in medians between lower and higher valued strata (92% versus 100% respectively, Table 3) and between older and newer properties (92% versus 103% respectively, Table 5) are notable.

iii. Vertical Equity: The final form of potential inequity examined is vertical equity. The PRD for the overall sample of 1.002 complies with the IAAO standard.

## 4. STC Study

4.1 Comparative Results: The following table contrasts our results with those from the STC study. The STC found the level of assessment adequate, as does ours. The STC reports a substandard horizontal equity measure and a poor measure for vertical equity, while our results find no such problems. We have already demonstrated that the PPRC study meets the criteria for achieving valid results. The rest of Section 4 examines the validity of the STC's study.

| Comparison of Study Results | | | |
|---|---|---|---|
| **Measure** | **STC Study*** | **PPRC Study*** | **PPRC Study Combined**** |
| Assessment Level - median | 96.8% | 97.2% | 96.4% |
| Assessment Level - wtd. mean | 94.4% | 93.9% | 92.8% |
| COD | 23.3% | 18.3% | |
| PRD | 1.06 | 1.00 | |
| Sample Size | 40 | 64 | |
| Relative Precision | 1.00 | 1.26 | |
| * Overall sample (un-stratified and un-weighted) | | | |
| ** Stratification and weighting by Property Use and Value Range | | | |

4.2 Representing the Population with the Sample: The STC does not examine the representivity of its sample, nor does it have the necessary sample size or information to do so. Therefore, in the following table, we provide that missing analysis. In this case, the table shows that the two improved value strata in the STC sample vary from 20.9% to 21.9%. Initially, this exhibits excessive variability from the sample to the population. Upon closer examination, this variation has a cumulative material effect on the overall assessment level and thus we conclude that the STC sample is insufficiently representative of the population.

| Comparing Representivity | | | | | | |
|---|---|---|---|---|---|---|
| | **Population** | | | **STC 2003 Appraisals** | | |
| **Strata** | **N** | **$** | **%** | **N** | **$** | **%** |
| Improved Properties <=$45,000 | 124 | 2,826,368 | 37.9% | 11 | 238,211 | 17.0% |
| Improved Properties >$45,000 | 62 | 4,435,263 | 59.4% | 17 | 1,138,579 | 81.3% |
| Unimproved Properties | 54 | 204,526 | 2.7% | 12 | 23,895 | 1.7% |
| Total | 240 | 7,466,158 | | 40 | 1,400,684 | |

4.3 Market Value: The final requirement for producing a valid appraisal study is that appraisals must represent market values. As discussed in the introduction for this Section II, and in greater depth in the Procedure Manual (Section III), we use 4 tests to make this determination. The results of each test are reported in the following tables.

| Mann-Whitney Test | | | | |
|---|---|---|---|---|
| For the Entire Sample | | | | |
| Study | Observations | Rank sum | Expected | Ho: Ratios (40 STC Appraisals)=Ratios (64 Sales)<br>z = 0.187<br>Prob > \|z\| = 0.8516 |
| 0 | 40 | 2128 | 2100 | |
| 1 | 64 | 3332 | 3360 | |
| Combined | 104 | 5460 | 5460 | |
| For Single Family Properties Only | | | | |
| Study | Observations | Rank sum | Expected | Ho : Ratios (28 STC Appraisals)=Ratios (57 Sales)<br>z = -0.402<br>Prob > \|z\| = 0.6876 |
| 0 | 28 | 1161 | 1204 | |
| 1 | 57 | 2494 | 2451 | |
| Combined | 85 | 3655 | 3655 | |

| K-Sample Test | | | | |
|---|---|---|---|---|
| For the Entire Sample | | | | |
| Study | Not Greater than the median | Greater than the median | Total | Ho: Ratios (40 STC Appraisals)=Ratios (64 Sales)<br>Pearson chi2(1) = 0.0000 Pr = 1.000<br>Continuity corrected:<br>Pearson chi2(1) = 0.0406 Pr = 0.840 |
| 0 | 20 | 20 | 40 | |
| 1 | 32 | 32 | 64 | |
| Total | 52 | 52 | 104 | |
| For Single Family Properties Only | | | | |
| Study | Not Greater than the median | Greater than the median | Total | Ho: Ratios (28 STC Appraisals)=Ratios (57 Sales)<br>Pearson chi2(1) = 0.1487 Pr = 0.700<br>Continuity corrected:<br>Pearson chi2(1) = 0.0240 Pr = 0.877 |
| 0 | 15 | 13 | 28 | |
| 1 | 28 | 29 | 57 | |
| Total | 43 | 42 | 85 | |

All four tests lead to the conclusion that we cannot reject the null hypothesis. Therefore, we conclude that the STC appraisals approximately represent market values.

## 5. Additional Analysis and Findings

5.1 Analysis of Reassessment History: The following table provides a comparison of actual assessment changes (net of new construction) to those that might have been expected for each of the last four reassessments as well as the six-year period leading up to 2003. None of the reassessments produced changes in line with the market indicator.

| Actual Value Changes from Reassessment vs. Expected Value Change | | | |
|---|---|---|---|
| Biennial Year | % Net Assessment Change | Missouri OFHEO Index | % Value Change: Actual vs. Expected |
| 1999 | 0.2 | 8.4 | 2% |
| 2001 | 0.8 | 11.4 | 7% |
| 2003 | 33.8 | 11.8 | 286% |
| 2005 | 7.2 | 12.4 | 58% |
| Cumulative 1997 - 2003 | 35.0 | 35.0 | 100% |

## 6. Figures and Tables

**Table 1. STC's Appraisal Ratio Studies**

| | | Group | | | |
|---|---|---|---|---|---|
| | | 1999 | 2001 | 2003 | 2005* |
| Number of Appraisals | | 40 | 125 | 40 | 35 |
| Median | | .726 | .851 | .968 | 1.015 |
| 95% Confidence Interval | Lower Bound | .615 | .812 | .895 | .947 |
| for Median | Upper Bound | .924 | .885 | 1.035 | 1.088 |
| Weighted Mean | | .700 | .814 | .944 | .976 |
| 95% Confidence Interval | Lower Bound | .614 | .774 | .883 | .873 |
| for Weighted Mean | Upper Bound | .786 | .854 | 1.006 | 1.080 |
| Minimum | | .220 | .230 | .288 | .426 |
| Maximum | | 15.158 | 5.158 | 2.895 | 7.719 |
| Std. Deviation | | 2.319 | .616 | .402 | 1.202 |
| Price Related Differential | | 1.720 | 1.184 | 1.055 | 1.269 |
| Coefficient of Dispersion | | .942 | .330 | .233 | .411 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 20.0% | 20.8% | 40.0% | 48.6% |

* The STC has not completed its studies for the 2005 reassessment cycle. These results may not represent final values.

**Figure 1. Ratios before Outlier Trimming**

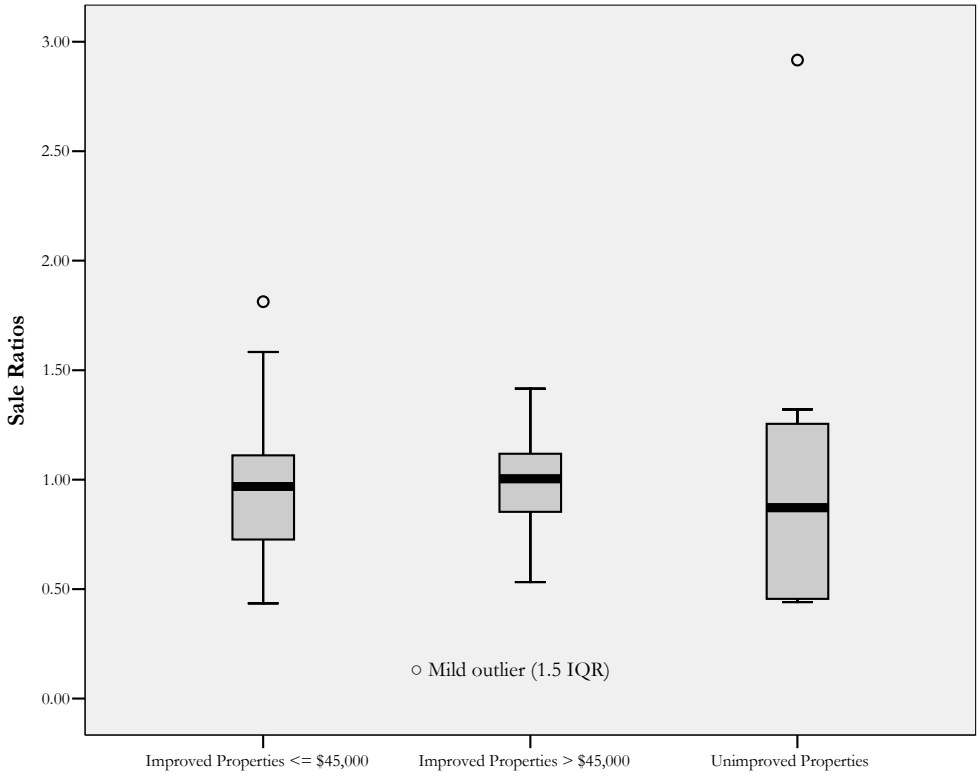
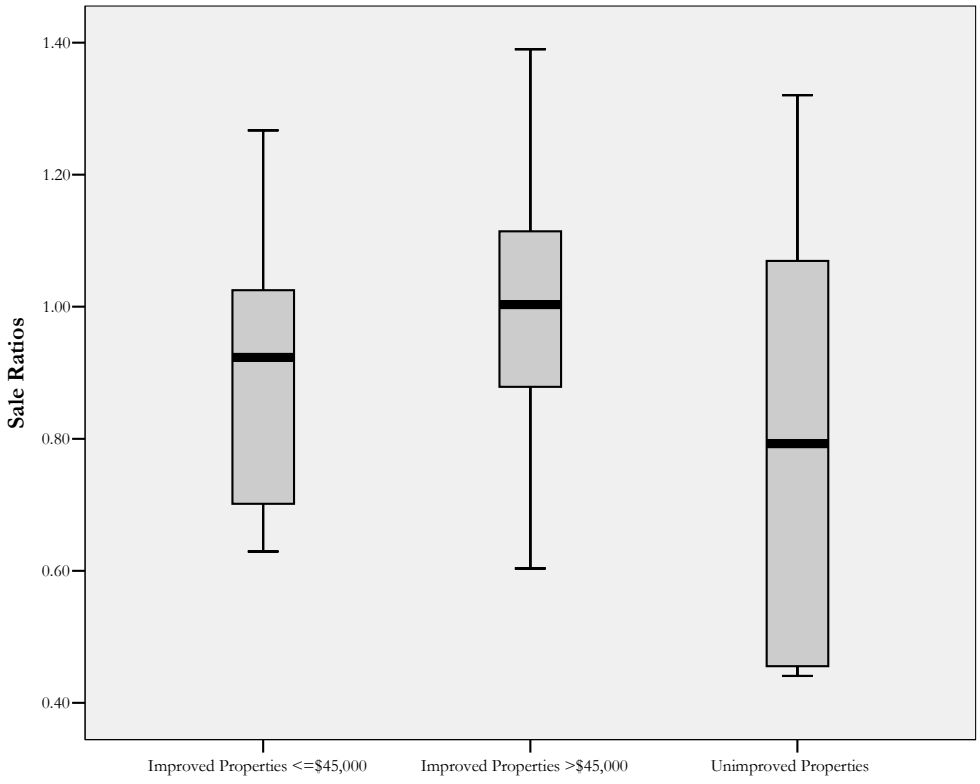
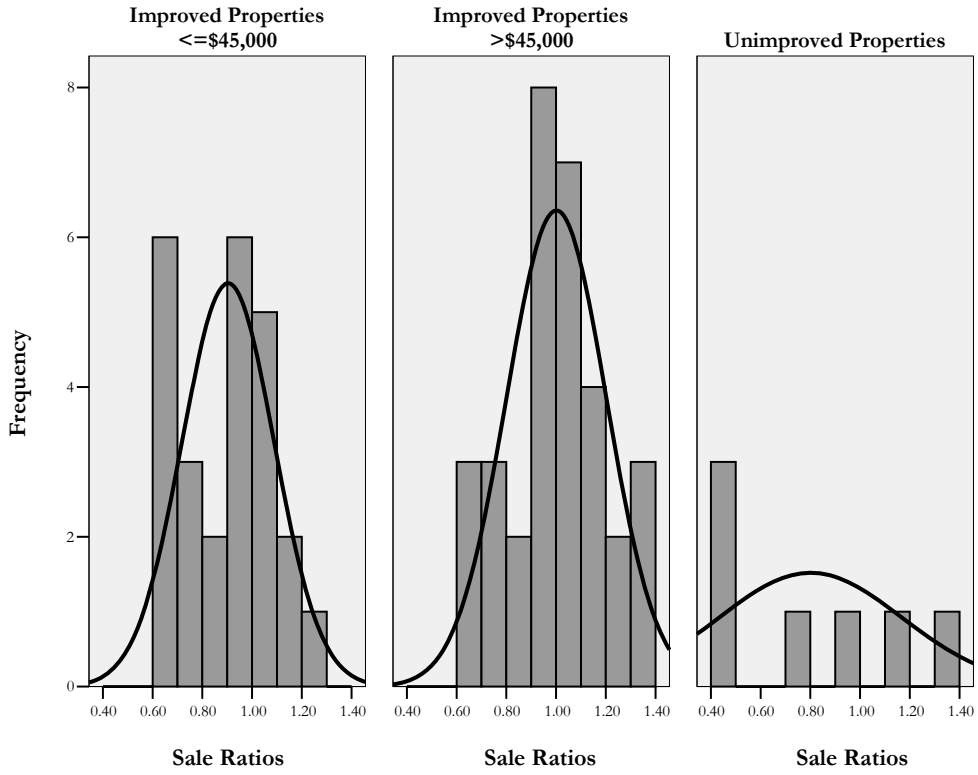



**Figure 2. Ratios after Outlier Trimming**



## Figure 3. Distribution of Final Sale Ratios




## Shapiro-Francia W' Tests for Normality for Various Strata

| Strata | Observations | W' | V' | z | Prob* |
|---|---|---|---|---|---|
| Single Family | 57 | 0.97637 | 1.358 | 0.596 | 0.27543 |
| Unimproved Properties | 7 | 0.90212 | 1.364 | 0.481 | 0.31534 |
| Improved Properties<=$45,000 | 25 | 0.95590 | 1.354 | 0.550 | 0.29112 |
| Improved Properties >$45,000 | 32 | 0.97988 | 0.741 | -0.562 | 0.71284 |
| Overall Un-weighted | 64 | 0.98444 | 0.980 | -0.040 | 0.51585 |
| *This value represents the indicated probability that the underlying population is normally distributed. A value of less than .05 indicates a distribution that is not normal. | | | | | |

## Table 2. Sales Ratio Analysis: Stratified by Property Use

| | | Strata | | |
|---|---|---|---|---|
| | | Single Family | Unimproved Properties | Overall Un-weighted |
| Number of Sales | | 57 | 7 | 64 |
| Median | | .979 | .792 | .972 |
| 95% Confidence Interval for Median | Lower Bound | .921 | .441 | .905 |
| | Upper Bound | 1.039 | 1.321 | 1.025 |
| Weighted Mean | | .939 | .937 | .939 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .876 | .616 | .878 |
| | Upper Bound | 1.001 | 1.259 | 1.000 |
| Minimum | | .604 | .441 | .441 |
| Maximum | | 1.390 | 1.321 | 1.390 |
| Std. Deviation | | .199 | .368 | .224 |
| Price Related Differential | | 1.021 | .854 | 1.002 |
| Coefficient of Dispersion | | .162 | .380 | .183 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 45.6% | 14.3% | 42.2% |

## Table 3. Sales Ratio Analysis: Stratified by Use and Value

| | | Strata | | | |
|---|---|---|---|---|---|
| | | Improved Properties <=$45,000 | Improved Properties >$45,000 | Unimproved Properties | Overall Un-weighted |
| Number of Sales | | 25 | 32 | 7 | 64 |
| Median | | .923 | 1.003 | .792 | .972 |
| 95% Confidence Interval for Median | Lower Bound | .752 | .921 | .441 | .905 |
| | Upper Bound | 1.019 | 1.091 | 1.321 | 1.025 |
| Weighted Mean | | .873 | .967 | .937 | .939 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .797 | .882 | .616 | .878 |
| | Upper Bound | .950 | 1.052 | 1.259 | 1.000 |
| Minimum | | .629 | .604 | .441 | .441 |
| Maximum | | 1.267 | 1.390 | 1.321 | 1.390 |
| Std. Deviation | | .185 | .201 | .368 | .224 |
| Price Related Differential | | 1.034 | 1.036 | .854 | 1.002 |
| Coefficient of Dispersion | | .170 | .152 | .380 | .183 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 44.0% | 46.9% | 14.3% | 42.2% |

## Table 4. Combined Results – Post Stratification and Weighting

| | Population Assessor's Value | Median | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Improved Properties <=$45,000 | 2,826,368 | 0.923 | 3,062,154 | 39.6% | 0.365 |
| Improved Properties >$45,000 | 4,435,263 | 1.003 | 4,421,997 | 57.1% | 0.573 |
| Unimproved Properties | 204,526 | 0.792 | 258,240 | 3.3% | 0.026 |
| Total | 7,466,158 | | 7,742,392 | 100.0% | 96.4% |

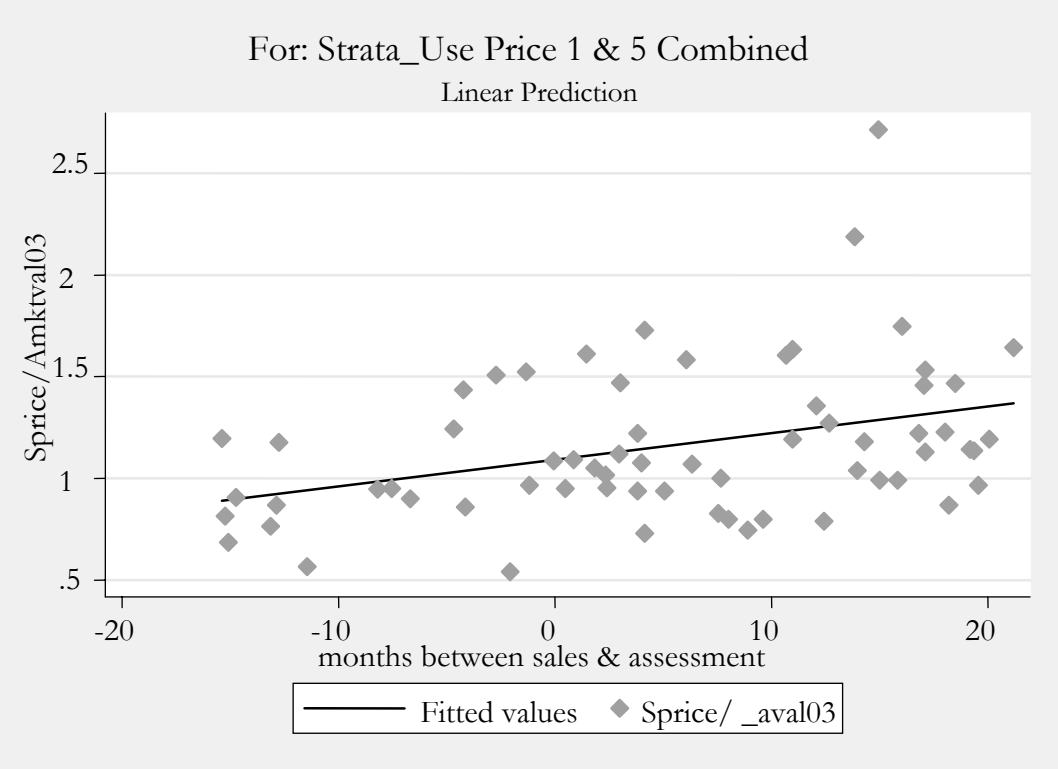
| | Population Assessor's Value | Weighted Mean | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Improved Properties <=$45,000 | 2,826,368 | 0.873 | 3,237,535 | 40.3% | 0.351 |
| Improved Properties >$45,000 | 4,435,263 | 0.967 | 4,586,622 | 57.0% | 0.551 |
| Unimproved Properties | 204,526 | 0.937 | 218,278 | 2.7% | 0.025 |
| Total | 7,466,158 | | 8,042,435 | 100.0% | 92.8% |

## Table 5. Sales Ratio Analysis: Stratified by Age

| | | Strata | | | |
|---|---|---|---|---|---|
| | | Unimproved Properties | Built before 1955 | Built 1955 And Newer | Overall Un-weighted |
| Number of Sales | | 7 | 31 | 26 | 64 |
| Median | | .792 | .923 | 1.029 | .972 |
| 95% Confidence Interval for Median | Lower Bound | .441 | .752 | .979 | .905 |
| | Upper Bound | 1.321 | .998 | 1.124 | 1.025 |
| Weighted Mean | | .937 | .853 | 1.013 | .939 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .616 | .778 | .923 | .878 |
| | Upper Bound | 1.259 | .929 | 1.102 | 1.000 |
| Minimum | | .441 | .604 | .645 | .441 |
| Maximum | | 1.321 | 1.193 | 1.390 | 1.390 |
| Std. Deviation | | .368 | .175 | .197 | .224 |
| Price Related Differential | | .854 | 1.044 | 1.026 | 1.002 |
| Coefficient of Dispersion | | .380 | .161 | .149 | .183 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 14.3% | 51.6% | 38.5% | 42.2% |

**Graph 1. Improved Property Price Trend**

A thorough analysis of price-time trends by price strata determined that adjusting reported prices was desirable for the lowest and highest valued improved property strata. The prices for these strata ranged from $12,000 - $142,000. The resultant trend and statistical analysis is shown below.




**Price Trend Regression Statistics**

| Source | SS | df | MS | | |
|---|---|---|---|---|---|
| Model | .855746761 | 1 | .855746761 | Number of obs = 64 | R-squared = 0.1305 |
| Residual | 5.70242379 | 62 | .091974577 | F( 1, 55) = 9.30 | Adj R-squared= 0. 1165 |
| Total | 6.55817055 | 63 | .104097945 | Prob > F = 0. 0034 | Root MSE = .30327 |

| _aratio | Coef. | Std. Err. | T | P> t | [80% Conf. Interval] | |
|---|---|---|---|---|---|---|
| _adjperiod | .0110503 | .0036227 | 3.05 | 0.003 | .0063576 | .0157431 |
| _cons | 1.078774 | .0420519 | 25.65 | 0.000 | 1.024302 | 1.133246 |
| Monthly adjustment rate=.0102434 | | | | Annualized adjustment rate=.1229206 | | |

# Chapter 18. Montgomery County

## 1. Significant Findings

1.1 Assessment Level: Montgomery County's 2003 residential property assessments were approximately 74% of market value (Section 3.5). The results from the corresponding STC study are invalid because the STC's appraisals did not meet the requirement that they reflect market values (Section 4.3). Furthermore, the STC's sample is not representative of residential property for the county (Section 4.2).

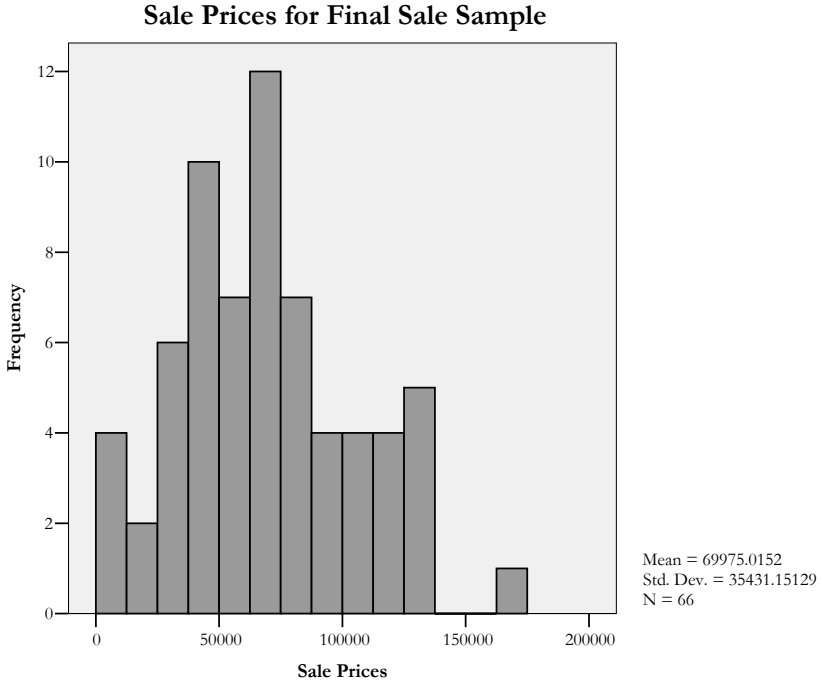
1.2 Assessment Equity: Lower-valued properties, older properties, and properties outside of Montgomery City are assessed less uniformly and at lower levels than other properties (Section 3.6 and Tables 3, 5 & 6).

1.3 Reassessment History: One indicator of market value changes suggests that two of the past four biennial reassessments have produced lower value increases than the market. Cumulatively, the reassessments from 1997 through 2003 produced only 26% of the expected rise in assessments. The net change in assessments in 1999 and 2003 raises questions regarding whether any serious revaluation occurred (Section 5.1).

## 2. Data and Related Issues

2.1 Assessment Data: Sales and assessment information were matched at the county offices. Subsequently, the assessor reviewed the matched parcels and provided further information that assisted our screening process.

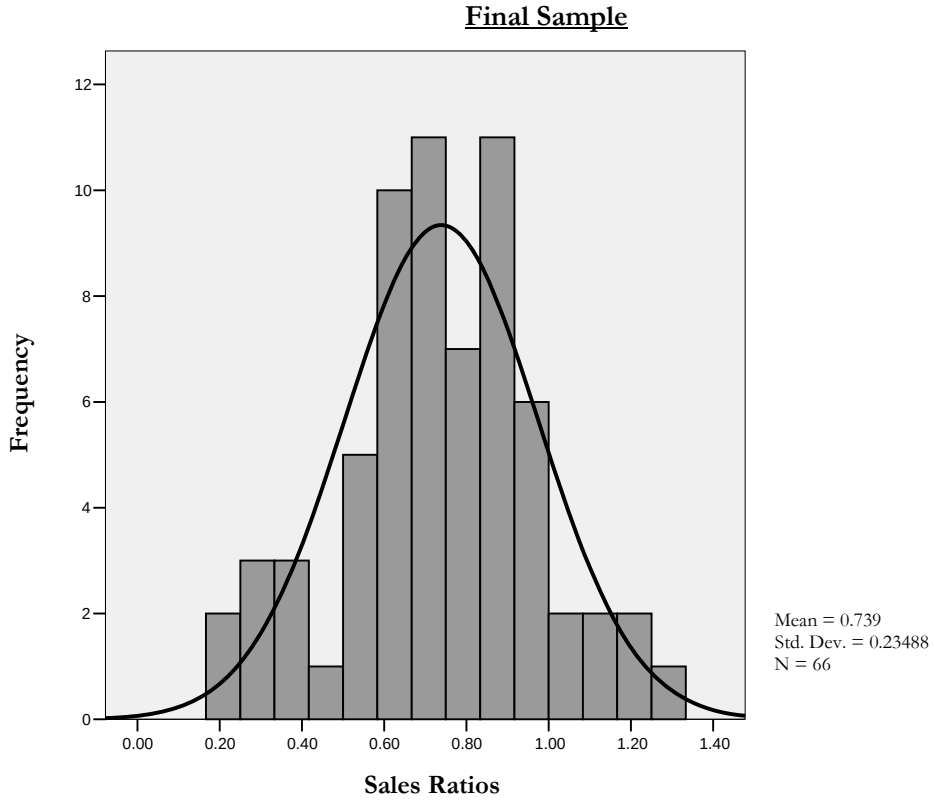
2.2 Sales and Ratio Data: The distribution of sale prices used is reflected in the following histogram.



The next table reports results of the data screening and trimming process. The "screened sales" represent the initial screened sample. The screened sales that were excluded from the final analysis because their ratios were deemed unrepresentative are identified as high or low trims. The "remaining ratios" represent the sample on which all the study's results are based.

| Trimming of Outliers | | | | | |
|---|---|---|---|---|---|
| | | Improved Properties <=$50,400 | Improved Properties >$50,400 | Unimproved Properties | Total |
| **Screened Sales** | | 35 | 30 | 7 | 72 |
| Excluded | High Trims | 2 | 2 | 1 | 5 |
| | Low Trims | 0 | 0 | 1 | 1 |
| **Remaining Ratios** | | **33** | **28** | **5** | **66** |

The histogram below shows the distribution of the ratios for the sample.




2.3 Population: Since a complete copy of the assessment rolls in electronic form was not available, we used the best available alternative as a pseudo-population (hereinafter, "the population"), i.e. four random samples that were drawn and used by the STC.

## 3. Ratio Study Results

3.1 The Sample: The following table shows that the two improved property strata vary from 3.2% to 5.8% from the population. Initially, this exhibits excessive variability from the sample to the

population. However, upon closer examination, this variation has no material effect and thus we conclude that the un-stratified sample is sufficiently representative of the population.

| Comparing Representivity | | | | | | |
|---|---|---|---|---|---|---|
| | Population Distribution | | | PPRC 2003 Sale Sample | | |
| Strata | N | $ | $ Weight | N | $ | $ Weight |
| Improved Properties <=$50,400 | 80 | 1,961,315 | 35.6% | 33 | 1,110,495 | 32.4% |
| Improved Properties >$50,400 | 40 | 3,356,894 | 61.0% | 28 | 2,288,105 | 66.8% |
| Unimproved Properties | 24 | 187,631 | 3.4% | 5 | 26,226 | 0.8% |
| Total | 144 | 5,505,840 | | 66 | 3,424,826 | |

3.2 Representing the Population with the Sample: Since the un-stratified sample is sufficiently representative of the population (Section 3.1), the use of stratification and weighting is not essential. Nevertheless, we used stratification because it produces additional analytical benefits and further optimizes representivity.

3.3 Sales Chasing: There was no indication of sales chasing.

3.4 Study Validity: The sample meets the requirements for producing valid inferences about the county's population of residential properties.

3.5 Assessment Level: Measures of the assessment level are summarized below. For the purposes of this study, the weighted mean from combined stratification is the preferred measure as long as both of the requirements from using the weighted mean are met. In this case, the distributions are normal (Figure 3) and weighting is compromised by the use of seriously undersized samples. Since both requirements are not met, we focus on the median, though taking notice of the weighted mean, to conclude that the County's assessments for 2003 reflect approximately 74% of market value.

| Assessment Level (Based on Percent of Market Value) | | | | |
|---|---|---|---|---|
| | Stratification and Weighting | Reference | Weighted Mean | Median |
| **Overall Un-weighted** | None | Table 3 | 74.2% | 74.5% |
| **Combined** | By Property Use and Value Range | Table 4 | 72.8% | 74.4% |

3.6 Equity Measures and Evaluation:

i. Uniformity within Strata: Tables 2, 3, 5 & 6 show results for individual strata of sufficient sample size for evaluation. The following strata represent problem areas for internal uniformity.

| Strata with Inadequate Uniformity | |
|---|---|
| **Property Strata** | **COD** |
| Overall Un-weighted | 23.8% |
| Single Family | 21.6% |
| Improved Properties <= $50,400 | 30.6% |
| Montgomery City Area | 21.9% |
| All Other Areas | 24.1% |
| Built before 1980 | 23.5% |

ii. Uniformity between Strata: Another form of inequity exists when different strata are assessed at different levels. The IAAO has established guidelines for identifying such inequity, but compliance can be heavily affected by sample size and uniformity. Therefore, we confine our remarks to identifying where assessment levels differ markedly from the norm. We find the difference in medians between lower and higher valued strata (65% versus 82% respectively, Table 3), the higher median for properties in the Montgomery City area (80% versus 71%, Table 5), and the difference in medians between older and newer properties (65% versus 86% respectively, Table 6) notable.

iii. Vertical Equity: The final form of potential inequity examined is vertical equity. The PRD for the overall sample of 0.997 complies with the IAAO standard.

## 4. STC Study

4.1 Comparative Results: The following table contrasts our results with those from the STC study. The STC found the level of assessment adequate, ours does not. The STC reports acceptable horizontal equity and vertical equity measure, while we find a similar vertical equity measure but a slightly substandard horizontal equity measure. We have already demonstrated that the PPRC study meets the criteria for achieving valid results. The rest of Section 4 examines the validity of the STC's study.

| Comparison of Study Results | | | |
|---|---|---|---|
| **Measure** | **STC Study*** | **PPRC Study*** | **PPRC Study Combined**** |
| Assessment Level - median | 99.3% | 74.5% | 74.4% |
| Assessment Level - wtd. mean | 97.0% | 74.2% | 72.8% |
| COD | 9.1% | 23.8% | |
| PRD | 1.00 | 1.00 | |
| Sample Size | 35 | 66 | |
| Relative Precision | 1.00 | 1.37 | |
| * Overall sample (un-stratified and un-weighted) | | | |
| ** Stratification and weighting by Property Use and Value Range | | | |

4.2 Representing the Population with the Sample: The STC does not examine the representivity of its sample, nor does it have the necessary sample size or information to do so. Therefore, in the following table, we provide that missing analysis. In this case, the table shows that all three of the strata in the STC sample vary from 4.1% to 8.6%. Initially, this exhibits excessive variability from the sample to the population. Upon closer examination, this variation has a cumulative material effect on the overall assessment level and thus we conclude that the STC sample is insufficiently representative of the population.

| Comparing Representivity | | | | | | |
|---|---|---|---|---|---|---|
| | **Population** | | | **STC 2003 Appraisals** | | |
| **Strata** | **N** | **$** | **%** | **N** | **$** | **%** |
| Improved Properties <=$50,400 | 80 | 1,961,315 | 35.6% | 17 | 431,473 | 27.0% |
| Improved Properties >$50,400 | 40 | 3,356,894 | 61.0% | 12 | 1,044,052 | 65.4% |
| Unimproved Properties | 24 | 187,631 | 3.4% | 6 | 119,947 | 7.5% |
| Total | 144 | 5,505,840 | | 35 | 1,595,472 | |

4.3 Market Value: The final requirement for producing a valid appraisal study is that appraisals must represent market values. As discussed in the introduction for this Section II, and in greater depth in

the Procedure Manual (Section III), we use 4 tests to make this determination. The results of each test are reported in the following tables.

| Mann-Whitney Test | | | | |
|---|---|---|---|---|
| **For the Entire Sample** | | | | |
| Study | Observations | Rank sum | Expected | Ho: Ratios (35 STC Appraisals)=Ratios (66 Sales)<br>z = 5.481<br>Prob > \|z\| = 0.0000 |
| 0 | 35 | 2553 | 1785 | |
| 1 | 66 | 2598 | 3366 | |
| Combined | 101 | 5151 | 5151 | |
| **For Single Family Properties Only** | | | | |
| Study | Observations | Rank sum | Expected | Ho : Ratios (29 STC Appraisals)=Ratios (59 Sales)<br>z = 5.419<br>Prob > \|z\| = 0.0000 |
| 0 | 29 | 1901 | 1290.5 | |
| 1 | 59 | 2015 | 2625.5 | |
| Combined | 88 | 3916 | 3916 | |

| K-Sample Test | | | | |
|---|---|---|---|---|
| **For the Entire Sample** | | | | |
| Study | Not Greater than the median | Greater than the median | Total | Ho: Ratios (35 STC Appraisals)=Ratios (66 Sales)<br>Pearson chi2(1) = 32.7007 Pr = 0.000<br>Continuity corrected:<br>Pearson chi2(1) = 30.3528 Pr = 0.000 |
| 0 | 4 | 31 | 35 | |
| 1 | 47 | 19 | 66 | |
| Total | 51 | 50 | 101 | |
| **For Single Family Properties Only** | | | | |
| Study | Not Greater than the median | Greater than the median | Total | Ho: Ratios (29 STC Appraisals)=Ratios (59 Sales)<br>Pearson chi2(1) = 22.6815 Pr = 0.000<br>Continuity corrected:<br>Pearson chi2(1) = 20.5728 Pr = 0.000 |
| 0 | 4 | 25 | 29 | |
| 1 | 40 | 19 | 59 | |
| Total | 44 | 44 | 88 | |

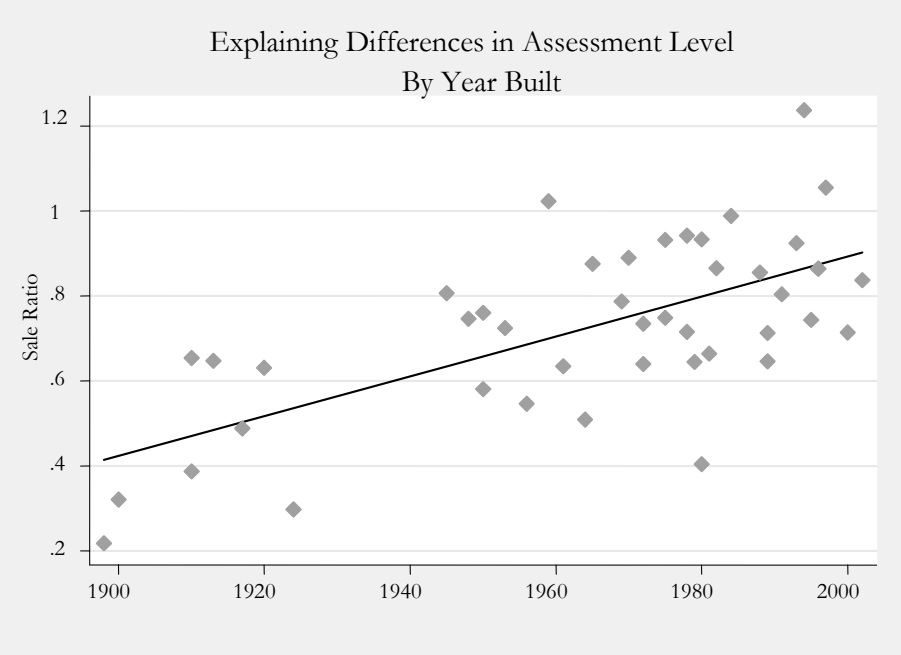
All four tests lead to the conclusion that the STC appraisals do not represent market values (all with 99% statistical confidence). Therefore, the STC study is invalid and its reported results are unreliable.

## 5. Additional Analysis and Findings

5.1 Analysis of Reassessment History: The following table provides a comparison of actual assessment changes (net of new construction) to those that might have been expected for each of the last four reassessments as well as the six-year period leading up to 2003. Only two of the reassessments produced changes in line with the market indicator.

| Actual Value Changes from Reassessment vs. Expected Value Change | | | |
|---|---|---|---|
| Biennial Year | % Net Assessment Change | Missouri OFHEO Index | % Value Change: Actual vs. Expected |
| 1999 | 0.1 | 8.4 | 1% |
| 2001 | 9.4 | 11.4 | 82% |
| 2003 | -0.3 | 11.8 | -3% |
| 2005 | 12.0 | 12.4 | 97% |
| Cumulative 1997 - 2003 | 9.1 | 35.0 | 26% |

5.2 Analysis of the Effect of Age on Assessment Level: We previously suggested that the different assessment levels for low and high valued properties might be explained by a correlation with age differences. In fact, we found that the lower valued stratum's average year built was 1949 whereas the higher value stratum's average year built was 1982. The effect of property age is clearly evident in the graph below.




The newer the properties, the higher the percentage of market value assessments represent. A regression analysis (results shown in the following table) demonstrates that the explanatory relationship is statistically significant (99% confidence level) and reports that this single difference in property characteristic (property age) explains 42% of the differences in assessment level between properties (see Adj R-squared).

| Source | SS | df | MS | | |
|---|---|---|---|---|---|
| Model | .825900526 | 1 | .825900526 | Number of obs = 44 | R-squared = 0.4369 |
| Residual | 1.06446479 | 42 | .0253444 | F( 1, 42) = 32.59 | Adj R-squared= 0.4235 |
| Total | 1.89036532 | 43 | .043961984 | Prob > F = 0.0000 | Root MSE = .1592 |

| Sale Ratio | Coef. | Std. Err. | t | P> t | [80% Conf. Interval] | |
|---|---|---|---|---|---|---|
| Year Built | .0046903 | .0008216 | 5.71 | 0.000 | .0030322 | .0063484 |
| _cons | -8.487865 | 1.614464 | -5.26 | 0.000 | -11.74598 | -5.229744 |

Exploring this relationship and its effects is not a primary objective of this study. Nevertheless, it is clear that correcting this inequity would produce improved assessment results and a fairer distribution of the local tax burden.

## 6. Figures and Tables

**Table 1. STC's Appraisal Ratio Studies**

| | | Group | | | |
|---|---|---|---|---|---|
| | | 1999 | 2001 | 2003 | 2005* |
| Number of Appraisals | | 36 | 38 | 35 | 35 |
| Median | | .989 | 1.008 | .993 | .984 |
| 95% Confidence Interval | Lower Bound | .942 | .939 | .965 | .733 |
| for Median | Upper Bound | 1.030 | 1.111 | 1.018 | 1.026 |
| Weighted Mean | | .963 | 1.040 | .970 | .957 |
| 95% Confidence Interval | Lower Bound | .925 | .949 | .925 | .842 |
| for Weighted Mean | Upper Bound | 1.001 | 1.131 | 1.014 | 1.073 |
| Minimum | | .564 | .478 | .137 | .516 |
| Maximum | | 3.211 | 2.118 | 1.205 | 4.190 |
| Std. Deviation | | .434 | .318 | .174 | .619 |
| Price Related Differential | | 1.101 | 1.030 | .995 | 1.102 |
| Coefficient of Dispersion | | .220 | .206 | .091 | .321 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 50.0% | 44.7% | 77.1% | 28.6% |

* The STC has not completed its studies for the 2005 reassessment cycle. These results may not represent final values.

**Figure 1. Ratios before Outlier Trimming**

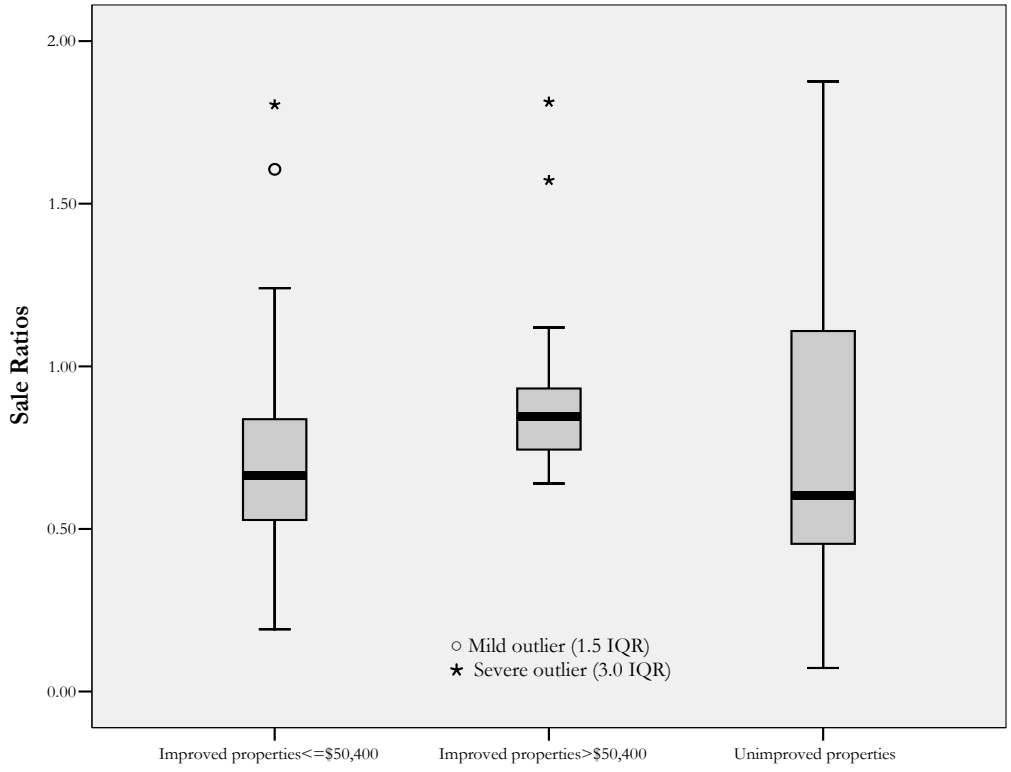
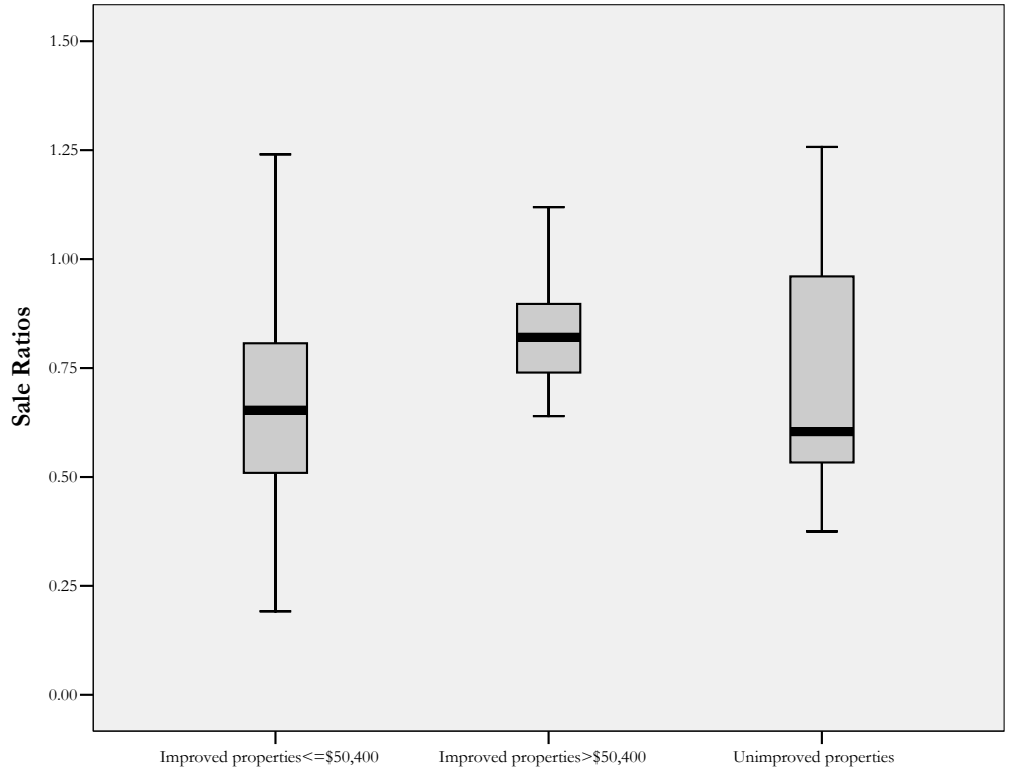
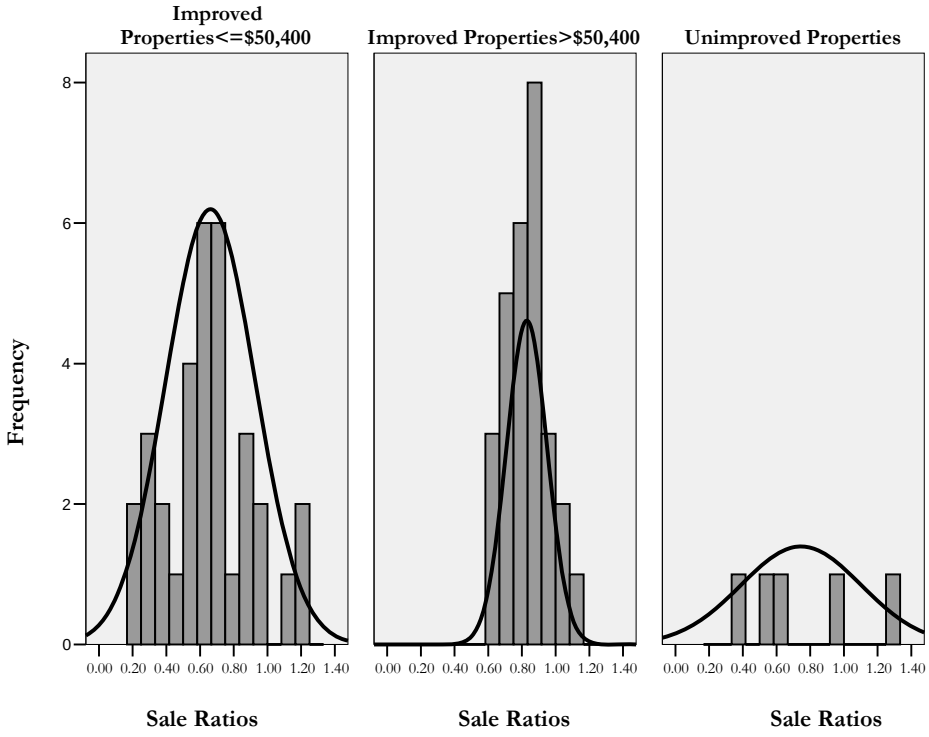



**Figure 2. Ratios after Outlier Trimming**



## Figure 3. Distribution of Final Sale Ratios




## Shapiro-Francia W' Tests for Normality for Various Strata

| Strata | Observations | W' | V' | z | Prob* |
|---|---|---|---|---|---|
| Single Family | 59 | 0.95943 | 2.397 | 1.679 | 0.04654 |
| Multi-family | 2 | . | . | . | . |
| Unimproved Properties | 5 | .0.93845 | .0.766 | -0.337 | 0.63178 |
| Improved Properties | 61 | 0.96959 | 1.845 | 1.188 | 0.11740 |
| Improved Properties <=$50,400 | 33 | 0.97512 | 0.938 | -0.120 | 0.54789 |
| Improved Properties >$50,400 | 28 | 0.97178 | 0.941 | -0.112 | 0.54446 |
| Overall Un-weighted | 66 | 0.97985 | 1.301 | 0.519 | 0.30185 |
| *This value represents the indicated probability that the underlying population is normally distributed. A value of less than .05 indicates a distribution that is not normal. | | | | | |

## Table 2. Sales Ratio Analysis: Stratified by Property Use

| | | Strata | | | |
|---|---|---|---|---|---|
| | | Single Family | Unimproved Properties | Multi-family | Overall Un-weighted |
| Number of Sales | | 59 | 5 | 2 | 66 |
| Median | | .744 | .604 | 1.109 | .745 |
| 95% Confidence Interval for Median | Lower Bound | .702 | .375 | 1.098 | .702 |
| | Upper Bound | .804 | 1.257 | 1.119 | .807 |
| Weighted Mean | | .734 | .610 | 1.110 | .742 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .678 | .308 | .977 | .686 |
| | Upper Bound | .790 | .912 | 1.244 | .797 |
| Minimum | | .192 | .375 | 1.098 | .192 |
| Maximum | | 1.240 | 1.257 | 1.119 | 1.257 |
| Std. Deviation | | .219 | .357 | .015 | .235 |
| Price Related Differential | | .989 | 1.223 | .998 | .997 |
| Coefficient of Dispersion | | .216 | .434 | .010 | .238 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 13.6% | 20.0% | 50.0% | 15.2% |

## Table 3. Sales Ratio Analysis: Stratified by Use and Value

| | | Strata | | | |
|---|---|---|---|---|---|
| | | Improved Properties <=$50,400 | Improved Properties >$50,400 | Unimproved Properties | Overall Un-weighted |
| Number of Sales | | 33 | 28 | 5 | 66 |
| Median | | .653 | .821 | .604 | .745 |
| 95% Confidence Interval for Median | Lower Bound | .547 | .761 | .375 | .702 |
| | Upper Bound | .746 | .865 | 1.257 | .807 |
| Weighted Mean | | .613 | .828 | .610 | .742 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .521 | .779 | .308 | .686 |
| | Upper Bound | .705 | .877 | .912 | .797 |
| Minimum | | .192 | .640 | .375 | .192 |
| Maximum | | 1.240 | 1.119 | 1.257 | 1.257 |
| Std. Deviation | | .266 | .121 | .357 | .235 |
| Price Related Differential | | 1.080 | 1.001 | 1.223 | .997 |
| Coefficient of Dispersion | | .306 | .117 | .434 | .238 |
| Coefficient of Concentration | Percent between .9 & and 1.1 inclusive | 9.1% | 21.4% | 20.0% | 15.2% |

## Table 4. Combined Results – Post Stratification and Weighting

| | Population Assessor's Value | Median | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Improved Properties <=$50,400 | 1,961,315 | 0.653 | 3,003,545 | 40.6% | 0.265 |
| Improved Properties >$50,400 | 3,356,894 | 0.821 | 4,088,787 | 55.2% | 0.453 |
| Unimproved Properties | 187,631 | 0.604 | 310,647 | 4.2% | 0.025 |
| Total | 5,505,840 | | 7,402,979 | 100.0% | 74.4% |

| | Population Assessor's Value | Weighted Mean | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Improved Properties <=$50,400 | 1,961,315 | 0.613 | 3,199,535 | 42.3% | 0.259 |
| Improved Properties >$50,400 | 3,356,894 | 0.828 | 4,054,220 | 53.6% | 0.444 |
| Unimproved Properties | 187,631 | 0.61 | 307,592 | 4.1% | 0.025 |
| Total | 5,505,840 | | 7,561,347 | 100.0% | 72.8% |

## Table 5. Sales Ratio Analysis: Stratified by Location

| | | Strata | | |
|---|---|---|---|---|
| | | Montgomery City Area | All Other Areas | Overall Un-weighted |
| Number of Sales | | 36 | 30 | 66 |
| Median | | .796 | .713 | .745 |
| 95% Confidence Interval for Median | Lower Bound | .715 | .640 | .702 |
| | Upper Bound | .864 | .789 | .807 |
| Weighted Mean | | .769 | .705 | .742 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .691 | .627 | .686 |
| | Upper Bound | .847 | .783 | .797 |
| Minimum | | .218 | .192 | .192 |
| Maximum | | 1.257 | 1.240 | 1.257 |
| Std. Deviation | | .233 | .238 | .235 |
| Price Related Differential | | .993 | 1.006 | .997 |
| Coefficient of Dispersion | | .219 | .241 | .238 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 19.4% | 10.0% | 15.2% |

## Table 6. Sales Ratio Analysis: Stratified by Age

| | | Strata | | |
|---|---|---|---|---|
| | | Built before 1980 | Built 1980 through 2003 | Overall Un-weighted |
| Number of Sales | | 27 | 17 | 44 |
| Median | | .653 | .855 | .739 |
| 95% Confidence Interval for Median | Lower Bound | .581 | .714 | .653 |
| | Upper Bound | .761 | .925 | .807 |
| Weighted Mean | | .678 | .812 | .739 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .591 | .712 | .673 |
| | Upper Bound | .764 | .911 | .804 |
| Minimum | | .218 | .404 | .218 |
| Maximum | | 1.023 | 1.237 | 1.237 |
| Std. Deviation | | .201 | .184 | .210 |
| Price Related Differential | | .978 | 1.023 | .985 |
| Coefficient of Dispersion | | .235 | .152 | .214 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 11.1% | 23.5% | 15.9% |

# Chapter 19. Phelps County

## 1. Significant Findings

1.1 Assessment Level: Phelps County's 2003 residential property assessments were approximately 77% of market value (Section 3.5). The results from the corresponding STC study are invalid because the STC's appraisals did not meet the requirement that they reflect market values (Section 4.3). Furthermore, the STC's sample is not representative of residential property for the county (Section 4.2).

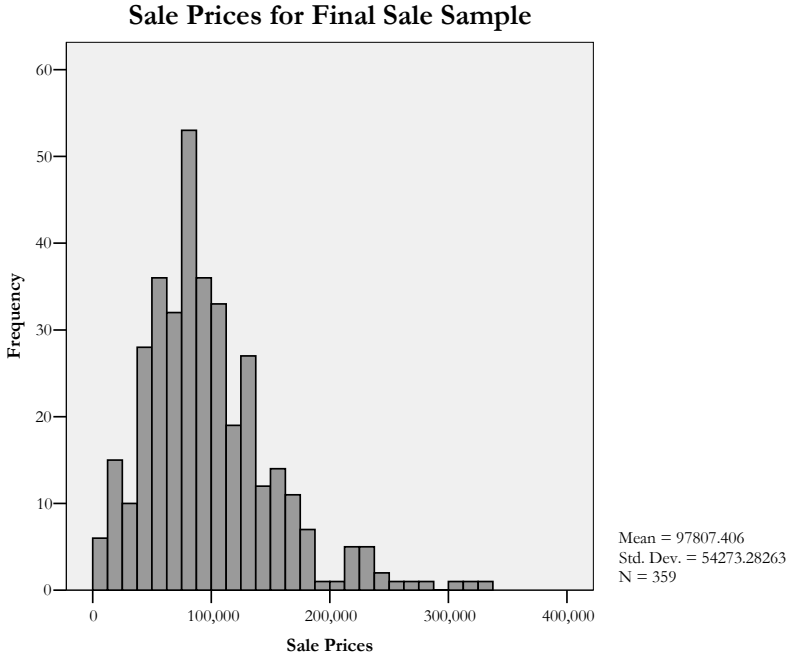
1.2 Assessment Equity: Lower-valued and older properties are assessed less uniformly and at lower levels than higher-valued and newer properties respectively (Section 3.7 and Tables 4 & 8).

1.3 Reassessment History: One indicator of market value changes suggests that three of the past four biennial reassessments have produced lower value increases than the market. Cumulatively, the reassessments from 1997 through 2003 produced only 28% of the expected rise in assessments. The net change in assessments in 1999, 2003, and 2005 raises questions regarding whether any serious revaluation occurred (Section 5.1).

## 2. Data and Related Issues

2.1 Assessment Data: Sales and assessment information was available in electronic format. Sales were matched using a combination of computer techniques and software and then screened. The assessor answered all questions regarding the contents and coding of data when requested. The files received contained information allowing us to identify properties affected by new construction and to screen as appropriate.

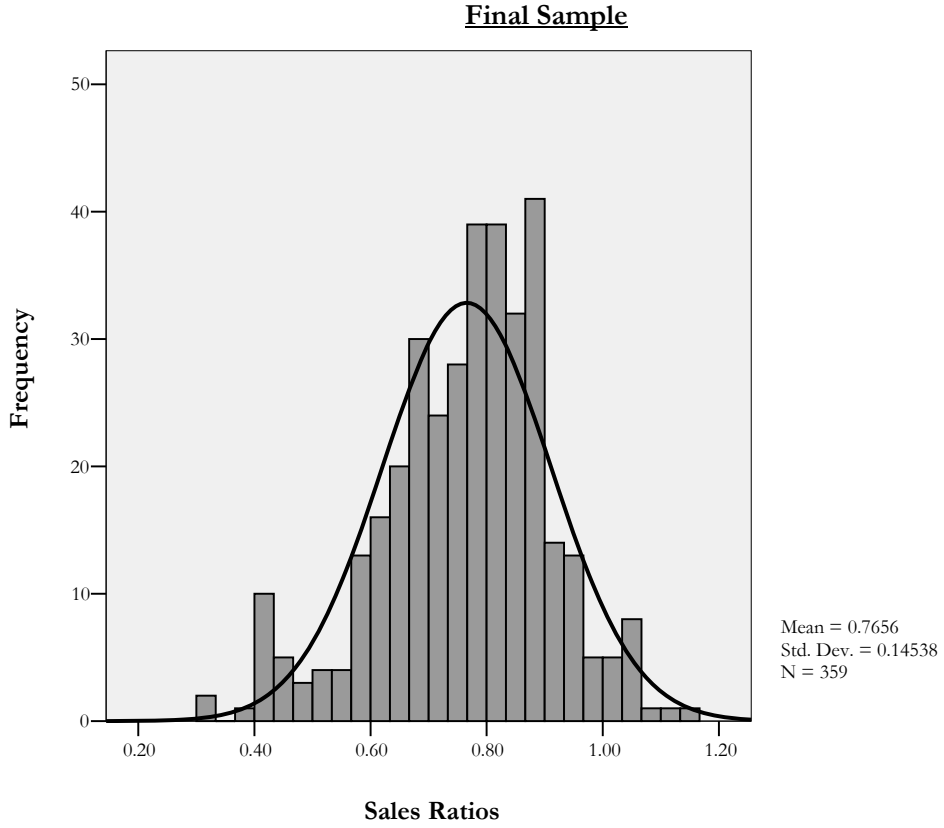
2.2 Sales and Ratio Data: The distribution of sale prices used is reflected in the following histogram.



The next table reports results of the data screening and trimming process. The "screened sales" represent the initial screened sample. The screened sales that were excluded from the final analysis because their ratios were deemed unrepresentative are identified as high or low trims. The "remaining ratios" represent the sample on which all the study's results are based.

| Trimming of Outliers | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Single Family <=$42,000 | Single Family >$42,000 & <=$62,500 | Single Family >$62,500 & <=$85,000 | Single Family >$85,000 & <=$115,000 | Single Family >$115,000 | Multi-family | Un-improved Properties | Total |
| **Screened Sales** | | 71 | 72 | 82 | 65 | 50 | 16 | 20 | 376 |
| Excluded | High Trims | 6 | 4 | 1 | 1 | 0 | 0 | 0 | 12 |
| | Low Trims | 1 | 0 | 1 | 1 | 0 | 0 | 2 | 5 |
| **Remaining Ratios** | | **64** | **68** | **80** | **63** | **50** | **16** | **18** | **359** |

The histogram below shows the distribution of the ratios for the sample.




2.3 Population: Since a complete copy of the 2003 assessment rolls in electronic form was available, we were able to analyze the county's population in detail. This allowed us to stratify and weight sales on a variety of property and location characteristics.

## 3. Ratio Study Results

3.1 The Sample: The following table shows that four of the single-family value strata vary from 3.6% to 7.0% from the population. Initially, this exhibits excessive variability from the sample to the population. Upon closer examination, this variation has a cumulative material effect on the overall assessment level and thus we conclude that the un-stratified sample is insufficiently representative of the population.

| Comparing Representivity | | | | | | |
|---|---|---|---|---|---|---|
| | Population Distribution | | | PPRC 2003 Sale Sample | | |
| Strata | N | $ | $ Weight | N | $ | $ Weight |
| Single Family <=$42,000 | 3,170 | 88,137,200 | 13.7% | 64 | 2,020,400 | 7.3% |
| Single Family >$42,000 & <=$62,500 | 1,841 | 95,622,300 | 14.8% | 68 | 3,572,500 | 13.0% |
| Single Family >$62,500 & <=$85,000 | 1,485 | 107,881,700 | 16.7% | 80 | 5,917,100 | 21.5% |
| Single Family >$85,000 & <=$115,000 | 987 | 96,661,100 | 15.0% | 63 | 6,103,900 | 22.2% |
| Single Family >$115,000 | 949 | 163,888,400 | 25.4% | 50 | 7,965,900 | 29.0% |
| Multi-family | 523 | 56,504,700 | 8.8% | 16 | 1,778,400 | 6.5% |
| Unimproved Properties | 2,839 | 35,414,800 | 5.5% | 18 | 135,800 | 0.5% |
| Total | 11,794 | 644,110,200 | | 359 | 27,494,000 | |

3.2 Representing the Population with the Sample: Since the un-stratified sample is insufficiently representative of the population (Section 3.1), the use of stratification and weighting is essential. Furthermore, stratification provides additional analytical benefits.

3.3 Sales Chasing: There was no indication of sales chasing.

3.4 Study Validity: Once the sample has been stratified and weighted, all requirements for producing valid inferences about the county's population of residential properties are met.

3.5 Assessment Level: Measures of the assessment level are summarized below. For the purposes of this study, the weighted mean from combined stratification is the preferred measure as long as both of the requirements for using the weighted mean are met. In this case, the distributions are approximately normal (Figure 3) and weighting is not severely compromised by the use of seriously undersized samples. Since both requirements are met, we focus on the weighted mean, though taking notice of the median, to conclude that the County's assessments for 2003 reflect approximately 77% of market value.

| Assessment Level (Based on Percent of Market Value) | | | | |
|---|---|---|---|---|
| | Stratification and Weighting | Reference | Weighted Mean | Median |
| **Overall Un-weighted** | None | Table 2 | 78.3% | 78.1% |
| **Combined** | By Property Use | Table 3 | 76.7% | 75.8% |
| **Combined** | By Property Use and Value Range | Table 5 | 77.9% | 76.1% |
| **Combined** | By Property Location | Table 7 | 76.3% | 75.5% |
| **Combined** | By Property Age | Table 9 | 76.9% | 78.0% |
| **Combined** | By Property Town and Rural Lots | Table 11 | 78.1% | 77.3% |

3.6 Equity Measures and Evaluation:

i. Uniformity within Strata: Tables 2, 4, 6, 8 & 10 show results for individual strata of sufficient sample size for evaluation. The following strata represent problem areas for internal uniformity.

| Strata with Inadequate Uniformity | |
|---|---|
| **Property Strata** | **COD** |
| Unimproved Properties | 35.8% |
| R-2 School District | 22.3% |
| Built before 1950 | 24.5% |

ii. Uniformity between Strata: Another form of inequity exists when different strata are assessed at different levels. The IAAO has established guidelines for identifying such inequity, but compliance can be heavily affected by sample size and uniformity. Therefore, we confine our remarks to identifying where assessment levels differ markedly from the norm. The difference in assessment levels (medians) between the lower and higher valued single family strata (67% versus 74-87% respectively, Table 4) and between older and newer properties (68% versus 73-87%, respectively, Table 8) are notable.

iii. Vertical Equity: The final form of potential inequity examined is vertical equity. The PRD for the overall sample of 0.978 complies with the IAAO standard.

## 4. STC Study

4.1 Comparative Results: The following table contrasts our results with those from the STC study. The STC found the level of assessment adequate, while ours does not. The STC reports substandard measures for horizontal and vertical equity, while our analysis finds otherwise. We have already demonstrated that the PPRC study meets the criteria for achieving valid results. The rest of Section 4 examines the validity of the STC's study.

| Comparison of Study Results | | | |
|---|---|---|---|
| **Measure** | **STC Study*** | **PPRC Study*** | **PPRC Study Combined**** |
| Assessment Level - median | 93.9% | 78.1% | 76.1% |
| Assessment Level - weighted mean | 95.7% | 78.3% | 77.9% |
| COD | 24.3% | 14.4% | |
| PRD | 0.95 | 0.98 | |
| Sample Size | 35 | 359 | |
| Relative Precision | 1.00 | 3.20 | |
| * Overall sample (un-stratified and un-weighted) | | | |
| ** Stratification and weighting by Property Use and Value Range | | | |
| NOTE: Value used for the Equivalent Sale Ratio from the 2003/2004 cycle: 100%, which was based on having a COD less than 25%. | | | |

4.2 Representing the Population with the Sample: The STC does not examine the representivity of its sample, nor does it have the necessary sample size or information to do so. Therefore, in the following table we provide that missing analysis. In this case, the table shows that five of the strata in the STC sample, including every stratum except the lowest single-family value stratum, vary from 7.4% to 39.1%. Initially, this exhibits excessive variability from the sample to the population. Upon closer examination, this variation has a cumulative material effect on the overall assessment level and thus we conclude that the STC sample is insufficiently representative of the population.

| Comparing Representivity | | | | | | |
|---|---|---|---|---|---|---|
| | Population | | | STC 2003 Appraisals | | |
| Strata | N | $ | % | N | $ | % |
| Single Family <=$42,000 | 3,170 | 88,137,200 | 13.7% | 18 | 283,000 | 12.1% |
| Single Family >$42,000 & <=$62,500 | 1,841 | 95,622,300 | 14.8% | 3 | 164,895 | 7.0% |
| Single Family >$62,500 & <=$85,000 | 1,485 | 107,881,700 | 16.7% | 3 | 209,579 | 9.0% |
| Single Family >$85,000 & <=$115,000 | 987 | 96,661,100 | 15.0% | 2 | 177,474 | 7.6% |
| Single Family >$115,000 | 949 | 163,888,400 | 25.4% | 9 | 1,504,474 | 64.3% |
| Multi-family | 523 | 56,504,700 | 8.8% | 0 | 0 | 0.0% |
| Unimproved Properties | 2,839 | 35,414,800 | 5.5% | 0 | 0 | 0.0% |
| Total | 11,794 | 644,110,200 | | 35 | 2,339,421 | |

4.3 Market Value: The final requirement for producing a valid appraisal study is that appraisals must represent market values. As discussed in the introduction for this Section II, and in greater depth in the Procedure Manual (Section III), we use 4 tests to make this determination. The results of each test are reported in the following tables.

| Mann-Whitney Test | | | | |
|---|---|---|---|---|
| For the Entire Sample | | | | |
| Study | Observations | Rank sum | Expected | Ho: Ratios (35 STC Appraisals)=Ratios (359 Sales)<br>z = 4.185<br>Prob > \|z\| = 0.0000 |
| 0 | 35 | 9604 | 6912.5 | |
| 1 | 359 | 68211 | 70902.5 | |
| Combined | 394 | 77815 | 77815 | |
| For Single Family Properties Only | | | | |
| Study | Observations | Rank sum | Expected | Ho : Ratios (35 STC Appraisals)=Ratios (325 Sales)<br>z = 4.162<br>Prob > \|z\| = 0.0000 |
| 0 | 35 | 8752 | 6317.5 | |
| 1 | 325 | 56228 | 58662.5 | |
| Combined | 360 | 64980 | 64980 | |

| K-Sample Test | | | | |
|---|---|---|---|---|
| For the Entire Sample | | | | |
| Study | Not Greater than the median | Greater than the median | Total | Ho: Ratios (35 STC Appraisals)=Ratios (359 Sales)<br>Pearson chi2(1) = 9.0622 Pr = 0.003<br>Continuity corrected:<br>Pearson chi2(1) = 8.0274 Pr = 0.005 |
| 0 | 9 | 26 | 35 | |
| 1 | 188 | 171 | 359 | |
| Total | 197 | 197 | 394 | |
| For Single Family Properties Only | | | | |
| Study | Not Greater than the median | Greater than the median | Total | Ho: Ratios (35 STC Appraisals)=Ratios (325 Sales)<br>Pearson chi2(1) = 9.1464 Pr = 0.002<br>Continuity corrected:<br>Pearson chi2(1) = 8.1020 Pr = 0.004 |
| 0 | 9 | 26 | 35 | |
| 1 | 171 | 154 | 325 | |
| Total | 180 | 180 | 360 | |

All four tests lead to the conclusion that the STC appraisals do not represent market values (all with 99% statistical confidence). Therefore, the STC study is invalid and its reported results are unreliable.

## 5. Additional Analysis and Findings

5.1 Analysis of Reassessment History: The following table provides a comparison of actual assessment changes (net of new construction) to those that might have been expected for each of the last four reassessments as well as the six-year period leading up to 2003. Only one of the reassessments produced changes in line with the market indicator. In our study, previous assessment information

was available for Phelps County, so we were able to test for the real reassessment rate. Using this information, we found evidence that a real reassessment did not take place 2003.

| Actual Value Changes from Reassessment vs. Expected Value Change | | | |
|---|---|---|---|
| Biennial Year | % Net Assessment Change | Missouri OFHEO Index | % Value Change: Actual vs. Expected |
| 1999 | 0.9 | 8.4 | 10% |
| 2001 | 8.3 | 11.4 | 73% |
| 2003 | 0.4 | 11.8 | 3% |
| 2005 | 1.5 | 12.4 | 12% |
| Cumulative 1997 - 2003 | 9.7 | 35.0 | 28% |

## 6. Figures and Tables

**Table 1. STC's Appraisal Ratio Studies**

| | | Group | | | |
|---|---|---|---|---|---|
| | | 1999 | 2001 | 2003 | 2005* |
| Number of Appraisals | | 33 | 40 | 35 | 35 |
| Median | | .998 | 1.016 | .939 | .794 |
| 95% Confidence Interval for Median | Lower Bound | .955 | .917 | .846 | .679 |
| | Upper Bound | 1.005 | 1.117 | 1.007 | .858 |
| Weighted Mean | | .962 | .974 | .957 | .802 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .901 | .827 | .901 | .719 |
| | Upper Bound | 1.023 | 1.121 | 1.013 | .885 |
| Minimum | | .518 | .147 | .026 | .047 |
| Maximum | | 1.401 | 6.680 | 2.126 | 1.419 |
| Std. Deviation | | .149 | 1.075 | .353 | .230 |
| Price Related Differential | | 1.027 | 1.226 | .952 | .951 |
| Coefficient of Dispersion | | .089 | .464 | .243 | .204 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 72.7% | 35.0% | 42.9% | 22.9% |

*The STC has not completed its studies for the 2005 reassessment cycle. These results may not represent final values.

**Figure 1. Ratios before Outlier Trimming**

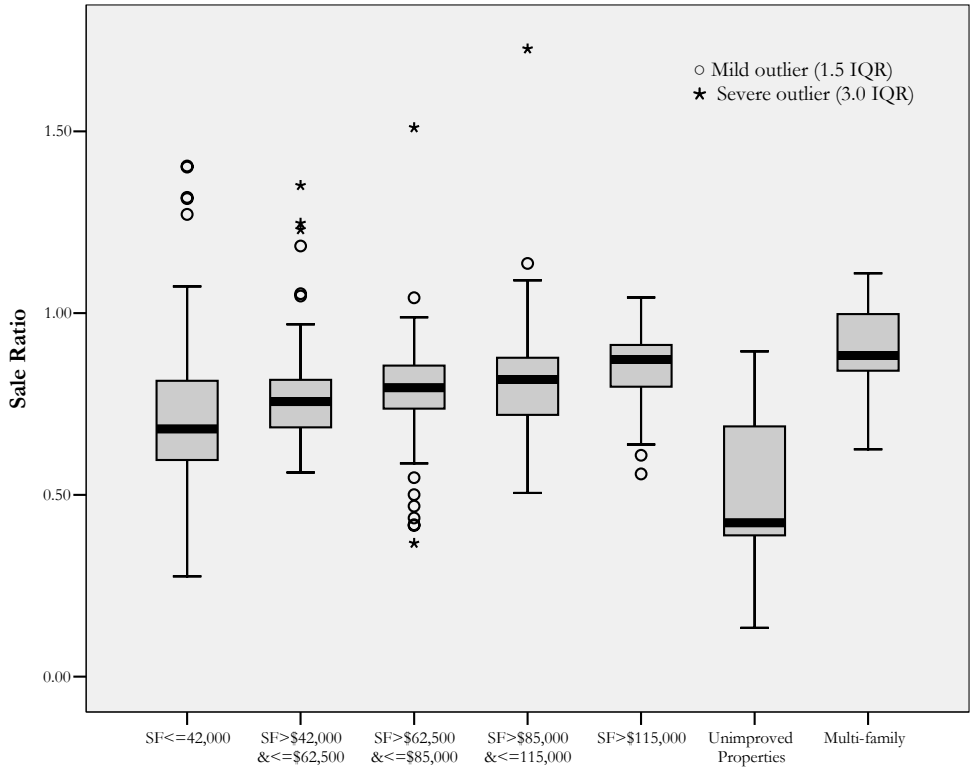
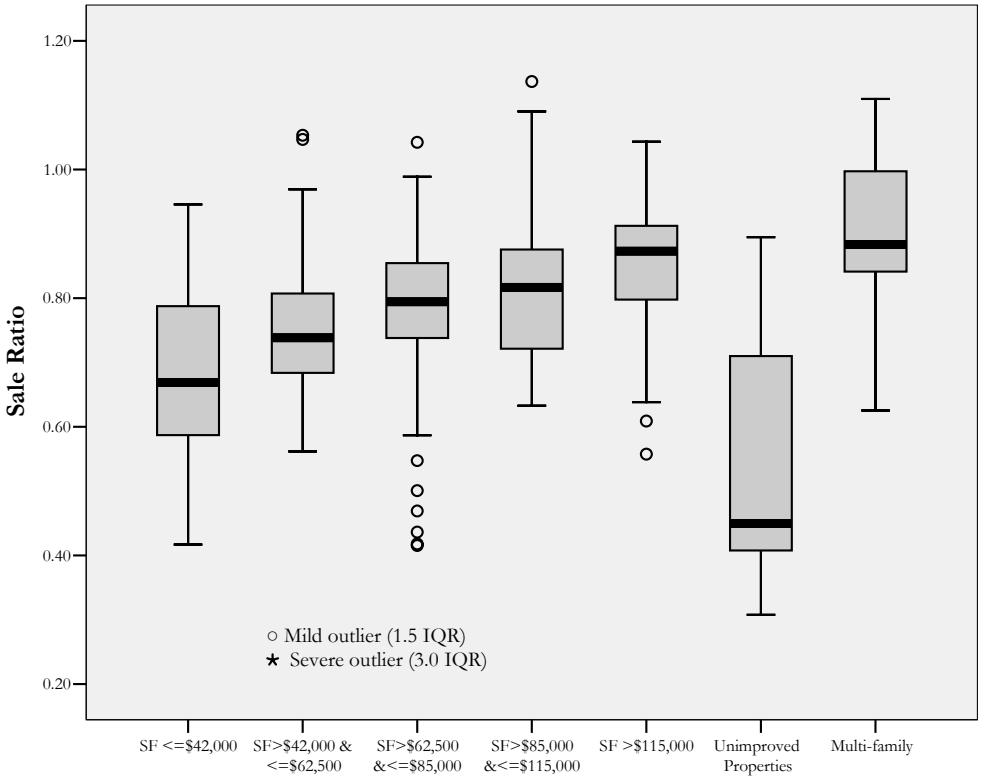
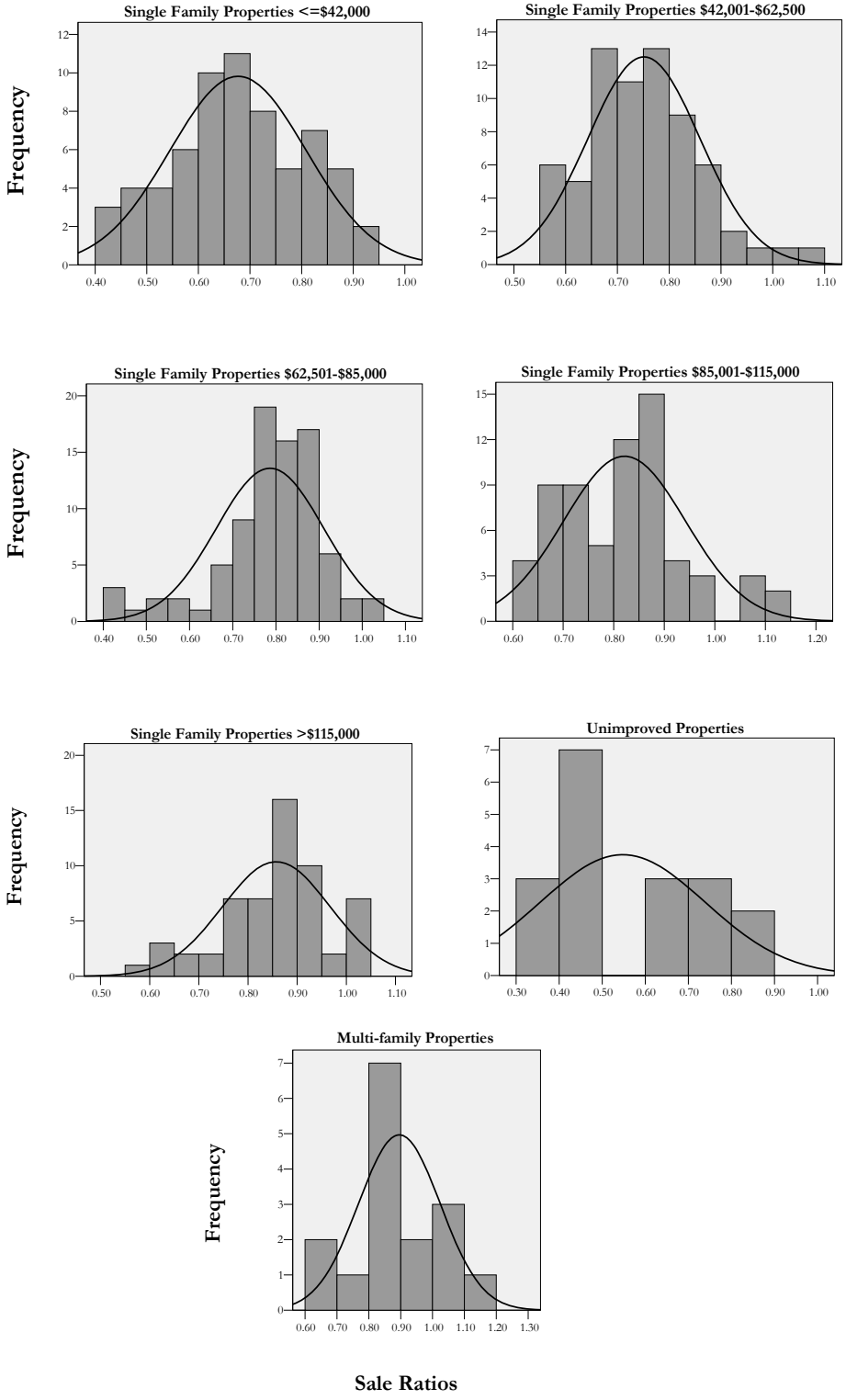



**Figure 2. Ratios after Outlier Trimming**



## Figure 3. Distribution of Final Sale Ratios



## Figure 3 (cont.). Distribution of Final Sale Ratios

### Shapiro-Francia W' Tests for Normality for Various Strata

| Strata | Observations | W' | V' | z | Prob* |
|---|---|---|---|---|---|
| Single Family | 325 | 0.98893 | 2.708 | 2.147 | 0.01591 |
| Multi-family | 16 | 0.96309 | 0.829 | -0.324 | 0.62719 |
| Unimproved Properties | 18 | 0.91170 | 2.147 | 1.354 | 0.08793 |
| Single Family<=$42,000 | 65 | 0.98401 | 1.020 | 0.039 | 0.48439 |
| Single Family>$42,000 & <=$62,500 | 68 | 0.97256 | 1.815 | 1.167 | 0.12161 |
| Single Family>$62,500 & <=$85,000 | 85 | 0.91950 | 6.372 | 3.560 | 0.00019 |
| Single Family>$85,000 & <=$115,000 | 66 | 0.96262 | 2.414 | 1.708 | 0.04386 |
| Single Family>$115,000 | 57 | 0.96208 | 2.180 | 1.497 | 0.06717 |
| Overall Un-weighted | 359 | 0.97908 | 5.585 | 3.675 | 0.00012 |
| *This value represents the indicated probability that the underlying population is normally distributed. A value of less than .05 indicates a distribution that is not normal. | | | | | |

## Table 2. Sales Ratio Analysis: Stratified by Property Use

| | | Strata | | | |
|---|---|---|---|---|---|
| | | Single Family | Unimproved Property | Multi-family | Overall Un-weighted |
| Number of Sales | | 325 | 18 | 16 | 359 |
| Median | | .781 | .450 | .883 | .781 |
| 95% Confidence Interval for Median | Lower Bound | .768 | .408 | .814 | .768 |
| | Upper Bound | .801 | .710 | 1.028 | .798 |
| Weighted Mean | | .779 | .535 | .874 | .783 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .763 | .437 | .779 | .767 |
| | Upper Bound | .795 | .634 | .968 | .799 |
| Minimum | | .416 | .308 | .625 | .308 |
| Maximum | | 1.137 | .895 | 1.110 | 1.137 |
| Std. Deviation | | .131 | .192 | .129 | .145 |
| Price Related Differential | | .990 | 1.023 | 1.025 | .978 |
| Coefficient of Dispersion | | .132 | .358 | .107 | .144 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 12.6% | .0% | 37.5% | 13.1% |

## Table 3. Combined Results – Post Stratification and Weighting

| | Population Assessor's Value | Median | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Single Family | 552,190,700 | 0.781 | 707,030,346 | 83.2% | 0.650 |
| Multi-family | 56,504,700 | 0.883 | 63,991,733 | 7.5% | 0.066 |
| Unimproved Properties | 35,414,800 | 0.45 | 78,699,556 | 9.3% | 0.042 |
| Total | 644,110,200 | 0.781 | 849,721,634 | 100.0% | 75.8% |

| | Population Assessor's Value | Weighted Mean | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Single Family | 552,190,700 | 0.779 | 708,845,571 | 84.4% | 0.658 |
| Multi-family | 56,504,700 | 0.874 | 64,650,686 | 7.7% | 0.067 |
| Unimproved Properties | 35,414,800 | 0.535 | 66,195,888 | 7.9% | 0.042 |
| Total | 644,110,200 | 0.783 | 839,692,146 | 100.0% | 76.7% |

## Table 4. Sales Ratio Analysis: Stratified by Use and Value

| | | Strata | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Single Family <=$42,000 | Single Family $42,001 - $62,500 | Single Family $62,501 - $85,000 | Single Family $85,001 - $115,000 | Single Family >$115,000 | Un-improved Properties | Multi-family | Overall Un-weighted |
| Number of Sales | | 64 | 68 | 80 | 63 | 50 | 18 | 16 | 359 |
| Median | | .669 | .738 | .794 | .817 | .873 | .450 | .883 | .781 |
| 95% Confidence Interval for Median | Lower Bound | .631 | .708 | .768 | .768 | .825 | .408 | .814 | .768 |
| | Upper Bound | .715 | .781 | .830 | .852 | .895 | .710 | 1.028 | .798 |
| Weighted Mean | | .654 | .738 | .757 | .801 | .842 | .535 | .874 | .783 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .620 | .712 | .722 | .772 | .808 | .437 | .779 | .767 |
| | Upper Bound | .689 | .764 | .793 | .829 | .876 | .634 | .968 | .799 |
| Minimum | | .417 | .562 | .416 | .633 | .558 | .308 | .625 | .308 |
| Maximum | | .946 | 1.053 | 1.042 | 1.137 | 1.043 | .895 | 1.110 | 1.137 |
| Std. Deviation | | .131 | .109 | .123 | .117 | .103 | .192 | .129 | .145 |
| Price Related Differential | | 1.030 | 1.018 | 1.029 | 1.018 | 1.016 | 1.023 | 1.025 | .978 |
| Coefficient of Dispersion | | .158 | .114 | .111 | .113 | .088 | .358 | .107 | .144 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 3.1% | 7.4% | 10.0% | 15.9% | 32.0% | .0% | 37.5% | 13.1% |

## Table 5. Combined Results – Post Stratification and Weighting

| | Population Assessor's Value | Median | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Single Family <= $42,000 | 88,137,200 | 0.669 | 131,744,694 | 15.6% | 0.104 |
| Single Family > $42,000 & <=$62,500 | 95,622,300 | 0.738 | 129,569,512 | 15.3% | 0.113 |
| Single Family > $62,500 & <=$85,500 | 107,881,700 | 0.794 | 135,871,159 | 16.1% | 0.128 |
| Single Family > $85,000 & <=$115,000 | 96,661,100 | 0.817 | 118,312,240 | 14.0% | 0.114 |
| Single Family > $115,000 | 163,888,400 | 0.873 | 187,730,126 | 22.2% | 0.194 |
| Multi-family | 56,504,700 | 0.883 | 63,991,733 | 7.6% | 0.067 |
| Unimproved Properties | 35,414,800 | 0.45 | 78,699,556 | 9.3% | 0.042 |
| Total | 644,110,200 | | 845,919,019 | 100.0% | 76.1% |

| | Population Assessor's Value | Weighted Mean | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Single Family <= $42,000 | 88,137,200 | 0.654 | 129,569,512 | 8.4% | 0.062 |
| Single Family > $42,000 & <=$62,500 | 95,622,300 | 0.738 | 142,512,153 | 9.2% | 0.070 |
| Single Family > $62,500 & <=$85,500 | 107,881,700 | 0.757 | 120,675,531 | 7.8% | 0.063 |
| Single Family > $85,000 & <=$115,000 | 96,661,100 | 0.801 | 194,641,805 | 12.6% | 0.106 |
| Single Family > $115,000 | 163,888,400 | 0.842 | 64,650,686 | 4.2% | 0.037 |
| Multi-family | 56,504,700 | 0.874 | 66,195,888 | 4.3% | 0.023 |
| Unimproved Properties | 35,414,800 | 0.535 | 822,618,391 | 53.4% | 0.418 |
| Total | 644,110,200 | 0.783 | 1,540,863,966 | 100.0% | 77.9% |

## Table 6. Sales Ratio Analysis: Stratified by Location

| | | Strata | | | | | |
|---|---|---|---|---|---|---|---|
| | | Rolla Area | St. James Area | All Other Areas | Unimproved Properties | Multi-family | Overall Un-weighted |
| Number of Sales | | 227 | 37 | 61 | 18 | 16 | 359 |
| Median | | .794 | .781 | .755 | .450 | .883 | .781 |
| 95% Confidence Interval for Median | Lower Bound | .772 | .693 | .708 | .408 | .814 | .768 |
| | Upper Bound | .810 | .813 | .797 | .710 | 1.028 | .798 |
| Weighted Mean | | .787 | .755 | .762 | .535 | .874 | .783 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .769 | .708 | .718 | .437 | .779 | .767 |
| | Upper Bound | .806 | .802 | .805 | .634 | .968 | .799 |
| Minimum | | .416 | .417 | .432 | .308 | .625 | .308 |
| Maximum | | 1.137 | .943 | 1.042 | .895 | 1.110 | 1.137 |
| Std. Deviation | | .123 | .136 | .150 | .192 | .129 | .145 |
| Price Related Differential | | .996 | .979 | .976 | 1.023 | 1.025 | .978 |
| Coefficient of Dispersion | | .121 | .137 | .157 | .358 | .107 | .144 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 13.2% | 10.8% | 11.5% | .0% | 37.5% | 13.1% |

## Table 7. Combined Results – Post Stratification and Weighting

| | **Population Assessor's Value** | **Median** | **Estimated Actual Value** | **% of Total Est. Mkt. Value** | **Subtotal** |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Rolla Area | 288,677,700 | 0.794 | 363,573,929 | 42.6% | 0.338 |
| St. James Area | 56,055,700 | 0.781 | 71,774,264 | 8.4% | 0.066 |
| All Other Area | 207,457,300 | 0.755 | 274,777,881 | 32.2% | 0.243 |
| Unimproved Properties | 35,414,800 | 0.45 | 78,699,556 | 9.2% | 0.042 |
| Multi-family | 56,504,700 | 0.883 | 63,991,733 | 7.5% | 0.066 |
| Total | 644,110,200 | 0.781 | 852,817,362 | 100.0% | 75.5% |

| | **Population Assessor's Value** | **Weighted Mean** | **Estimated Actual Value** | **% of Total Est. Mkt. Value** | **Subtotal** |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Rolla Area | 288,677,700 | 0.787 | 366,807,751 | 43.5% | 0.342 |
| St. James Area | 56,055,700 | 0.755 | 74,245,960 | 8.8% | 0.066 |
| All Other Area | 207,457,300 | 0.762 | 272,253,675 | 32.3% | 0.246 |
| Unimproved Properties | 35,414,800 | 0.535 | 66,195,888 | 7.8% | 0.042 |
| Multi-family | 56,504,700 | 0.874 | 64,650,686 | 7.7% | 0.067 |
| Total | 644,110,200 | 0.783 | 844,153,960 | 100.0% | 76.3% |

## Table 8. Sales Ratio Analysis: Stratified by Age

| | | Strata | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Un-improved Properties | Built before 1950 | Built in the 1950s | Built in the 1960s | Built in the 1970s | Built in the 1980s | Built 1990-1995 | Built 1996 and newer | Overall Un-weighted |
| Number of Sales | | 34 | 44 | 29 | 48 | 53 | 52 | 32 | 67 | 359 |
| Median | | .774 | .683 | .725 | .766 | .771 | .779 | .850 | .865 | .781 |
| 95% Confidence Interval for Median | Lower Bound | .615 | .631 | .652 | .693 | .724 | .737 | .813 | .828 | .768 |
| | Upper Bound | .874 | .722 | .771 | .802 | .809 | .827 | .907 | .880 | .798 |
| Weighted Mean | | .836 | .644 | .694 | .724 | .768 | .774 | .827 | .840 | .783 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .756 | .594 | .647 | .683 | .737 | .745 | .786 | .806 | .767 |
| | Upper Bound | .916 | .694 | .741 | .765 | .799 | .804 | .869 | .874 | .799 |
| Minimum | | .308 | .416 | .432 | .436 | .461 | .609 | .638 | .418 | .308 |
| Maximum | | 1.110 | .894 | .946 | 1.059 | 1.042 | 1.053 | 1.090 | 1.137 | 1.137 |
| Std. Deviation | | .240 | .121 | .123 | .134 | .115 | .092 | .111 | .123 | .145 |
| Price Related Differential | | .851 | 1.043 | 1.023 | 1.014 | 1.007 | 1.009 | 1.026 | 1.004 | .978 |
| Coefficient of Dispersion | | .261 | .141 | .132 | .136 | .115 | .097 | .101 | .098 | .144 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 17.6% | .0% | 6.9% | 4.2% | 15.1% | 5.8% | 31.3% | 23.9% | 13.1% |

## Table 9. Combined Results – Post Stratification and Weighting

| | **Population Assessor's Value** | **Median** | **Estimated Actual Value** | **% of Total Est. Mkt. Value** | **Subtotal** |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Before 1950 | 68,221,900 | 0.683 | 99,885,652 | 12.1% | 0.083 |
| 1950s | 40,996,000 | 0.725 | 56,546,207 | 6.8% | 0.050 |
| 1960s | 73,765,800 | 0.766 | 96,300,000 | 11.7% | 0.089 |
| 1970s | 103,116,700 | 0.771 | 133,744,099 | 16.2% | 0.125 |
| 1980s | 86,951,400 | 0.779 | 111,619,255 | 13.5% | 0.105 |
| 1990 - 1995 | 71,214,600 | 0.85 | 83,781,882 | 10.1% | 0.086 |
| 1996+ | 107,924,300 | 0.865 | 124,767,977 | 15.1% | 0.131 |
| Unimproved Properties | 91,919,500 | 0.77 | 119,375,974 | 14.5% | 0.111 |
| Total | 644,110,200 | 1 | 826,021,046 | 100.0% | 78.0% |

| | **Population Assessor's Value** | **Weighted Mean** | **Estimated Actual Value** | **% of Total Est. Mkt. Value** | **Subtotal** |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Before 1950 | 68,221,900 | 0.644 | 105,934,627 | 12.6% | 0.081 |
| 1950s | 40,996,000 | 0.694 | 59,072,046 | 7.0% | 0.049 |
| 1960s | 73,765,800 | 0.724 | 101,886,464 | 12.2% | 0.088 |
| 1970s | 103,116,700 | 0.768 | 134,266,536 | 16.0% | 0.123 |
| 1980s | 86,951,400 | 0.774 | 112,340,310 | 13.4% | 0.104 |
| 1990 - 1995 | 71,214,600 | 0.827 | 86,111,971 | 10.3% | 0.085 |
| 1996+ | 107,924,300 | 0.84 | 128,481,310 | 15.3% | 0.129 |
| Unimproved Properties | 91,919,500 | 0.836 | 109,951,555 | 13.1% | 0.110 |
| Total | 644,110,200 | 0.783 | 838,044,820 | 100.0% | 76.9% |

## Table 10. Sales Ratio Analysis: Stratified by Town and Rural Lots

| | | Strata | | |
|---|---|---|---|---|
| | | Town Lot | Rural Lot | Overall Un-weighted |
| Number of Sales | | 290 | 69 | 359 |
| Median | | .795 | .730 | .781 |
| 95% Confidence Interval for Median | Lower Bound | .777 | .665 | .768 |
| | Upper Bound | .809 | .772 | .798 |
| Weighted Mean | | .787 | .769 | .783 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .770 | .724 | .767 |
| | Upper Bound | .803 | .814 | .799 |
| Minimum | | .318 | .308 | .308 |
| Maximum | | 1.137 | 1.042 | 1.137 |
| Std. Deviation | | .134 | .179 | .145 |
| Price Related Differential | | .989 | .930 | .978 |
| Coefficient of Dispersion | | .130 | .195 | .144 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 13.4% | 11.6% | 13.1% |

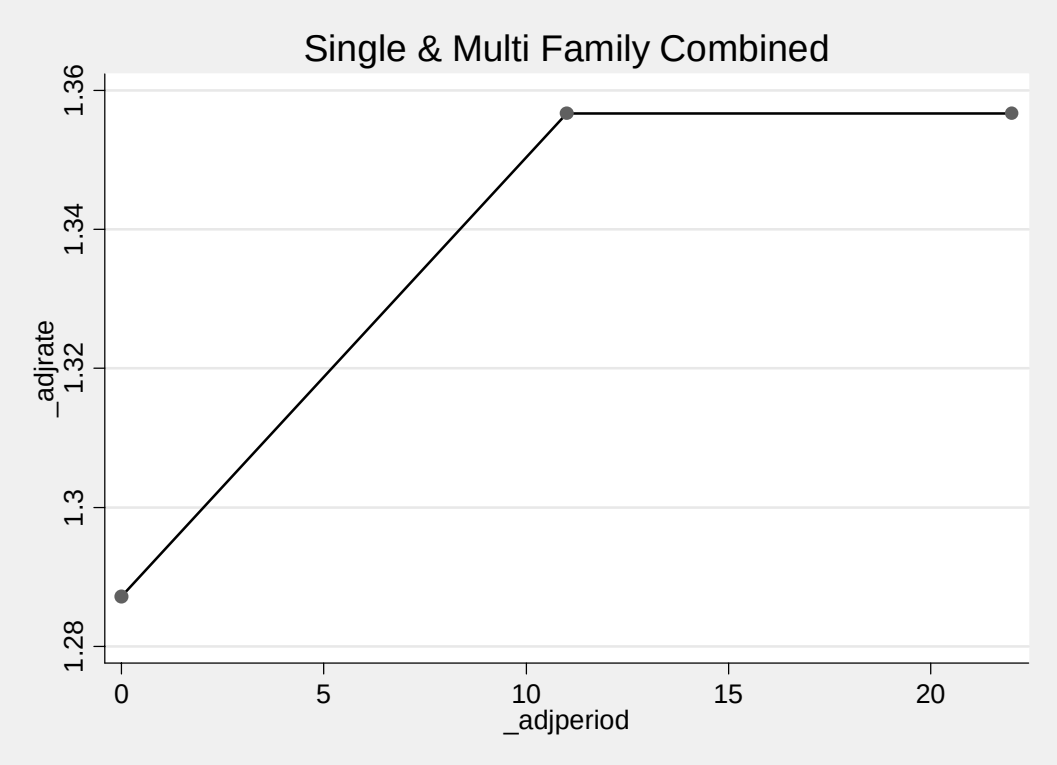
## Table 11. Combined Results – Post Stratification and Weighting

| | Population Assessor's Value | Median | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Town Lot | 433,839,500 | 0.795 | 545,710,063 | 65.5% | 0.520 |
| Rural Lot | 210,270,700 | 0.73 | 288,042,055 | 34.5% | 0.252 |
| Total | 644,110,200 | 1 | 833,752,118 | 100.0% | 77.3% |

| | Population Assessor's Value | Weighted Mean | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Town Lot | 433,839,500 | 0.787 | 551,257,306 | 66.8% | 0.526 |
| Rural Lot | 210,270,700 | 0.769 | 273,433,940 | 33.2% | 0.255 |
| Total | 644,110,200 | 0.783 | 824,691,246 | 100.0% | 78.1% |

**Graph 1. Single and Multi-family Property Price Trend**

A thorough analysis of price-time trends by price strata determined that adjusting reported prices was desirable for all single family and multi-family properties. The resultant trend and statistical analysis is shown below.




**Price Trend Regression Statistics**

| Source | SS | df | MS | | |
|---|---|---|---|---|---|
| Model | .108488026 | 1 | .108488026 | Number of obs = 321 | R-squared = 0.0074 |
| Residual | 14.6159737 | 319 | .045818099 | F( 1, 319) = 2.37 | Adj R-squared= 0.043 |
| Total | 14.7244617 | 320 | .046013943 | Prob > F = 0.1249 | Root MSE = .21405 |

| _aratio | Coef. | Std. Err. | t | P> t | [80% Conf. Interval] | |
|---|---|---|---|---|---|---|
| _adjperiod | .0063248 | .0041103 | 1.54 | 0.125 | -.0017619 | .0144115 |
| _cons | 1.287144 | .0282172 | 45.62 | 0.000 | 1.231629 | 1.34266 |

Monthly adjustment rate=.0049138 | Annualized adjustment rate=.0589659

# Chapter 20. Platte County

## 1. Significant Findings

1.1 Assessment Level: Platte County's 2003 residential property assessments were approximately 74% of market value (Section 3.5). The results from the corresponding STC study are invalid because the STC's appraisals did not meet the requirement that they reflect market values (Section 4.3). Furthermore, the STC's sample is not representative of residential property for the county (Section 4.2).

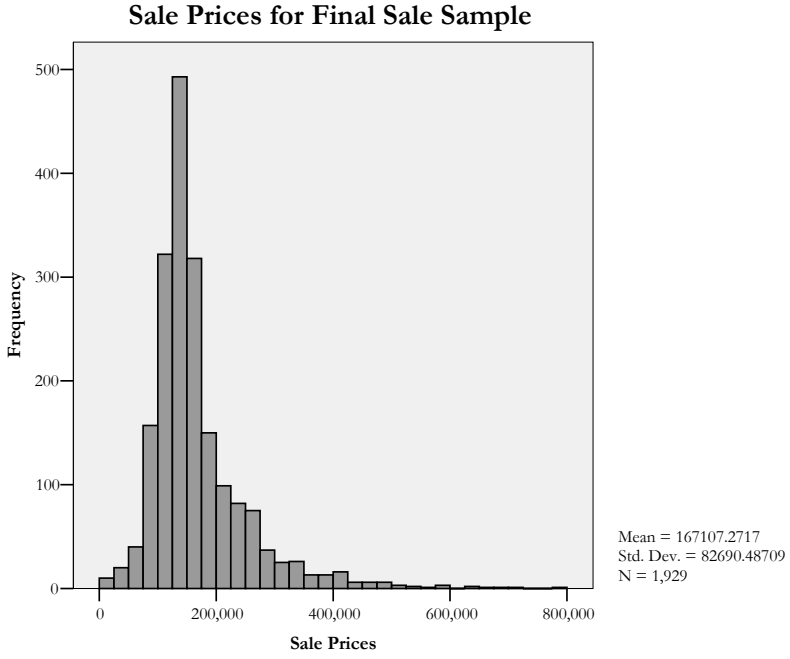
1.2 Assessment Equity: Lower-valued properties, older properties, and properties in the R-2 school district were assessed less uniformly and at lower levels than other properties (Section 3.6 and Tables 4, 6 & 8).

1.3 Reassessment History: Two indicators of market value changes suggest that all of the past four biennial reassessments have produced lower value increases than the market. Cumulatively, the reassessments from 1997 through 2003 produced only 37% of the expected rise in assessments. The net change in assessments in 1999 raises questions regarding whether any serious revaluation occurred (Section 5.1).

## 2. Data and Related Issues

2.1 Assessment Data: Sales and assessment information was available in electronic format. Sales were matched using a combination of computer techniques and software and then screened. The assessor answered all questions regarding the contents and coding of data when requested. The files received contained information allowing us to identify properties affected by new construction and to screen as appropriate.

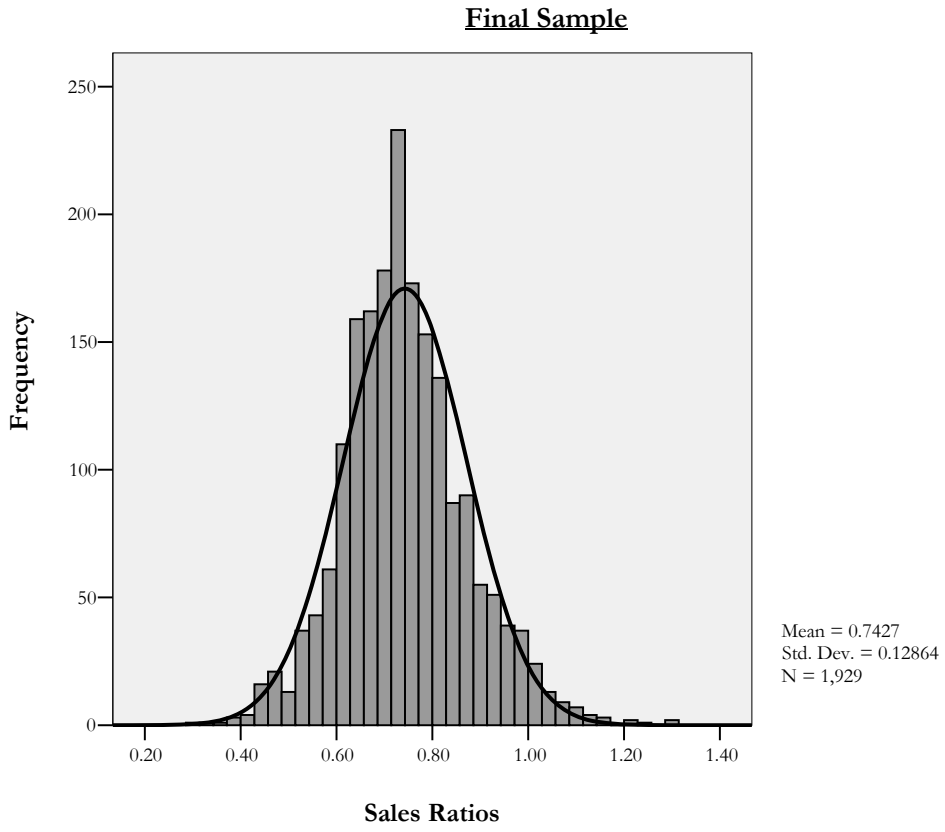
2.2 Sales and Ratio Data: The distribution of sale prices used is reflected in the following histogram.



The next table reports results of the data screening and trimming process. The "screened sales" represent the initial screened sample. The screened sales that were excluded from the final analysis because their ratios were deemed unrepresentative are identified as high or low trims. The "remaining ratios" represent the sample on which all the study's results are based.

| Trimming of Outliers | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Single Family <=$85,000 | Single Family $85,001 - $105,000 | Single Family $105,001 - $135,000 | Single Family $135,001 - $200,000 | Single Family >$200,000 | Unimproved Properties | Multi-family | Total |
| **Screened Sales** | | 388 | 419 | 380 | 373 | 217 | 38 | 140 | 1955 |
| Excluded | Value Outliers | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 |
| | High Trims | 5 | 2 | 0 | 1 | 0 | 5 | 3 | 16 |
| | Low Trims | 0 | 0 | 1 | 0 | 0 | 6 | 2 | 9 |
| **Remaining Ratios** | | **383** | **417** | **379** | **372** | **217** | **26** | **135** | **1929** |

The histogram below shows the distribution of the ratios for the sample.




2.3 Population: Since a complete copy of the 2003 assessment rolls in electronic form was available, we were able to analyze the county's population in detail. This allowed us to stratify and weight sales on a variety of property and location characteristics.

## 3. Ratio Study Results

3.1 The Sample: The following table shows that four of the strata, including the three highest valued single-family strata and the unimproved stratum, vary from 3.5% to 7.3% from the population. Initially, this exhibits excessive variability from the sample to the population. Upon closer examination, this variation has a cumulative material effect on the overall assessment level and thus we conclude that the un-stratified sample is insufficiently representative of the population.

| Comparing Representivity | | | | | | |
|---|---|---|---|---|---|---|
| | Population Distribution | | | PPRC 2003 Sale Sample | | |
| Strata | N | $ | $ Weight | N | $ | $ Weight |
| Single Family <=$85,000 | 5,748 | 363,721,727 | 11.0% | 383 | 25,836,347 | 10.6% |
| Single Family $85,001-$105,000 | 4,157 | 393,683,311 | 11.9% | 417 | 39,333,747 | 16.1% |
| Single Family $105,001-$135,000 | 4,151 | 491,996,242 | 14.9% | 379 | 44,752,784 | 18.4% |
| Single Family $135,001-$200,000 | 4,254 | 687,156,131 | 20.8% | 372 | 59,824,153 | 24.6% |
| Single Family >$200,000 | 3,002 | 912,644,121 | 27.7% | 217 | 62,683,000 | 25.7% |
| Unimproved Properties | 3,259 | 255,676,558 | 7.7% | 26 | 1,061,953 | 0.4% |
| Multi-family | 1,906 | 195,413,411 | 5.9% | 135 | 10,118,832 | 4.2% |
| Total | 26477 | 3,300,291,500 | | 1929 | 243,610,816 | |

3.2 Representing the Population with the Sample: Since the un-stratified sample is insufficiently representative of the population (Section 3.1), the use of stratification and weighting is essential. Furthermore, stratification provides additional analytical benefits.

3.3 Sales Chasing: There was no indication of sales chasing.

3.4 Study Validity: Once the sample has been stratified and weighted, all requirements for producing valid inferences about the county's population of residential properties are met.

3.5 Assessment Level: Measures of the assessment level are summarized below. For the purposes of this study, the weighted mean from combined stratification is the preferred measure as long as both of the requirements from using the weighted mean are met. In this case, the distributions are not normal (Figure 3) and weighting is compromised by the use of seriously undersized samples. Since both requirements are not met, we focus on the median, though taking notice of the weighted mean, to conclude that the County's assessments for 2003 reflect approximately 74% of market value.

| Assessment Level (Based on Percent of Market Value) | | | | |
|---|---|---|---|---|
| | Stratification and Weighting | Reference | Weighted Mean | Median |
| **Overall Un-weighted** | None | Table 2 | 75.6% | 73.2% |
| **Combined** | By Property Use | Table 3 | 73.8% | 71.8% |
| **Combined** | By Property Use and Value Range | Table 5 | 74.1% | 74.8% |
| **Combined** | By Property Location | Table 7 | 75.4% | 73.2% |
| **Combined** | By Property Age | Table 9 | 73.7% | 73.5% |
| **Combined** | By Property Town and Rural Lots | Table 11 | 75.5% | 73.1% |

3.6 Equity Measures and Evaluation:

i. Uniformity within Strata: Tables 2, 4, 6, 8 & 10 show results for individual strata of sufficient sample size for evaluation. The following strata represent problem areas for internal uniformity.

| Strata with Inadequate Uniformity | |
|---|---|
| **Property Strata** | **COD** |
| Unimproved Properties | 33.2% |
| R-2 School District | 22.3% |
| Built before 1950 | 24.5% |

ii. Uniformity between Strata: Another form of inequity exists when different strata are assessed at different levels. The IAAO has established guidelines for identifying such inequity, but compliance can be heavily affected by sample size and uniformity. Therefore, we confine our remarks to identifying where assessment levels differ markedly from the norm. The following are notable: the differences in assessment levels (medians) among unimproved, multi-family and single family strata (58.7%, 67.9% and 73.2% respectively, Table 3); the differences between the lowest and higher valued single family strata (64.8% and 80.3-86.5% respectively, Table 4); that the R-2 School District is assessed at a lower level than the others (Table 6); and the differences in medians among properties built before 1980 and newer properties (65.7%-69.9% versus 74.5%-85.6%) (Table 8).

iii. Vertical Equity: The final form of potential inequity examined is vertical equity. The PRD for the overall sample of 0.983 complies with the IAAO standard.

## 4. STC Study

4.1 Comparative Results: The following table contrasts our results with those from the STC study. The STC found the level of assessment adequate, while ours does not. The STC reports an equally acceptable horizontal equity measure and vertical equity measure. We have already demonstrated that the PPRC study meets the criteria for achieving valid results. The rest of Section 4 examines the validity of the STC's study.

| Comparison of Study Results | | | |
|---|---|---|---|
| **Measure** | **STC Study*** | **PPRC Study*** | **PPRC Study Combined**** |
| Assessment Level - median | 97.0% | 73.2% | 74.8% |
| Assessment Level - weighted mean | 90.5% | 75.6% | 74.1% |
| COD | 15.0% | 13.4% | |
| PRD | 1.03 | 0.98 | |
| Sample Size | 40 | 1,929 | |
| Relative Precision | 1.00 | 6.94 | |
| * Overall sample (un-stratified and un-weighted) | | | |
| ** Stratification and weighting by Property Use and Value Range | | | |

4.2 Representing the Population with the Sample: The STC does not examine the representivity of its sample, nor does it have the necessary sample size or information to do so. Therefore, in the following table, we provide that missing analysis. In this case, the table shows that six of the strata in the STC sample with the exception of the highest single-family value strata, vary from 3.1% to 8.3%. Initially, this exhibits excessive variability from the sample to the population. Upon closer examination, this variation has a cumulative material effect on the overall assessment level and thus we conclude that the STC sample is insufficiently representative of the population.

| Comparing Representivity | | | | | | |
|---|---|---|---|---|---|---|
| | Population | | | STC 2003 Appraisals | | |
| Strata | N | $ | % | N | $ | % |
| Single Family <=$85,000 | 5,748 | 363,721,727 | 11.0% | 6 | 316,163 | 7.1% |
| Single Family $85,001-$105,000 | 4,157 | 393,683,311 | 11.9% | 4 | 394,532 | 8.8% |
| Single Family $105,001-$135,000 | 4,151 | 491,996,242 | 14.9% | 9 | 1,039,500 | 23.2% |
| Single Family $135,001-$200,000 | 4,254 | 687,156,131 | 20.8% | 7 | 1,092,442 | 24.4% |
| Single Family >$200,000 | 3,002 | 912,644,121 | 27.7% | 3 | 1,131,789 | 25.2% |
| Unimproved Properties | 3,259 | 255,676,558 | 7.7% | 6 | 65,100 | 1.5% |
| Multi-family | 1,906 | 195,413,411 | 5.9% | 5 | 444,395 | 9.9% |
| Total | 26477 | 3,300,291,500 | | 40 | 4,483,921 | |

4.3 Market Value: The final requirement for producing a valid appraisal study is that appraisals must represent market values. As discussed in the introduction for this Section II, and in greater depth in the Procedure Manual (Section III), we use 4 tests to make this determination. The results of each test are reported in the following tables.

| Mann-Whitney Test | | | | |
|---|---|---|---|---|
| For the Entire Sample | | | | |
| Study | Observations | Rank sum | Expected | Ho: Ratios (40 STC Appraisals)=Ratios (1929 Sales)<br>z = 6.650<br>Prob > \|z\| = 0.0000 |
| 0 | 40 | 63069.5 | 39400 | |
| 1 | 1929 | 1876395.5 | 1900065 | |
| Combined | 1969 | 1939465 | 1939465 | |
| For Single Family Properties Only | | | | |
| Study | Observations | Rank sum | Expected | Ho : Ratios (29 STC Appraisals)=Ratios (1768 Sales)<br>z = 4.590<br>Prob > \|z\| = 0.0000 |
| 0 | 29 | 38794 | 26071 | |
| 1 | 1768 | 1576709 | 1589432 | |
| Combined | 1797 | 1615503 | 1615503 | |

| K-Sample Test | | | | |
|---|---|---|---|---|
| For the Entire Sample | | | | |
| Study | Not Greater than the median | Greater than the median | Total | Ho: Ratios (40 STC Appraisals)=Ratios (1929 Sales)<br>Pearson chi2(1) = 26.1640 Pr = 0.000<br>Continuity corrected:<br>Pearson chi2(1) = 24.5553 Pr = 0.000 |
| 0 | 4 | 36 | 40 | |
| 1 | 981 | 948 | 1929 | |
| Total | 985 | 984 | 1969 | |
| For Single Family Properties Only | | | | |
| Study | Not Greater than the median | Greater than the median | Total | Ho: Ratios (29 STC Appraisals)=Ratios (1768 Sales)<br>Pearson chi2(1) = 15.4801 Pr = 0.000<br>Continuity corrected:<br>Pearson chi2(1) = 14.0420 Pr = 0.000 |
| 0 | 4 | 25 | 29 | |
| 1 | 895 | 873 | 1768 | |
| Total | 899 | 898 | 1797 | |

All four tests lead to the conclusion that the STC appraisals do not represent market values (all with 99% statistical confidence). Therefore, the STC study is invalid and its reported results are unreliable.

## 5. Additional Analysis and Findings

5.1 Analysis of Reassessment History: The following table provides a comparison of actual assessment changes (net of new construction) to those that might have been expected for each of the last four reassessments as well as the six-year period leading up to 2003. Only one of the reassessments

produced changes somewhat in line with the market indicator. In our study, previous assessment information was available for Platte County, so we were able to test for the real reassessment rate. Using this information, we found evidence that a real reassessment took place in 2003.

| Actual Value Changes from Reassessment vs. Expected Value Change | | | | | |
|---|---|---|---|---|---|
| Biennial Year | % Net Assessment Change | Missouri OFHEO Index | % Value Change: Actual vs. Expected | KC MSA OFHEO Index | % Value Change: Actual vs. Expected |
| 1999 | 1.2 | 8.4 | 15% | 12.3 | 10% |
| 2001 | 4.8 | 11.4 | 42% | 13.0 | 37% |
| 2003 | 6.6 | 11.8 | 56% | 9.9 | 67% |
| 2005 | 4.9 | 12.4 | 39% | 10.5 | 46% |
| Cumulative 1997 - 2003 | 13.1 | 35.0 | 37% | 39.5 | 33% |

## 6. Figures and Tables

**Table 1. STC's Appraisal Ratio Studies**

| | | Group | | | |
|---|---|---|---|---|---|
| | | 1999 | 2001 | 2003 | 2005* |
| Number of Appraisals | | 36 | 40 | 40 | 34 |
| Median | | .977 | .924 | .970 | .819 |
| 95% Confidence Interval for | Lower Bound | .882 | .863 | .801 | .756 |
| Median | Upper Bound | 1.050 | 1.000 | 1.000 | .867 |
| Weighted Mean | | .921 | .940 | .905 | .809 |
| 95% Confidence Interval for | Lower Bound | .847 | .880 | .845 | .747 |
| Weighted Mean | Upper Bound | .995 | 1.000 | .964 | .871 |
| Minimum | | .250 | .195 | .631 | .586 |
| Maximum | | 3.000 | 1.546 | 1.303 | 3.600 |
| Std. Deviation | | .497 | .212 | .178 | .514 |
| Price Related Differential | | 1.183 | .988 | 1.032 | 1.145 |
| Coefficient of Dispersion | | .292 | .160 | .150 | .251 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 33.3% | 35.0% | 42.5% | 17.6% |
| *The STC has not completed its studies for the 2005 reassessment cycle. These results may not represent final values. | | | | | |

**Figure 1. Ratios before Outlier Trimming**

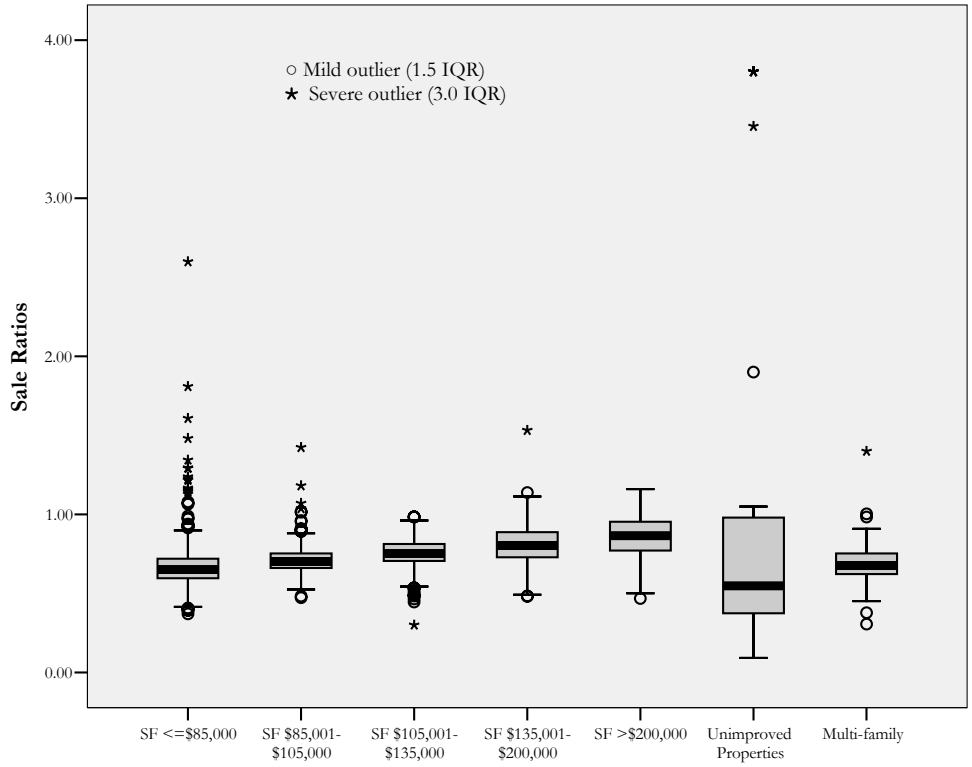
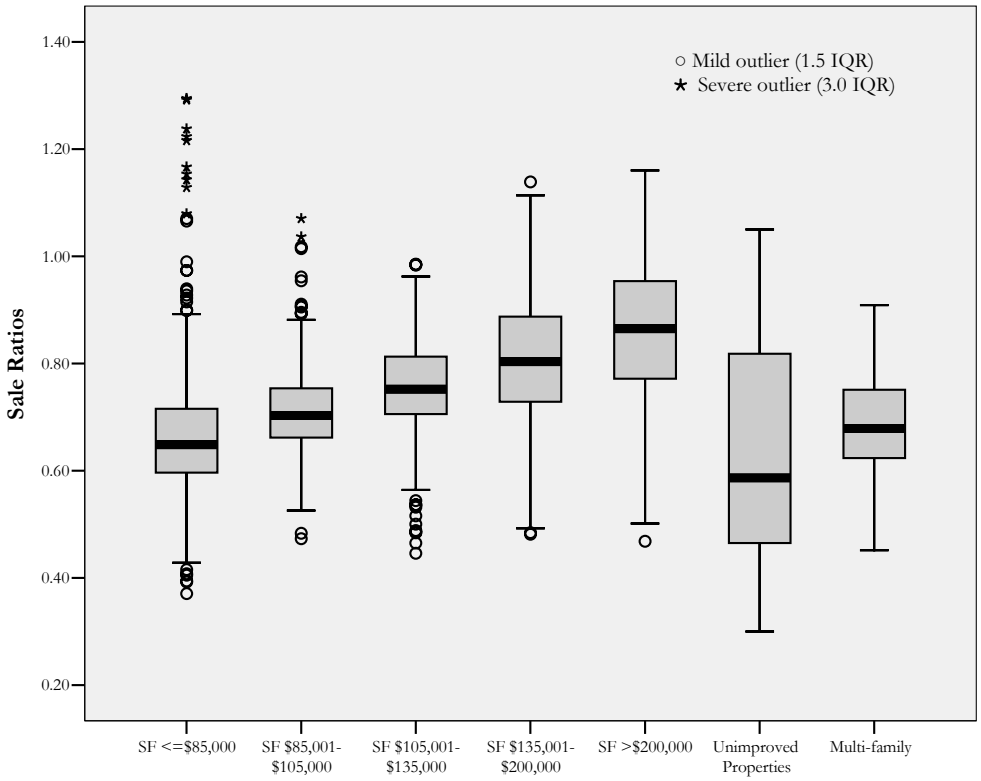
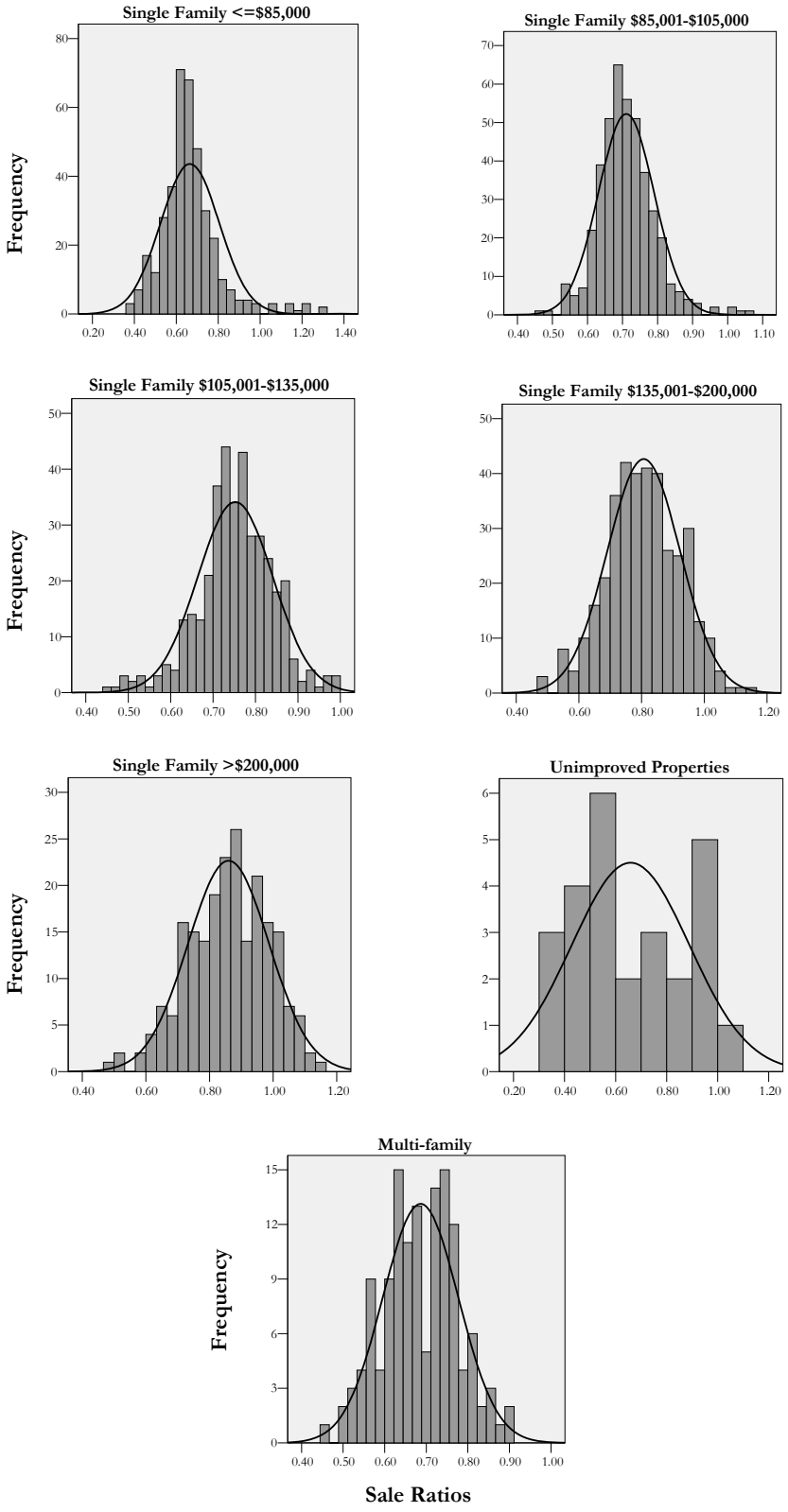



**Figure 2. Ratios after Outlier Trimming**



## Figure 3. Distribution of Final Sale Ratios



## Figure 3 (cont.). Distribution of Final Sale Ratios

### Shapiro-Francia W' Tests for Normality for Various Strata

| Strata | Observations | W' | V' | z | Prob* |
|---|---|---|---|---|---|
| Single Family | 1768 | 0.98713 | 12.884 | 5.175 | 0.00001 |
| Unimproved Properties | 26 | 0.94656 | 1.688 | 0.952 | 0.17048 |
| Multi-family | 135 | 0.99400 | 0.694 | -0.769 | 0.77907 |
| Single Family <=$85,000 | 383 | 0.89007 | 31.076 | 7.124 | 0.00001 |
| Single Family $85,001- $105,000 | 417 | 0.96121 | 11.830 | 5.236 | 0.00001 |
| Single Family $105,001- $135,000 | 379 | 0.98222 | 4.979 | 3.446 | 0.00028 |
| Single Family $135,001- $200,000 | 372 | 0.99677 | 0.891 | -0.256 | 0.60102 |
| Single Family >$200,000 | 217 | 0.99221 | 1.343 | 0.630 | 0.26420 |
| Overall Un-weighted | 1929 | 0.98828 | 12.260 | 5.027 | 0.00001 |
| *This value represents the indicated probability that the underlying population is normally distributed. A value of less than .05 indicates a distribution that is not normal. | | | | | |

## Table 2. Sales Ratio Analysis: Stratified by Property Use

| | | Strata | | | |
|---|---|---|---|---|---|
| | | Single Family | Unimproved Properties | Multi-family | Overall Un-weighted |
| Number of Sales | | 1768 | 26 | 135 | 1929 |
| Median | | .736 | .587 | .679 | .732 |
| 95% Confidence Interval for Median | Lower Bound | .730 | .526 | .659 | .727 |
| | Upper Bound | .742 | .800 | .718 | .738 |
| Weighted Mean | | .760 | .582 | .687 | .756 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .753 | .519 | .671 | .749 |
| | Upper Bound | .767 | .645 | .702 | .763 |
| Minimum | | .371 | .300 | .452 | .300 |
| Maximum | | 1.294 | 1.050 | .909 | 1.294 |
| Std. Deviation | | .128 | .230 | .091 | .129 |
| Price Related Differential | | .984 | 1.131 | .999 | .983 |
| Coefficient of Dispersion | | .133 | .332 | .111 | .134 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 11.0% | 23.1% | .7% | 10.5% |

## Table 3. Combined Results – Post Stratification and Weighting

| | Population Assessor's Value | Median | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Single Family | 2,849,201,531 | 0.736 | 3,871,197,732 | 84.3% | 0.620 |
| Unimproved Properties | 255,676,558 | 0.587 | 435,564,835 | 9.5% | 0.056 |
| Multi-family | 195,413,411 | 0.679 | 287,795,892 | 6.3% | 0.043 |
| Total | 3,300,291,500 | | 4,594,558,459 | 100.0% | 71.8% |

| | Population Assessor's Value | Weighted Mean | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Single Family | 2,849,201,531 | 0.76 | 3,748,949,383 | 83.8% | 0.637 |
| Unimproved Properties | 255,676,558 | 0.582 | 439,306,801 | 9.8% | 0.057 |
| Multi-family | 195,413,411 | 0.687 | 284,444,557 | 6.4% | 0.044 |
| Total | 3,300,291,500 | | 4,472,700,741 | 100.0% | 73.8% |

## Table 4. Sales Ratio Analysis: Stratified by Use and Value

| | | Strata | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | SF <= $85,000 | SF $85,001-$105,000 | SF $105,001-$135,000 | SF $135,001-$200,000 | SF > $200,000 | Un-improved Property | Multi-family | Overall Un-weighted |
| Number of Sales | | 383 | 417 | 379 | 372 | 217 | 26 | 135 | 1929 |
| Median | | .648 | .703 | .752 | .803 | .865 | .587 | .679 | .732 |
| 95% Confidence Interval for Median | Lower Bound | .639 | .695 | .741 | .789 | .843 | .526 | .659 | .727 |
| | Upper Bound | .659 | .712 | .764 | .818 | .887 | .800 | .718 | .738 |
| Weighted Mean | | .647 | .703 | .742 | .790 | .848 | .582 | .687 | .756 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .636 | .696 | .732 | .778 | .829 | .519 | .671 | .749 |
| | Upper Bound | .658 | .711 | .752 | .803 | .868 | .645 | .702 | .763 |
| Minimum | | .371 | .473 | .446 | .481 | .468 | .300 | .452 | .300 |
| Maximum | | 1.294 | 1.070 | .985 | 1.139 | 1.160 | 1.050 | .909 | 1.294 |
| Std. Deviation | | .140 | .080 | .089 | .116 | .127 | .230 | .091 | .129 |
| Price Related Differential | | 1.029 | 1.010 | 1.014 | 1.021 | 1.013 | 1.131 | .999 | .983 |
| Coefficient of Dispersion | | .146 | .084 | .090 | .115 | .118 | .332 | .111 | .134 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 2.9% | 2.2% | 3.4% | 22.3% | 36.4% | 23.1% | .7% | 10.5% |

## Table 5. Combined Results – Post Stratification and Weighting

| | Population Assessor's Value | Median | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Single Family <=$85,000 | 363,721,727 | 0.648 | 561,298,961 | 12.7% | 0.082 |
| Single Family $85,001 - $105,000 | 393,683,311 | 0.703 | 560,004,710 | 12.7% | 0.089 |
| Single Family $105,001 - $135,000 | 491,996,242 | 0.752 | 654,250,322 | 14.8% | 0.112 |
| Single Family $135,001 - $200,000 | 687,156,131 | 0.803 | 855,736,154 | 19.4% | 0.156 |
| Single Family >$200,000 | 912,644,121 | 0.865 | 1,055,079,908 | 23.9% | 0.207 |
| Unimproved Properties | 255,676,558 | 0.587 | 435,564,835 | 9.9% | 0.058 |
| Multi-family | 195,413,411 | 0.679 | 287,795,892 | 6.5% | 0.044 |
| Total | 3,300,291,500 | | 4,409,730,781 | 100.0% | 74.8% |

| | Population Assessor's Value | Weighted Mean | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Single Family <=$85,000 | 363,721,727 | 0.647 | 562,166,502 | 12.6% | 0.082 |
| Single Family $85,001 - $105,000 | 393,683,311 | 0.703 | 560,004,710 | 12.6% | 0.088 |
| Single Family $105,001 - $135,000 | 491,996,242 | 0.742 | 663,067,712 | 14.9% | 0.110 |
| Single Family $135,001 - $200,000 | 687,156,131 | 0.79 | 869,817,888 | 19.5% | 0.154 |
| Single Family >$200,000 | 912,644,121 | 0.848 | 1,076,231,274 | 24.2% | 0.205 |
| Unimproved Properties | 255,676,558 | 0.582 | 439,306,801 | 9.9% | 0.057 |
| Multi-family | 195,413,411 | 0.687 | 284,444,557 | 6.4% | 0.044 |
| Total | 3,300,291,500 | | 4,455,039,443 | 100.0% | 74.1% |

## Table 6. Sales Ratio Analysis: Stratified by Location

| | | Strata | | | | | |
|---|---|---|---|---|---|---|---|
| | | PH School District | R-1 School District | R-2 School District | R-3 School District | Other School Districts | Overall Un-weighted |
| Number of Sales | | 1545 | 42 | 63 | 269 | 10 | 1929 |
| Median | | .731 | .693 | .683 | .754 | .657 | .732 |
| 95% Confidence Interval for Median | Lower Bound | .726 | .637 | .599 | .737 | .454 | .727 |
| | Upper Bound | .740 | .738 | .721 | .778 | .738 | .738 |
| Weighted Mean | | .758 | .694 | .642 | .772 | .669 | .756 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .750 | .647 | .604 | .751 | .615 | .749 |
| | Upper Bound | .765 | .741 | .680 | .792 | .724 | .763 |
| Minimum | | .300 | .456 | .375 | .371 | .450 | .300 |
| Maximum | | 1.238 | 1.153 | 1.294 | 1.116 | .754 | 1.294 |
| Std. Deviation | | .121 | .162 | .210 | .132 | .107 | .129 |
| Price Related Differential | | .980 | 1.012 | 1.059 | .996 | .952 | .983 |
| Coefficient of Dispersion | | .128 | .181 | .223 | .138 | .115 | .134 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 9.8% | 7.1% | 1.6% | 17.1% | .0% | 10.5% |

## Table 7. Combined Results – Post Stratification and Weighting

| | Population Assessor's Value | Median | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| PH School District | 2,564,297,216 | 0.731 | 3,507,930,528 | 77.8% | 0.568 |
| R-1 School District | 64,492,184 | 0.693 | 93,062,315 | 2.1% | 0.014 |
| R-2 School District | 83,980,821 | 0.683 | 122,958,742 | 2.7% | 0.019 |
| R-3 School District | 545,367,363 | 0.754 | 723,298,890 | 16.0% | 0.121 |
| Other School Districts | 42,153,916 | 0.657 | 64,161,211 | 1.4% | 0.009 |
| Total | 3,300,291,500 | | 4,511,411,687 | 100.0% | 73.2% |

| | Population Assessor's Value | Weighted Mean | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| PH School District | 2,564,297,216 | 0.758 | 3,382,977,858 | 77.3% | 0.586 |
| R-1 School District | 64,492,184 | 0.694 | 92,928,219 | 2.1% | 0.015 |
| R-2 School District | 83,980,821 | 0.642 | 130,811,248 | 3.0% | 0.019 |
| R-3 School District | 545,367,363 | 0.772 | 706,434,408 | 16.1% | 0.125 |
| Other School Districts | 42,153,916 | 0.669 | 63,010,337 | 1.4% | 0.010 |
| Total | 3,300,291,500 | | 4,376,162,070 | 100.0% | 75.4% |

## Table 8. Sales Ratio Analysis: Stratified by Age

| | | Strata | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Un-improved Properties | Multi-family | Built before 1950 | Built 1950s | Built 1960s | Built 1970s | Built 1980s | Built 1990 thru 1995 | Built 1996 and newer | Overall Un-weighted |
| Number of Sales | | 26 | 135 | 81 | 109 | 164 | 413 | 274 | 392 | 335 | 1929 |
| Median | | .587 | .679 | .669 | .657 | .683 | .699 | .745 | .754 | .856 | .732 |
| 95% Confidence Interval for Median | Lower Bound | .526 | .659 | .626 | .614 | .666 | .689 | .735 | .744 | .835 | .727 |
| | Upper Bound | .800 | .718 | .714 | .680 | .696 | .710 | .755 | .765 | .870 | .738 |
| Weighted Mean | | .582 | .687 | .660 | .657 | .680 | .701 | .749 | .769 | .855 | .756 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .519 | .671 | .621 | .633 | .664 | .690 | .734 | .756 | .840 | .749 |
| | Upper Bound | .645 | .702 | .698 | .682 | .696 | .711 | .765 | .781 | .871 | .763 |
| Minimum | | .300 | .452 | .371 | .392 | .445 | .416 | .439 | .468 | .437 | .300 |
| Maximum | | 1.050 | .909 | 1.292 | 1.070 | .935 | 1.066 | 1.089 | 1.294 | 1.160 | 1.294 |
| Std. Deviation | | .230 | .091 | .220 | .126 | .099 | .100 | .103 | .097 | .126 | .129 |
| Price Related Differential | | 1.131 | .999 | 1.077 | 1.015 | 1.014 | 1.006 | 1.001 | .993 | .991 | .983 |
| Coefficient of Dispersion | | .332 | .111 | .245 | .148 | .114 | .107 | .103 | .097 | .119 | .134 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 23.1% | .7% | 6.2% | 4.6% | 2.4% | 4.4% | 6.2% | 6.6% | 35.8% | 10.5% |

## Table 9. Combined Results – Post Stratification and Weighting

| | Population Assessor's Value | Median | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Unimproved Properties | 255,676,558 | 0.587 | 435,564,835 | 9.7% | 0.057 |
| Multi-family | 195,413,411 | 0.679 | 287,795,892 | 6.4% | 0.044 |
| Built before 1950 | 110,853,053 | 0.669 | 165,699,630 | 3.7% | 0.025 |
| Built 1950s | 136,177,690 | 0.657 | 207,271,978 | 4.6% | 0.030 |
| Built 1960s | 215,626,548 | 0.683 | 315,705,048 | 7.0% | 0.048 |
| Built 1970s | 494,255,558 | 0.699 | 707,089,496 | 15.7% | 0.110 |
| Built 1980s | 445,480,063 | 0.745 | 597,959,816 | 13.3% | 0.099 |
| Built 1990 thru 1995 | 531,891,574 | 0.754 | 705,426,491 | 15.7% | 0.118 |
| Built 1996 and newer | 914,917,046 | 0.856 | 1,068,828,325 | 23.8% | 0.204 |
| Total | 3,300,291,500 | | 4,491,341,512 | 100.0% | 73.5% |

| | Population Assessor's Value | Weighted Mean | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Unimproved Properties | 255,676,558 | 0.582 | 439,306,801 | 9.8% | 0.057 |
| Multi-family | 195,413,411 | 0.687 | 284,444,557 | 6.4% | 0.044 |
| Built before 1950 | 110,853,053 | 0.66 | 167,959,171 | 3.8% | 0.025 |
| Built 1950s | 136,177,690 | 0.657 | 207,271,978 | 4.6% | 0.030 |
| Built 1960s | 215,626,548 | 0.68 | 317,097,864 | 7.1% | 0.048 |
| Built 1970s | 494,255,558 | 0.701 | 705,072,123 | 15.7% | 0.110 |
| Built 1980s | 445,480,063 | 0.749 | 594,766,439 | 13.3% | 0.099 |
| Built 1990 thru 1995 | 531,891,574 | 0.769 | 691,666,546 | 15.4% | 0.119 |
| Built 1996 and newer | 914,917,046 | 0.855 | 1,070,078,417 | 23.9% | 0.204 |
| Total | 3,300,291,500 | | 4,477,663,896 | 100.0% | 73.7% |

## Table 10. Sales Ratio Analysis: Stratified by Town and Rural Lots

| | | Strata | | |
|---|---|---|---|---|
| | | Rural Lots | Town Lots | Overall Un-weighted |
| Number of Sales | | 421 | 1508 | 1929 |
| Median | | .729 | .732 | .732 |
| 95% Confidence Interval for Median | Lower Bound | .718 | .727 | .727 |
| | Upper Bound | .745 | .739 | .738 |
| Weighted Mean | | .747 | .758 | .756 |
| 95% Confidence Interval for | Lower Bound | .734 | .750 | .749 |
| Weighted Mean | Upper Bound | .761 | .766 | .763 |
| Minimum | | .333 | .300 | .300 |
| Maximum | | 1.294 | 1.292 | 1.294 |
| Std. Deviation | | .132 | .128 | .129 |
| Price Related Differential | | .990 | .981 | .983 |
| Coefficient of Dispersion | | .140 | .133 | .134 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 11.4% | 10.2% | 10.5% |

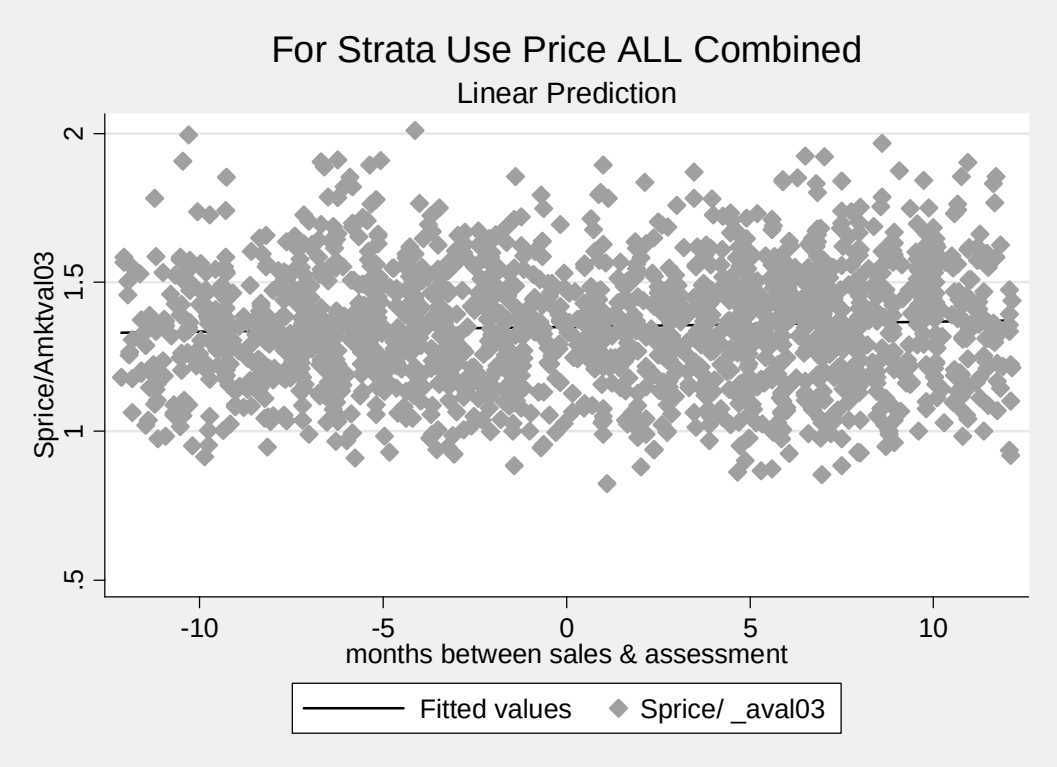
## Table 11. Combined Results – Post Stratification and Weighting

| | Population Assessor's Value | Median | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Town Lot | 2,523,257,410 | 0.732 | 3,447,072,964 | 76.4% | 0.559 |
| Rural Lot | 777,034,090 | 0.729 | 1,065,890,384 | 23.6% | 0.172 |
| Total | 3,300,291,500 | | 4,512,963,348 | 100.0% | 73.1% |

| | Population Assessor's Value | Weighted Mean | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Town Lot | 2,523,257,410 | 0.758 | 3,328,835,633 | 76.2% | 0.578 |
| Rural Lot | 777,034,090 | 0.747 | 1,040,206,278 | 23.8% | 0.178 |
| Total | 3,300,291,500 | | 4,369,041,911 | 100.0% | 75.5% |

**Graph 1. Single Family Property Price Trend**

A thorough analysis of price-time trends by price strata determined that adjusting reported prices was desirable for all single family properties combined. The prices for these strata ranged from $15,000 - $801,500. The resultant trend and statistical analysis is shown below.




**Price Trend Regression Statistics**

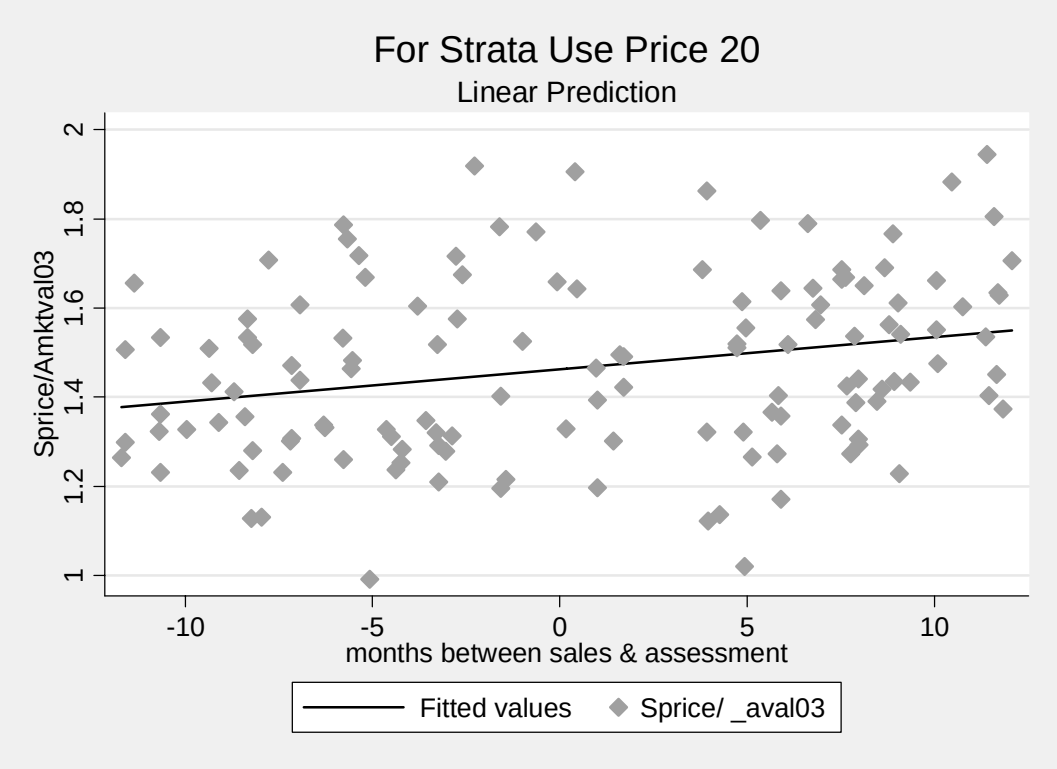
| Source | SS | df | MS | | |
|---|---|---|---|---|---|
| Model | .216649644 | 1 | .216649644 | Number of obs = 1700 | R-squared = 0.0032 |
| Residual | 68.4685325 | 1698 | .040323046 | F( 1, 1698) = 5.37 | Adj R-squared= 0.0026 |
| Total | 68.6851821 | 1699 | .040426829 | Prob > F = 0.0206 | Root MSE = .20081 |

| _aratio | Coef. | Std. Err. | t | P> t | [80% Conf. Interval] | |
|---|---|---|---|---|---|---|
| _adjperiod | .0017033 | .0007348 | 2.32 | 0.021 | .0007612 | .0026454 |
| _cons | 1.350814 | .0048789 | 276.87 | 0.000 | 1.344559 | 1.357069 |

Monthly adjustment rate=.00126094 | Annualized adjustment rate=.01513128

**Graph 2. Multi-family Property Price Trend**

A thorough analysis of price-time trends by price strata determined that adjusting reported prices was desirable for multi-family properties. The prices for this stratum ranged from $52,500 - $207,500. The resultant trend and statistical analysis is shown below.




**Price Trend Regression Statistics**

| Source | SS | df | MS | | |
|---|---|---|---|---|---|
| Model | .354554316 | 1 | .354554316 | Number of obs = 133 | R-squared = 0.0675 |
| Residual | 4.89468976 | 131 | .037364044 | F( 1, 131) = 9.49 | Adj R-squared= 0.0604 |
| Total | 5.24924408 | 132 | .039767001 | Prob > F = 0.0025 | Root MSE = .1933 |

| _aratio | Coef. | Std. Err. | t | P> t | [80% Conf. | Interval] |
|---|---|---|---|---|---|---|
| _adjperiod | .0072038 | .0023386 | 3.08 | 0.003 | .0041916 | .010216 |
| _cons | 1.462532 | .0168459 | 86.82 | 0.000 | 1.440833 | 1.48423 |

Monthly adjustment rate=.00492557 | Annualized adjustment rate=.05910684

# Chapter 21. Ray County

## 1. Significant Findings

1.1 Assessment Level: Ray County's 2003 residential property assessments were approximately 86% of market value (Section 3.5). The results from the corresponding STC study are invalid because the STC's appraisals did not meet the requirement that they reflect market values (Section 4.3).

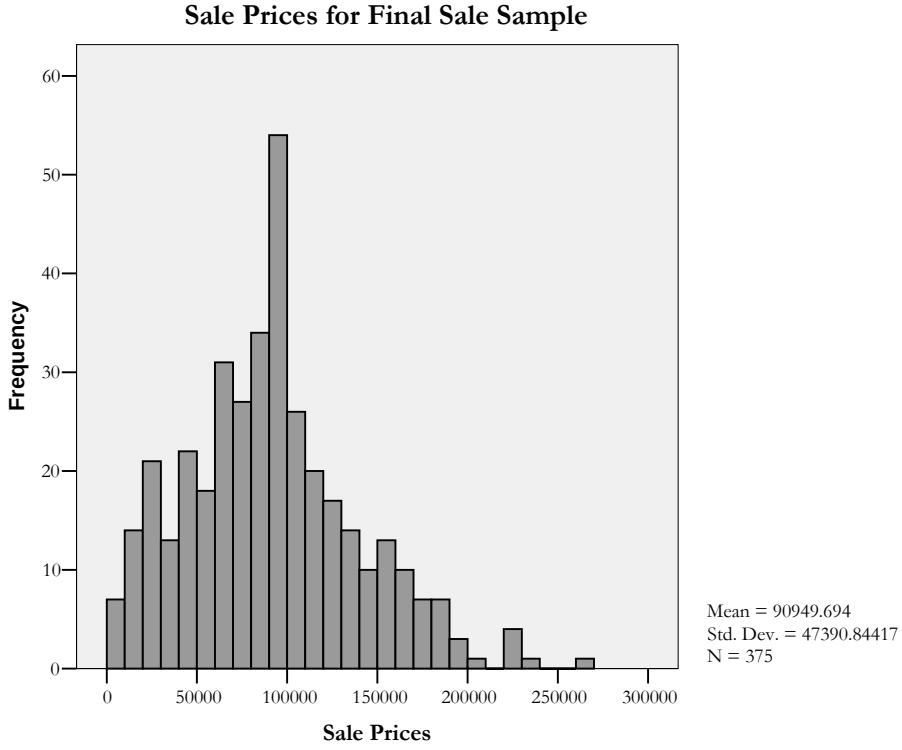
1.2 Assessment Equity: Lower-valued properties and properties in certain locations are assessed less uniformly and at lower levels than other strata (Section 3.6 and Tables 3 & 5).

1.3 Reassessment History: Two indicators of market value changes suggest that three of the past four biennial reassessments have produced lower value increases than the market. Cumulatively, the reassessments from 1997 through 2003 produced 68% of the expected rise in assessments, primarily due to the large increase in 2001. The net change in assessments in 1999 raises questions regarding whether any serious revaluation occurred (Section 5.1).

## 2. Data and Related Issues

2.1 Assessment Data: Assessment information was gathered from the county's website and matched electronically with sales.

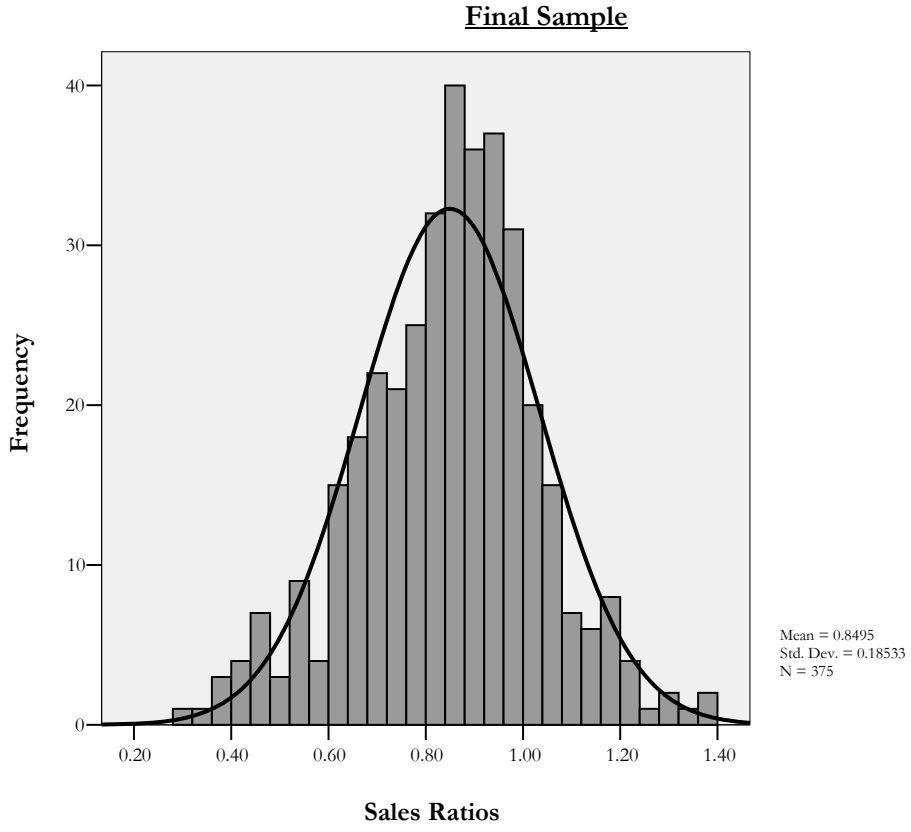
2.2 Sales and Ratio Data: The distribution of sale prices used is reflected in the following histogram.



The next table reports results of the data screening and trimming process. The "screened sales" represent the initial screened sample. The screened sales that were excluded from the final analysis because their ratios were deemed unrepresentative are identified as high or low trims. The "remaining ratios" represent the sample on which all the study's results are based.

| Trimming of Outliers | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Improved Properties <=$48,000 | Improved Properties >$48,000 & <=$72,000 | Improved Properties >$72,000 & <=$88,000 | Improved Properties >$88,000 & <=$108,000 | Improved Properties >$108,000 | Unimproved Properties | Total |
| **Screened Sales** | | 74 | 72 | 77 | 75 | 75 | 33 | 406 |
| Excluded | High Trims | 3 | 7 | 5 | 6 | 3 | 1 | 25 |
| Excluded | Low Trims | 2 | 0 | 3 | 0 | 1 | 0 | 6 |
| **Remaining Ratios** | | **69** | **65** | **69** | **69** | **71** | **32** | **375** |

The histogram below shows the distribution of the ratios for the sample.




2.3 Population: Since a complete copy of the assessment rolls in electronic form was not available, we used the best available alternative as a pseudo-population (hereinafter, "the population"), i.e. three random samples that were drawn and used by the STC.

## 3. Ratio Study Results

3.1 The Sample: The following table shows that the three highest valued improved property strata vary from 5.7% to 8.1% from the population. Initially, this exhibits excessive variability from the sample to the population. However, upon closer examination, this variation has no material effect and thus we conclude that the un-stratified sample is sufficiently representative of the population.

| Comparing Representivity | | | | | | |
|---|---|---|---|---|---|---|
| | Population Distribution | | | PPRC 2003 Sale Sample | | |
| Strata | N | $ | $ Weight | N | $ | $ Weight |
| Improved Properties <=$48,000 | 30 | 805,632 | 10.4% | 69 | 2,316,240 | 8.0% |
| Improved Properties >$48,000 & <=72,000 | 18 | 1,105,684 | 14.2% | 65 | 3,853,480 | 13.3% |
| Improved Properties >$72,000 & <=88,000 | 13 | 1,033,053 | 13.3% | 69 | 5,536,930 | 19.1% |
| Improved Properties >$88,000 & <=108,000 | 14 | 1,356,842 | 17.4% | 69 | 6,698,060 | 23.1% |
| Improved Properties >$108,000 | 36 | 3,352,316 | 43.1% | 71 | 10,116,740 | 35.0% |
| Unimproved Properties | 36 | 127,526 | 1.6% | 32 | 421,500 | 1.5% |
| Total | 147 | 7,781,053 | | 375 | 28,942,950 | |

3.2 Representing the Population with the Sample: Since the un-stratified sample is sufficiently representative of the population (Section 3.1), the use of stratification and weighting is not essential. Nevertheless, we used stratification because it produces additional analytical benefits and further optimizes representivity.

3.3 Sales Chasing: There was no indication of sales chasing.

3.4 Study Validity: The sample meets the requirements for producing valid inferences about the county's population of residential properties.

3.5 Assessment Level: Measures of the assessment level are summarized below. For the purposes of this study, the weighted mean from combined stratification is the preferred measure as long as both of the requirements from using the weighted mean are met. In this case, the distributions are not normal (Figure 3) and weighting is compromised by the use of seriously undersized samples. Since both requirements are not met, we focus on the median, though taking notice of the weighted mean, to conclude that the County's assessments for 2003 reflect approximately 86% of market value.

| Assessment Level (Based on Percent of Market Value) | | | | |
|---|---|---|---|---|
| | Stratification and Weighting | Reference | Weighted Mean | Median |
| **Overall Un-weighted** | None | Table 3 | 84.9% | 85.9% |
| **Combined** | By Property Use and Value Range | Table 4 | 84.5% | 86.0% |

3.6 Equity Measures and Evaluation:

i. Uniformity within Strata: Tables 2, 3 and 5 show results for individual strata of sufficient sample size for evaluation. The following strata represent problem areas for internal uniformity.

| Strata with Inadequate Uniformity | |
|---|---|
| **Property Strata** | **COD** |
| Unimproved Properties | 29.8% |
| Improved Properties <= $48,000 | 29.2% |
| All Other Areas | 23.1% |

ii. Uniformity between Strata: Another form of inequity exists when different strata are assessed at different levels. The IAAO has established guidelines for identifying such inequity, but compliance can be heavily affected by sample size and uniformity. Therefore, we confine our remarks to identifying where assessment levels differ markedly from the norm. We find the difference in medians between lower and higher valued improved property strata (70% versus 83-91% respectively, Table 3) and the difference in medians between properties in the Excelsior Springs, Richmond & Lawson areas and other areas (84-88% versus 73% respectively, Table 5) notable.

iii. Vertical Equity: The final form of potential inequity examined is vertical equity. The PRD for the overall sample of 1.001 complies with the IAAO standard.

## 4. STC Study

4.1 Comparative Results: The following table contrasts our results with those from the STC study. The STC found the level of assessment adequate, while ours does not. The STC reports a substandard horizontal equity measure and an extremely poor measure for vertical equity, while our results find no such problems. We have already demonstrated that the PPRC study meets the criteria for achieving valid results. The rest of Section 4 examines the validity of the STC's study.

| Comparison of Study Results | | | |
|---|---|---|---|
| **Measure** | **STC Study*** | **PPRC Study*** | **PPRC Study Combined**** |
| Assessment Level - median | 111.9% | 85.9% | 86.0% |
| Assessment Level - wtd. mean | 105.4% | 84.9% | 84.5% |
| COD | 26.1% | 16.6% | |
| PRD | 1.13 | 1.00 | |
| Sample Size | 36 | 375 | |
| Relative Precision | 1.00 | 3.23 | |
| * Overall sample (un-stratified and un-weighted) | | | |
| ** Stratification and weighting by Property Use and Value Range | | | |

4.2 Representing the Population with the Sample: The STC does not examine the representivity of its sample, nor does it have the necessary sample size or information to do so. Therefore, in the following table, we provide that missing analysis. In this case, the table shows that the four highest improved value strata in the STC sample vary from 5.1% to 20.3%. Initially, this exhibits excessive variability from the sample to the population. However, upon closer examination, this variation has no material effect and thus we conclude that the STC sample is sufficiently representative of the population.

| Comparing Representivity | | | | | | |
|---|---|---|---|---|---|---|
| | Population | | | STC 2003 Appraisals | | |
| Strata | N | $ | % | N | $ | % |
| Improved Properties <=$48,000 | 30 | 805,632 | 10.4% | 7 | 188,737 | 9.2% |
| Improved Properties >$48,000 & <=72,000 | 18 | 1,105,684 | 14.2% | 3 | 178,158 | 8.7% |
| Improved Properties >$72,000 & <=88,000 | 13 | 1,033,053 | 13.3% | 2 | 163,684 | 8.0% |
| Improved Properties >$88,000 & <=108,000 | 14 | 1,356,842 | 17.4% | 7 | 689,105 | 33.7% |
| Improved Properties >$108,000 | 36 | 3,352,316 | 43.1% | 5 | 776,947 | 38.0% |
| Unimproved Properties | 36 | 127,526 | 1.6% | 12 | 48,368 | 2.4% |
| Total | 147 | 7,781,053 | | 36 | 2,045,000 | |

4.3 Market Value: The final requirement for producing a valid appraisal study is that appraisals must represent market values. As discussed in the introduction for this Section II, and in greater depth in the Procedure Manual (Section III), we use 4 tests to make this determination. The results of each test are reported in the following tables.

| Mann-Whitney Test | | | | |
|---|---|---|---|---|
| For the Entire Sample | | | | |
| Study | Observations | Rank sum | Expected | Ho: Ratios (36 STC Appraisals)=Ratios (375 Sales)<br>z = 6.105<br>Prob > \|z\| = 0.0000 |
| 0 | 36 | 11572 | 7416 | |
| 1 | 375 | 73094 | 77250 | |
| Combined | 411 | 84666 | 84666 | |
| For Single Family Properties Only | | | | |
| Study | Observations | Rank sum | Expected | Ho : Ratios (24 STC Appraisals)=Ratios (342 Sales)<br>z = 5.098<br>Prob > \|z\| = 0.0000 |
| 0 | 24 | 6958 | 4404 | |
| 1 | 342 | 60203 | 62757 | |
| Combined | 366 | 67161 | 67161 | |

| K-Sample Test | | | | |
|---|---|---|---|---|
| For the Entire Sample | | | | |
| Study | Not Greater than the median | Greater than the median | Total | Ho: Ratios (36 STC Appraisals)=Ratios(375 Sales)<br>Pearson chi2(1) = 14.8528 Pr = 0.000<br>Continuity corrected:<br>Pearson chi2(1) = 13.5383 Pr = 0.000 |
| 0 | 7 | 29 | 36 | |
| 1 | 199 | 176 | 375 | |
| Total | 206 | 205 | 411 | |
| For Single Family Properties Only | | | | |
| Study | Not Greater than the median | Greater than the median | Total | Ho: Ratios (24 STC Appraisals)=Ratios(342 Sales)<br>Pearson chi2(1) = 8.7398 Pr = 0.003<br>Continuity corrected:<br>Pearson chi2(1) = 7.5358 Pr = 0.006 |
| 0 | 5 | 19 | 24 | |
| 1 | 178 | 164 | 342 | |
| Total | 183 | 183 | 366 | |

All four tests lead to the conclusion that the STC appraisals do not represent market values (all with 99% statistical confidence). Therefore, the STC study is invalid and its reported results are unreliable.

## 5. Additional Analysis and Findings

5.1 Analysis of Reassessment History: The following table provides a comparison of actual assessment changes (net of new construction) to those that might have been expected for each of the last four reassessments as well as the six-year period leading up to 2003. Only one of the reassessments produced changes somewhat in line with the market indicator.

| Actual Value Changes from Reassessment vs. Expected Value Change | | | | | |
|---|---|---|---|---|---|
| Biennial Year | % Net Assessment Change | Missouri OFHEO Index | % Value Change: Actual vs. Expected | KC MSA OFHEO Index | % Value Change: Actual vs. Expected |
| 1999 | 0.0 | 8.4 | 0% | 12.3 | 0% |
| 2001 | 20.2 | 11.4 | 177% | 13.0 | 155% |
| 2003 | 3.0 | 11.8 | 26% | 9.9 | 31% |
| 2005 | 3.7 | 12.4 | 30% | 10.5 | 35% |
| Cumulative 1997 - 2003 | 23.8 | 35.0 | 68% | 39.5 | 60% |

## 6. Figures and Tables

**Table 1. STC's Appraisal Ratio Studies**

| | | Group | | |
|---|---|---|---|---|
| | | 1999 | 2001 | 2003 |
| Number of Appraisals | | 36 | 40 | 36 |
| Median | | .997 | 1.033 | 1.119 |
| 95% Confidence Interval for Median | Lower Bound | .901 | .970 | 1.025 |
| | Upper Bound | 1.140 | 1.145 | 1.216 |
| Weighted Mean | | .981 | 1.019 | 1.054 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .906 | .884 | .980 |
| | Upper Bound | 1.056 | 1.153 | 1.127 |
| Minimum | | .421 | .064 | .194 |
| Maximum | | 2.561 | 2.702 | 2.366 |
| Std. Deviation | | .543 | .523 | .418 |
| Price Related Differential | | 1.213 | 1.121 | 1.133 |
| Coefficient of Dispersion | | .376 | .325 | .261 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 30.6% | 37.5% | 27.8% |

**Figure 1. Ratios before Outlier Trimming**

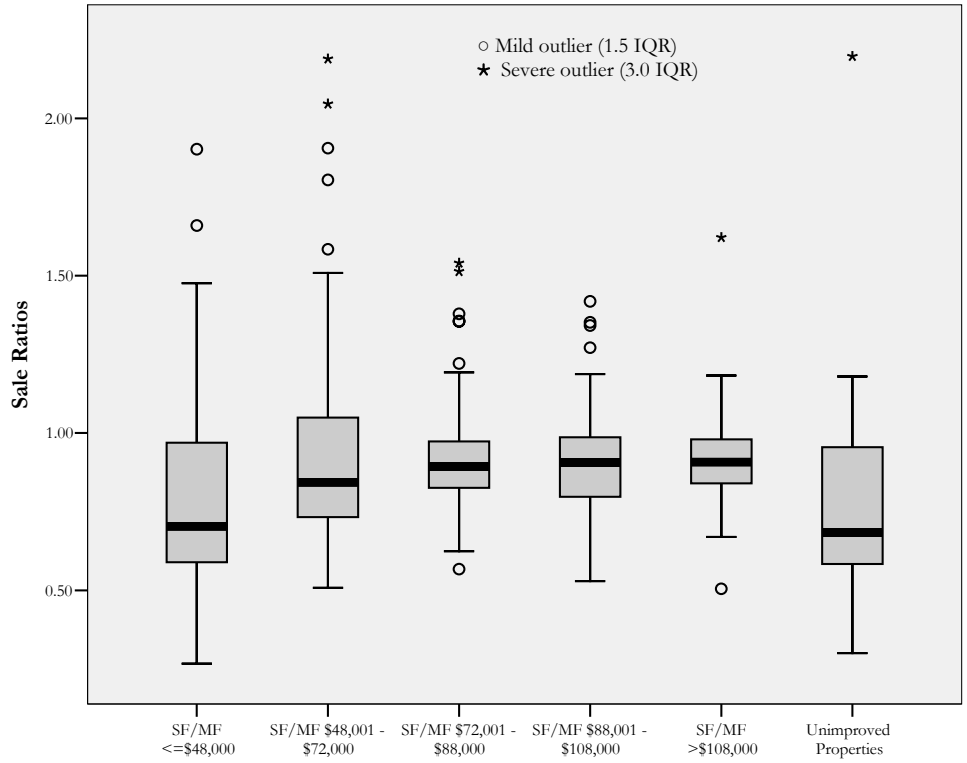
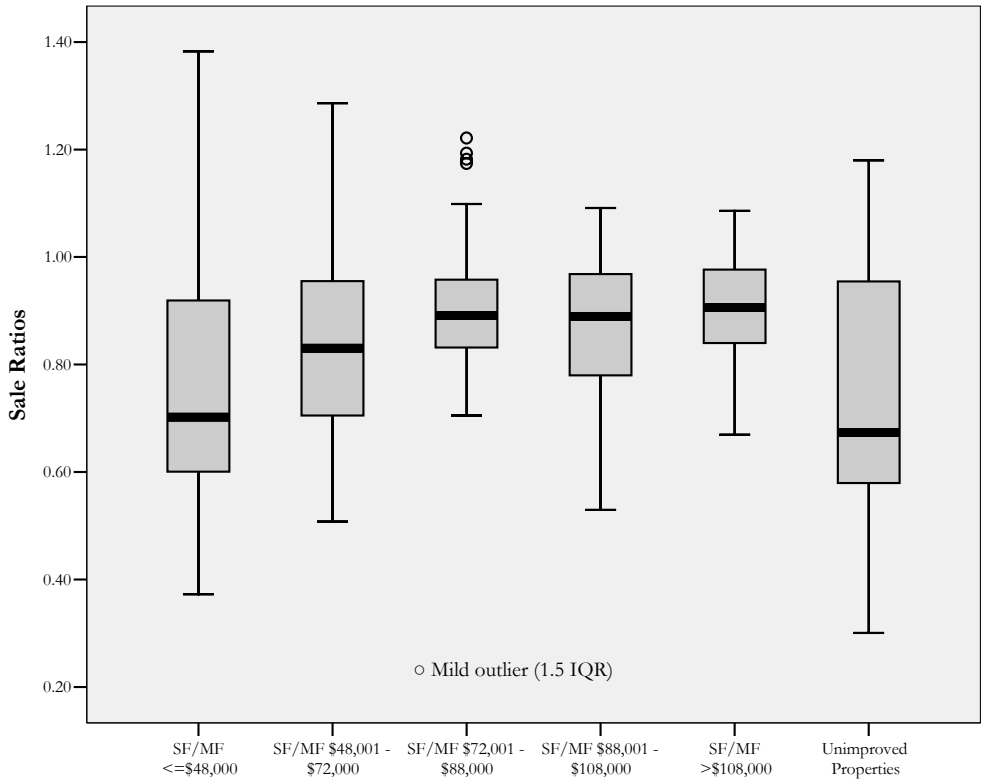
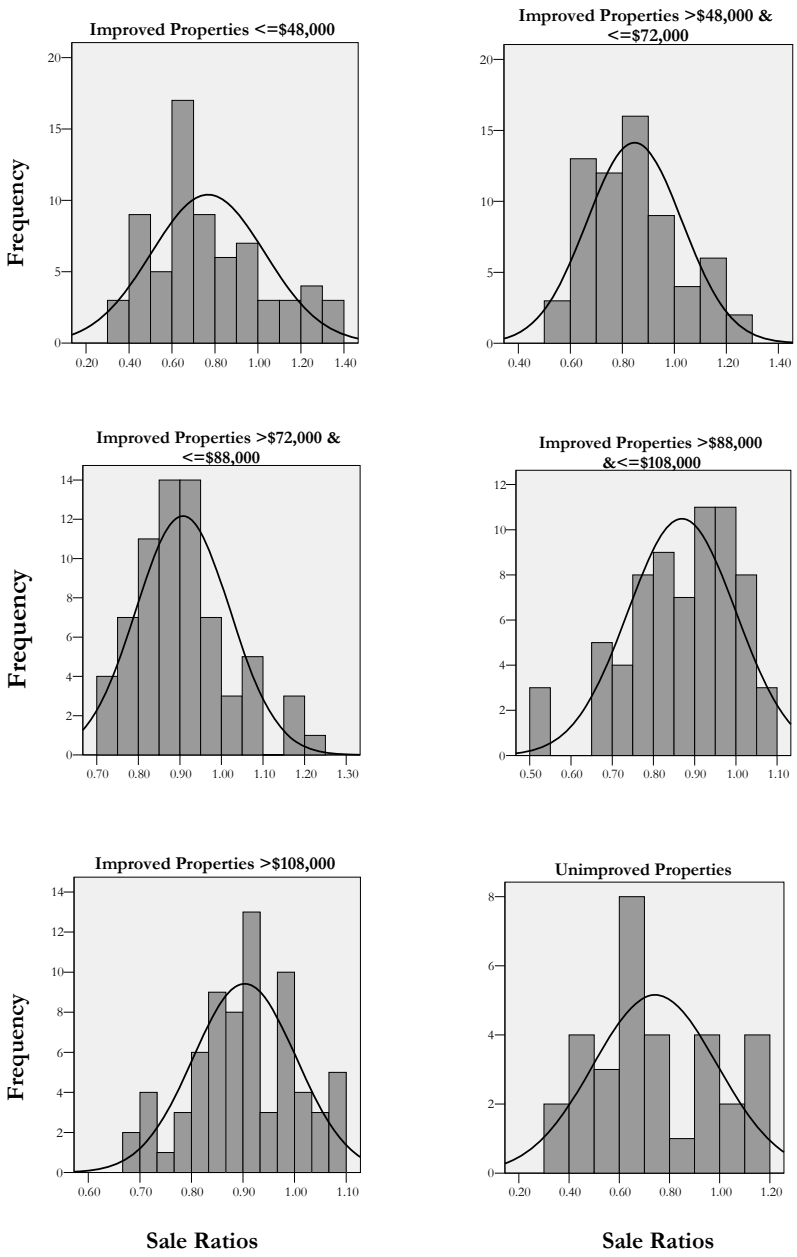



**Figure 2. Ratios after Outlier Trimming**



## Figure 3. Distribution of Final Sale Ratios



## Figure 3 (cont.). Distribution of Final Sale Ratios

### Shapiro-Francia W' Tests for Normality for Various Strata

| Strata | Observations | W' | V' | z | Prob* |
|---|---|---|---|---|---|
| Single Family | 342 | 0.98866 | 2.901 | 2.299 | 0.01076 |
| Unimproved Properties | 32 | 0.96710 | 1.212 | 0.357 | 0.36037 |
| Multi-family | 1 | . | . | . | . |
| Improved Properties | 343 | 0.98882 | 2.867 | 2.274 | 0.01148 |
| Improved Properties <=$48,000 | 69 | 0.94899 | 3.414 | 2.363 | 0.00906 |
| Improved Properties >$48,000 & <=$72,000 | 65 | 0.97395 | 1.662 | 0.994 | 0.16018 |
| Improved Properties >$72,000 & <=$88,000 | 69 | 0.95092 | 3.284 | 2.291 | 0.01097 |
| Improved Properties >$88,000 & <=$108,000 | 69 | 0.96165 | 2.566 | 1.829 | 0.03372 |
| Improved Properties >$108,000 | 71 | 0.98315 | 1.154 | 0.284 | 0.38804 |
| Overall Un-weighted | 375 | 0.99127 | 2.423 | 1.926 | 0.02707 |
| *This value represents the indicated probability that the underlying population is normally distributed. A value of less than .05 indicates a distribution that is not normal. | | | | | |

## Table 2. Sales Ratio Analysis: Stratified by Property Use

| | | Strata | | | |
|---|---|---|---|---|---|
| | | Single Family | Unimproved Properties | Multi-family | Overall Un-weighted |
| Number of Sales | | 342 | 32 | 1 | 375 |
| Median | | .871 | .673 | 1.040 | .859 |
| 95% Confidence Interval for Median | Lower Bound | .848 | .600 | . | .843 |
| | Upper Bound | .886 | .955 | . | .882 |
| Weighted Mean | | .852 | .671 | 1.040 | .849 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .835 | .594 | . | .832 |
| | Upper Bound | .868 | .748 | . | .865 |
| Minimum | | .372 | .301 | 1.040 | .301 |
| Maximum | | 1.383 | 1.180 | 1.040 | 1.383 |
| Std. Deviation | | .176 | .248 | . | .185 |
| Price Related Differential | | 1.008 | 1.108 | 1.000 | 1.001 |
| Coefficient of Dispersion | | .153 | .298 | .000 | .166 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 35.7% | 18.8% | 100.0% | 34.4% |

## Table 3. Sales Ratio Analysis: Stratified by Use and Value

| | | Strata | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Improved Properties <=$48,000 | Improved Properties $48,001 - $72,000 | Improved Properties $72,001 - $88,000 | Improved Properties $88,001 - $108,000 | Improved Properties >$108,000 | Un-improved Properties | Overall Un-weighted |
| Number of Sales | | 69 | 65 | 69 | 69 | 71 | 32 | 375 |
| Median | | .702 | .831 | .891 | .890 | .906 | .673 | .859 |
| 95% Confidence Interval for Median | Lower Bound | .676 | .774 | .856 | .826 | .882 | .600 | .843 |
| | Upper Bound | .801 | .877 | .921 | .945 | .929 | .955 | .882 |
| Weighted Mean | | .696 | .811 | .895 | .846 | .896 | .671 | .849 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .642 | .769 | .869 | .809 | .871 | .594 | .832 |
| | Upper Bound | .751 | .853 | .920 | .882 | .922 | .748 | .865 |
| Minimum | | .372 | .508 | .705 | .530 | .670 | .301 | .301 |
| Maximum | | 1.383 | 1.286 | 1.221 | 1.091 | 1.086 | 1.180 | 1.383 |
| Std. Deviation | | .265 | .183 | .113 | .131 | .100 | .248 | .185 |
| Price Related Differential | | 1.103 | 1.044 | 1.014 | 1.028 | 1.008 | 1.108 | 1.001 |
| Coefficient of Dispersion | | .292 | .173 | .095 | .121 | .088 | .298 | .166 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 14.5% | 20.0% | 42.0% | 47.8% | 53.5% | 18.8% | 34.4% |

## Table 4. Combined Results – Post Stratification and Weighting

| | Population Assessor's Value | Median | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Improved Properties <=$48,000 | 805,632 | 0.702 | 1,147,623 | 12.7% | 0.089 |
| Improved Properties >$48,000 & <=72,000 | 1,105,684 | 0.831 | 1,330,547 | 14.7% | 0.122 |
| Improved Properties >$72,000 & <=88,000 | 1,033,053 | 0.891 | 1,159,431 | 12.8% | 0.114 |
| Improved Properties >$88,000 & <=108,000 | 1,356,842 | 0.89 | 1,524,542 | 16.8% | 0.150 |
| Improved Properties >$108,000 | 3,352,316 | 0.906 | 3,700,128 | 40.9% | 0.370 |
| Unimproved Properties | 127,526 | 0.673 | 189,489 | 2.1% | 0.014 |
| Total | 7,781,053 | | 9,051,759 | 100.0% | 86.0% |

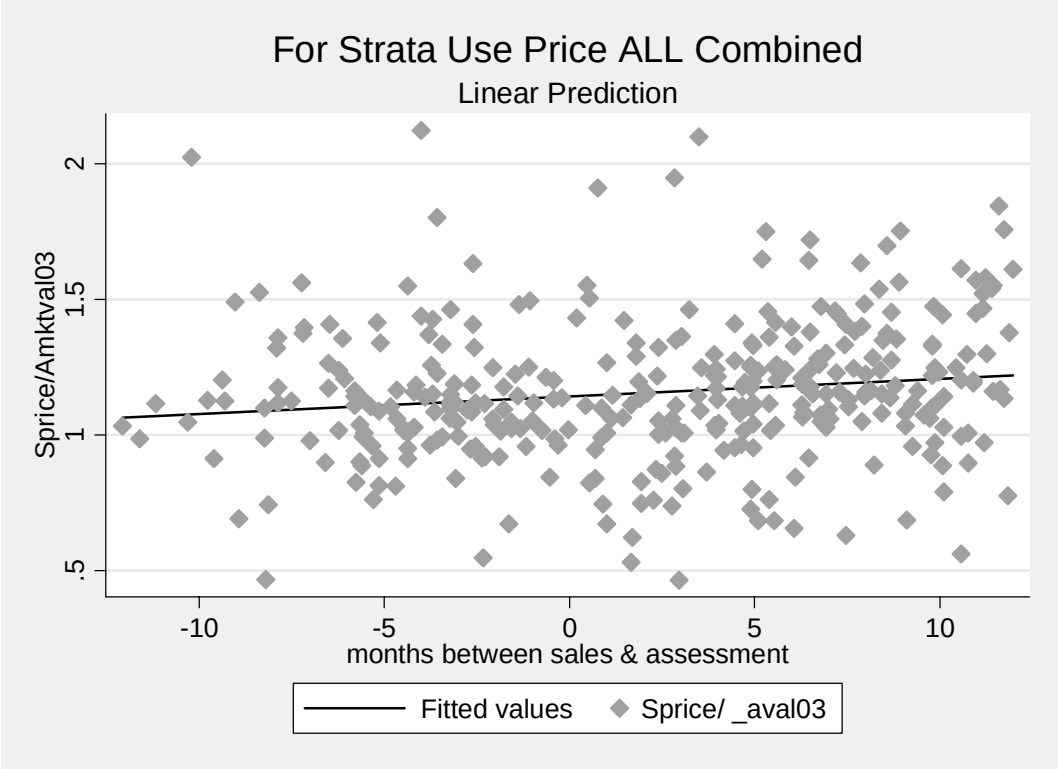
| | Population Assessor's Value | Weighted Mean | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Improved Properties <=$48,000 | 805,632 | 0.696 | 1,157,517 | 12.6% | 0.087 |
| Improved Properties >$48,000 & <=72,000 | 1,105,684 | 0.811 | 1,363,359 | 14.8% | 0.120 |
| Improved Properties >$72,000 & <=88,000 | 1,033,053 | 0.895 | 1,154,249 | 12.5% | 0.112 |
| Improved Properties >$88,000 & <=108,000 | 1,356,842 | 0.846 | 1,603,832 | 17.4% | 0.147 |
| Improved Properties >$108,000 | 3,352,316 | 0.896 | 3,741,424 | 40.6% | 0.364 |
| Unimproved Properties | 127,526 | 0.671 | 190,054 | 2.1% | 0.014 |
| Total | 7,781,053 | | 9,210,435 | 100.0% | 84.5% |

## Table 5. Sales Ratio Analysis: Stratified by Location

| | | Strata | | | | |
|---|---|---|---|---|---|---|
| | | Excelsior Springs Area | Lawson Area | Richmond Area | All other Areas | Overall Un-weighted |
| Number of Sales | | 79 | 105 | 140 | 51 | 375 |
| Median | | .879 | .846 | .879 | .735 | .859 |
| 95% Confidence Interval for Median | Lower Bound | .825 | .815 | .857 | .688 | .843 |
| | Upper Bound | .930 | .894 | .912 | .848 | .882 |
| Weighted Mean | | .857 | .846 | .879 | .765 | .849 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .823 | .818 | .852 | .716 | .832 |
| | Upper Bound | .891 | .873 | .905 | .814 | .865 |
| Minimum | | .436 | .301 | .329 | .410 | .301 |
| Maximum | | 1.193 | 1.383 | 1.377 | 1.276 | 1.383 |
| Std. Deviation | | .168 | .190 | .174 | .208 | .185 |
| Price Related Differential | | 1.006 | .960 | 1.013 | 1.042 | 1.001 |
| Coefficient of Dispersion | | .147 | .170 | .151 | .231 | .166 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 38.0% | 34.3% | 36.4% | 23.5% | 34.4% |

**Graph 1: Improved Property Price Trend**

A thorough analysis if price-time trends by price strata determined that adjusting reported prices was desirable for all improved properties. The prices for these strata ranged from $10,000 - $255,000. The resultant trend and statistical analysis is shown below.




**Price Trend Regression Statistics**

| Source | SS | df | MS | | |
|---|---|---|---|---|---|
| Model | .519957731 | 1 | .519957731 | Number of obs = 349 | R-squared = 0. 0223 |
| Residual | 22.8026474 | 347 | .065713681 | F( 1, 347) = 7.91 | Adj R-squared= 0. 0195 |
| Total | 23.3226051 | 348 | .06701898 | Prob > F = 0. 0052 | Root MSE = .25635 |

| _aratio | Coef. | Std. Err. | t | P> t | [80% Conf. Interval] | |
|---|---|---|---|---|---|---|
| _adjperiod | .0064739 | .0023015 | 2.81 | 0.005 | .0035188 | .009429 |
| _cons | 1.14253 | .0145887 | 78.32 | 0.000 | 1.123798 | 1.161262 |
| Monthly adjustment rate=.00566628 | | | | Annualized adjustment rate=.06799536 | | |

# Chapter 22. St. Charles County

## 1. Significant Findings

1.1 Assessment Level: St. Charles County's 2003 residential property assessments were approximately 96% of market value (Section 3.5).

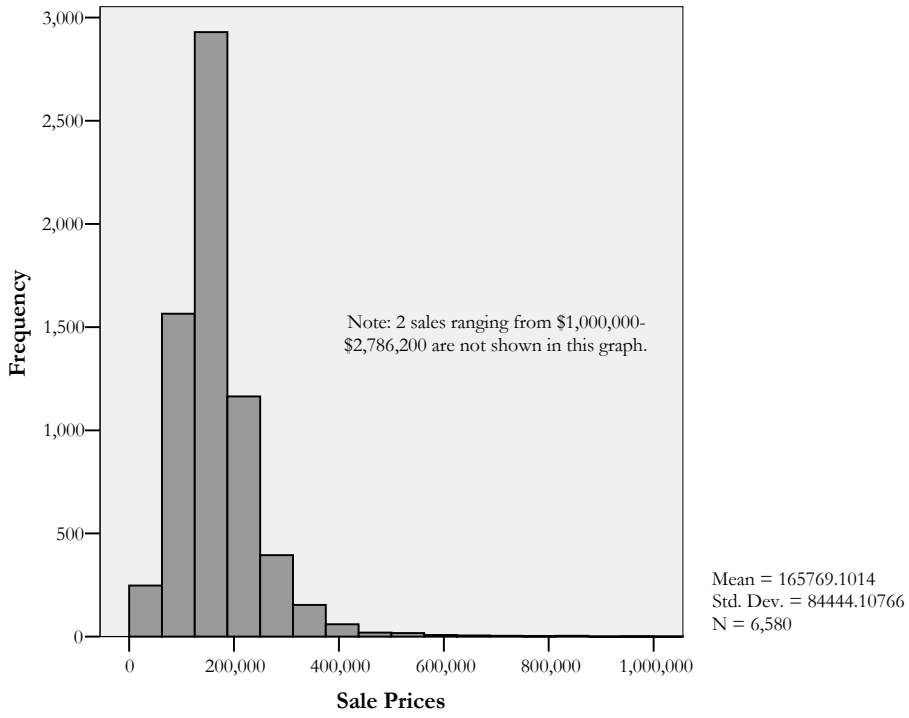
1.2 Assessment Equity: There were no substantial problems (Section 3.6).

1.3 Reassessment History: Two indicators of change in market values suggest that the past four biennial reassessments have produced value increases equivalent to the market. Cumulatively, the three reassessments from 1997 through 2003 produced 119% of the expected rise in assessments (Section 5.1).

## 2. Data and Related Issues

2.1 Assessment Data: The assessor provided the assessment roll in electronic format. Therefore, sales were matched using a combination of computer techniques and software and then screened. The assessor answered all questions regarding the contents and coding of data when requested. The files received contained information allowing us to identify properties affected by new construction and to screen as appropriate.

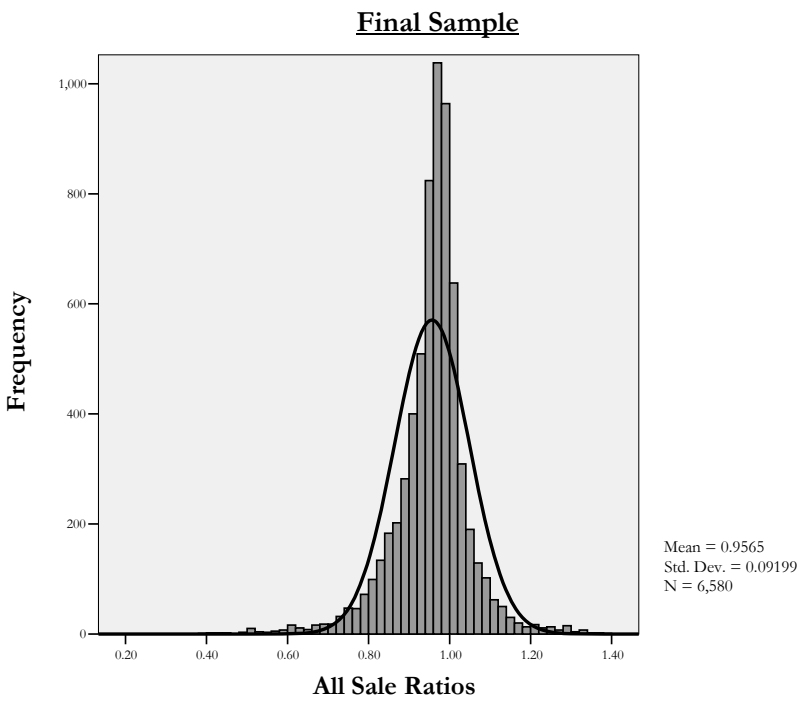
2.2 Sales and Ratio Data: The distribution of sale prices used is reflected in the following histogram.



The next table reports results of the data screening and trimming process. The "screened sales" represent the initial screened sample. The screened sales that were excluded from the final analysis because their ratios were deemed unrepresentative are identified as high or low trims. The "remaining ratios" represent the sample on which all the study's results are based.

| Trimming of Outliers | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Single Family <=$116,000 | Single Family $116,001-$139,000 | Single Family $139,001-$166,000 | Single Family $166,001-$213,000 | Single Family >$213,000 | Unimproved Properties | Multi-family | Total |
| **Screened Sales** | | 1,411 | 1,269 | 1,184 | 1,339 | 1,087 | 265 | 101 | 6,656 |
| Excluded | High Trims | 20 | 3 | 5 | 4 | 2 | 10 | 7 | 51 |
| | Low Trims | 3 | 1 | 2 | 4 | 4 | 9 | 2 | 25 |
| **Remaining Ratios** | | **1,388** | **1,265** | **1,177** | **1,331** | **1,081** | **246** | **92** | **6,580** |

The histogram below shows the distribution of the ratios for the sample.




2.3 Population: Since a complete copy of the 2003 assessment rolls in electronic form was available, we were able to analyze the county's population in detail. This allowed us to stratify and weight sales on a variety of property and location characteristics.

## 3. Ratio Study Results

3.1 The Sample: The following table shows that one of the strata, the highest valued single family stratum, varies by more than 3 percent from the population. However, upon closer examination, this variance has no material effect on the overall level of assessment and thus we conclude that the un-stratified sample is sufficiently representative of the population.

| Strata | Population | | | PPRC 2003 Sales | | |
|---|---|---|---|---|---|---|
| | N | $ | % | N | $ | % |
| Single Family <=$116,000 | 24,168 | 2,087,899,886 | 13.2% | 1,388 | 125,673,830 | 12.1% |
| Single Family $116,001-$139,000 | 19,428 | 2,488,472,880 | 15.7% | 1,265 | 161,967,570 | 15.5% |
| Single Family $139,001-$166,000 | 18,606 | 2,818,824,960 | 17.8% | 1,177 | 178,195,060 | 17.1% |
| Single Family $166,001-$213,000 | 18,650 | 3,478,554,130 | 21.9% | 1,331 | 248,306,520 | 23.8% |
| Single Family >$213,000 | 14,235 | 4,018,475,547 | 25.3% | 1,081 | 302,004,000 | 29.0% |
| Unimproved Properties | 10,852 | 387,062,477 | 2.4% | 246 | 15,328,820 | 1.5% |
| Multi-family | 1,880 | 581,953,359 | 3.7% | 92 | 11,297,350 | 1.1% |
| Total | 107,819 | 15,861,243,239 | | 6,580 | 1,042,773,150 | |

3.2 Representing the Population with the Sample: Since the un-stratified sample is sufficiently representative of the population (Section 3.1), the use of stratification and weighting is not essential. Nevertheless, we used stratification because it produces additional analytical benefits and further optimizes representivity.

3.3 Sales Chasing: There was no indication of sales chasing.

3.4 Study Validity: The sample meets the requirements for producing valid inferences about the county's population of residential properties.

3.5 Assessment Level: Measures of the assessment level are summarized below. For the purposes of this study, the weighted mean from combined stratification is the preferred measure as long as the both of the requirements from using the weighted mean are met. In this case, weighting is not compromised by the use of seriously undersized samples but the distributions are not sufficiently normal (Figure 3). Since both requirements are not met, we focus on the median, though taking notice of the weighted mean, to conclude that the County's assessments for 2003 reflect approximately 96% of market value.

| Assessment Level (Based on Percent of Market Value Captured) | | | | |
|---|---|---|---|---|
| | Stratification and Weighting | Appendix Reference | Weighted Mean | Median |
| **Overall Un-weighted** | None | Table 2 | 95.6% | 96.6% |
| **Combined** | By Property Use | Table 3 | 95.4% | 96.5% |
| **Combined** | By Property Use and Value Range | Table 5 | 95.3% | 96.4% |
| **Combined** | By Property Use and Location | Table 7 | 95.4% | 96.4% |
| **Combined** | By Property Age | Table 9 | 95.0% | 96.2% |
| **Combined** | By Property Town Lots and Rural Lots | Table 11 | 95.5% | 96.6% |

3.6 Equity Measures and Evaluation:

i. Uniformity within Strata: Results from Tables 2, 4, 6, 8 & 10 for the strata with sufficient sample size for individual evaluation indicate no problem areas for internal uniformity.

ii. Uniformity between Strata: Another form of inequity exists when different strata are assessed at different levels. The IAAO has established guidelines for identifying such inequity, but

compliance can be heavily affected by sample size and uniformity. Therefore, we confine our remarks to identifying where assessment levels differ markedly from the norm. For this county, there were no substantial differences.

iii. Vertical Equity: The final form of potential inequity examined is vertical equity. The PRD for the overall sample of 1.001 complies with the IAAO standard.

## 4. STC Study

4.1 Comparative Results: The following table contrasts our results with those from the STC study. All significant measures point to nearly similar conclusions. The STC found the level of assessment adequate, as do we. The STC reports similarly acceptable measures for horizontal equity and for vertical equity. We have already demonstrated that the PPRC study meets the criteria for achieving valid results. The rest of Section 4 examines the validity of the STC's study.

| Comparison of Study Results | | | |
|---|---|---|---|
| **Measure** | **STC Study*** | **PPRC Study*** | **PPRC Study Combined**** |
| Assessment Level – median | 94.8% | 96.6% | 96.4% |
| Assessment Level - wtd. Mean | 96.3% | 95.6% | 95.3% |
| COD | 6.4% | 6.3% | |
| PRD | 1.00 | 1.00 | |
| Sample Size | 39 | 6,580 | |
| Relative Precision | 1.00 | 12.99 | |
| * Overall sample (un-stratified and un-weighted) | | | |
| ** Stratification and weighting by Property Use and Value Range | | | |
| NOTE: Value used for the Equivalent Sale Ratio from the 2003/2004 cycle: 100%, which was based on having a COD less than 25%. | | | |

4.2 Representing the Population with the Sample: The STC does not examine the representivity of its sample, nor does it have the necessary sample size or information to do so. Therefore, in the following table, we provide that missing analysis. In this case, the table shows that two of the single-family value strata in the STC vary from 4.5% to 5.5%. Initially, this exhibits excessive variability from the sample to the population. However, upon closer examination, this variation has no material effect and thus we conclude that the STC sample is sufficiently representative of the population.

| Comparing Representivity | | | | | | |
|---|---|---|---|---|---|---|
| **Strata** | **Population** | | | **STC 2003 Appraisals** | | |
| | **N** | **$** | **%** | **N** | **$** | **%** |
| Single Family <=$116,000 | 24,168 | 2,087,899,886 | 13.2% | 8 | 746,474 | 14.8% |
| Single Family $116,001-$139,000 | 19,428 | 2,488,472,880 | 15.7% | 8 | 1,021,684 | 20.2% |
| Single Family $139,001-$166,000 | 18,606 | 2,818,824,960 | 17.8% | 6 | 909,842 | 18.0% |
| Single Family $166,001-$213,000 | 18,650 | 3,478,554,130 | 21.9% | 6 | 1,094,105 | 21.7% |
| Single Family >$213,000 | 14,235 | 4,018,475,547 | 25.3% | 4 | 1,000,579 | 19.8% |
| Unimproved Properties | 10,852 | 387,062,477 | 2.4% | 4 | 91,000 | 1.8% |
| Multi-family | 1,880 | 581,953,359 | 3.7% | 3 | 188,000 | 3.7% |
| Total | 107,819 | 15,861,243,239 | | 39 | 5,051,684 | |

4.3 Market Value: The final requirement for producing a valid appraisal study is that appraisals must represent market values. As discussed in the introduction for this Section II, and in greater depth in the Procedure Manual (Section III), we use 4 tests to make this determination. The results of each test are reported in the following tables.

| Mann-Whitney Test | | | | |
|---|---|---|---|---|
| For the Entire Sample | | | | |
| Study | Observations | Rank sum | Expected | Ho: Ratios (39 STC Appraisals)=Ratios (6580 Sales)<br>z = -1.132<br>Prob > \|z\| = 0.2577 |
| 0 | 39 | 115623 | 129090 | |
| 1 | 6580 | 21793267 | 21779800 | |
| Combined | 6619 | 21908890 | 21908890 | |
| For Single Family Properties Only | | | | |
| Study | Observations | Rank sum | Expected | Ho : Ratios (32 STC Appraisals)=Ratios (6242 Sales)<br>z = -0.853<br>Prob > \|z\| = 0.3936 |
| 0 | 32 | 91682 | 100400 | |
| 1 | 6242 | 19592993 | 19584275 | |
| Combined | 6274 | 19684675 | 19684675 | |

| K-Sample Test | | | | |
|---|---|---|---|---|
| For the Entire Sample | | | | |
| Study | Not Greater than the median | Greater than the median | Total | Ho: Ratios (39 STC Appraisals)=Ratios (6580 Sales)<br>Pearson chi2(1) = 3.1176 Pr = 0.077<br>Continuity corrected:<br>Pearson chi2(1) = 2.5763 Pr = 0.108 |
| 0 | 25 | 14 | 39 | |
| 1 | 3,285 | 3,295 | 6,580 | |
| Total | 3,310 | 3,309 | 6,619 | |
| For Single Family Properties Only | | | | |
| Study | Not Greater than the median | Greater than the median | Total | Ho: Ratios (32 STC Appraisals)=Ratios (6242 Sales)<br>Pearson chi2(1) = 2.0103 Pr = 0.156<br>Continuity corrected:<br>Pearson chi2(1) = 1.5391 Pr = 0.215 |
| 0 | 20 | 12 | 32 | |
| 1 | 3,117 | 3,125 | 6,242 | |
| Total | 3,137 | 3,137 | 6,274 | |

All four tests lead to the conclusion that we cannot reject the null hypothesis. Therefore, we conclude that the STC appraisals approximately represent market values.

## 5. Additional Analysis and Findings

5.1 Analysis of Reassessment History: The following table provides a comparison of actual assessment changes (net of new construction) to those that might have been expected for each of the last four reassessments as well as the six-year period leading up to 2003. All of the reassessments produced changes in line with the market indicator. In our study, previous assessment information was available for St. Charles County, so we were able to test for the real reassessment rate. Using this information, we found evidence that a real reassessment took place in 2003.

| Actual Value Changes from Reassessment vs. Expected Value Change | | | | | |
|---|---|---|---|---|---|
| Biennial Year | % Net Assessment Change | Missouri OFHEO Index | % Value Change: Actual vs. Expected | St. Louis MSA OFHEO Index | % Value Change: Actual vs. Expected |
| 1999 | 10.4 | 8.4 | 124% | 9.6 | 108% |
| 2001 | 11.5 | 11.4 | 101% | 13.5 | 85% |
| 2003 | 14.9 | 11.8 | 127% | 12.9 | 116% |
| 2005 | 13.5 | 12.4 | 109% | 16.8 | 80% |
| Cumulative 1997 - 2003 | 41.5 | 35.0 | 119% | 40.4 | 103% |

## 6. Figures and Tables

**Table 1. STC's Appraisal Ratio Studies**

| | | Group | | | |
|---|---|---|---|---|---|
| | | 1999 | 2001 | 2003 | 2005* |
| Number of Appraisals | | 36 | 40 | 39 | 38 |
| Median | | 1.021 | .979 | .948 | .972 |
| 95% Confidence Interval for Median | Lower Bound | 1.010 | .942 | .941 | .939 |
| | Upper Bound | 1.039 | 1.016 | .973 | .993 |
| Weighted Mean | | 1.011 | .955 | .963 | .789 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .988 | .915 | .941 | .510 |
| | Upper Bound | 1.034 | .995 | .985 | 1.069 |
| Minimum | | .834 | .585 | .588 | .090 |
| Maximum | | 1.232 | 1.113 | 1.552 | 1.076 |
| Std. Deviation | | .076 | .117 | .126 | .164 |
| Price Related Differential | | 1.014 | 1.005 | 1.001 | 1.172 |
| Coefficient of Dispersion | | .049 | .083 | .064 | .080 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 83.3% | 75.0% | 74.4% | 78.9% |
| *The STC has not completed its studies for the 2005 reassessment cycle. These results may not represent final values. | | | | | |

**Figure 1. Ratios before Outlier Trimming**

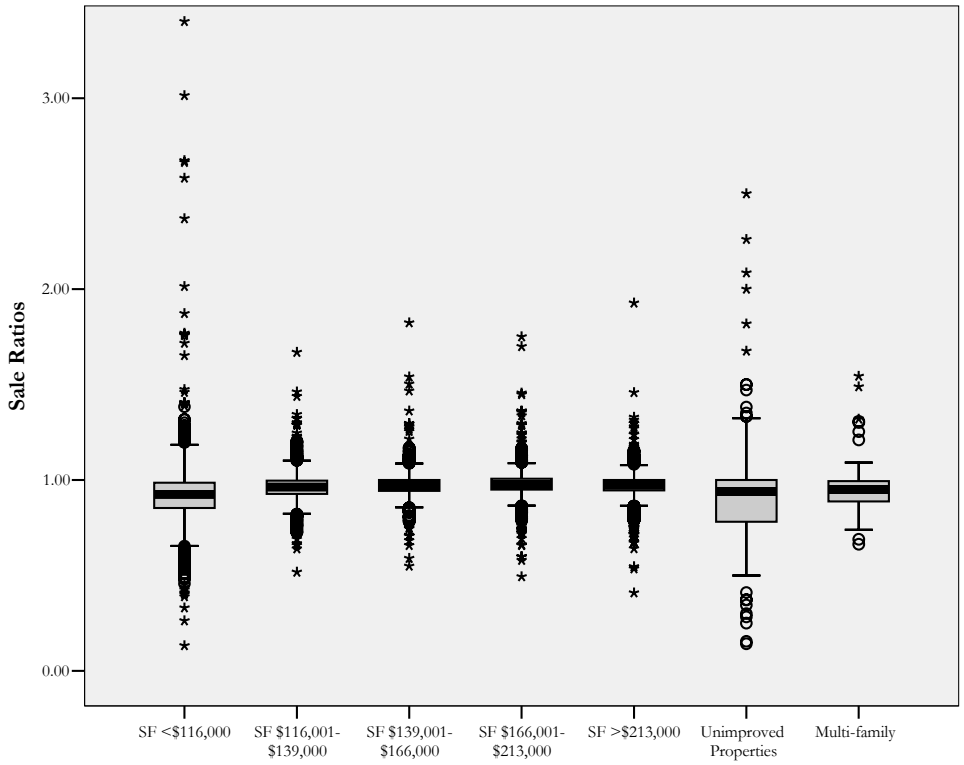
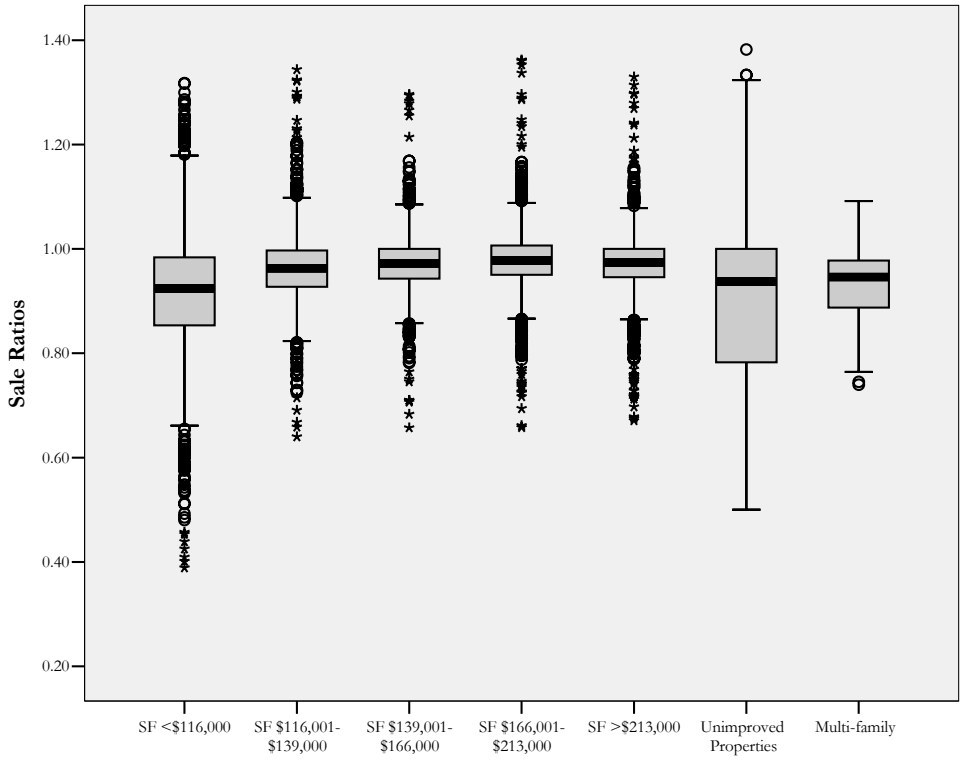
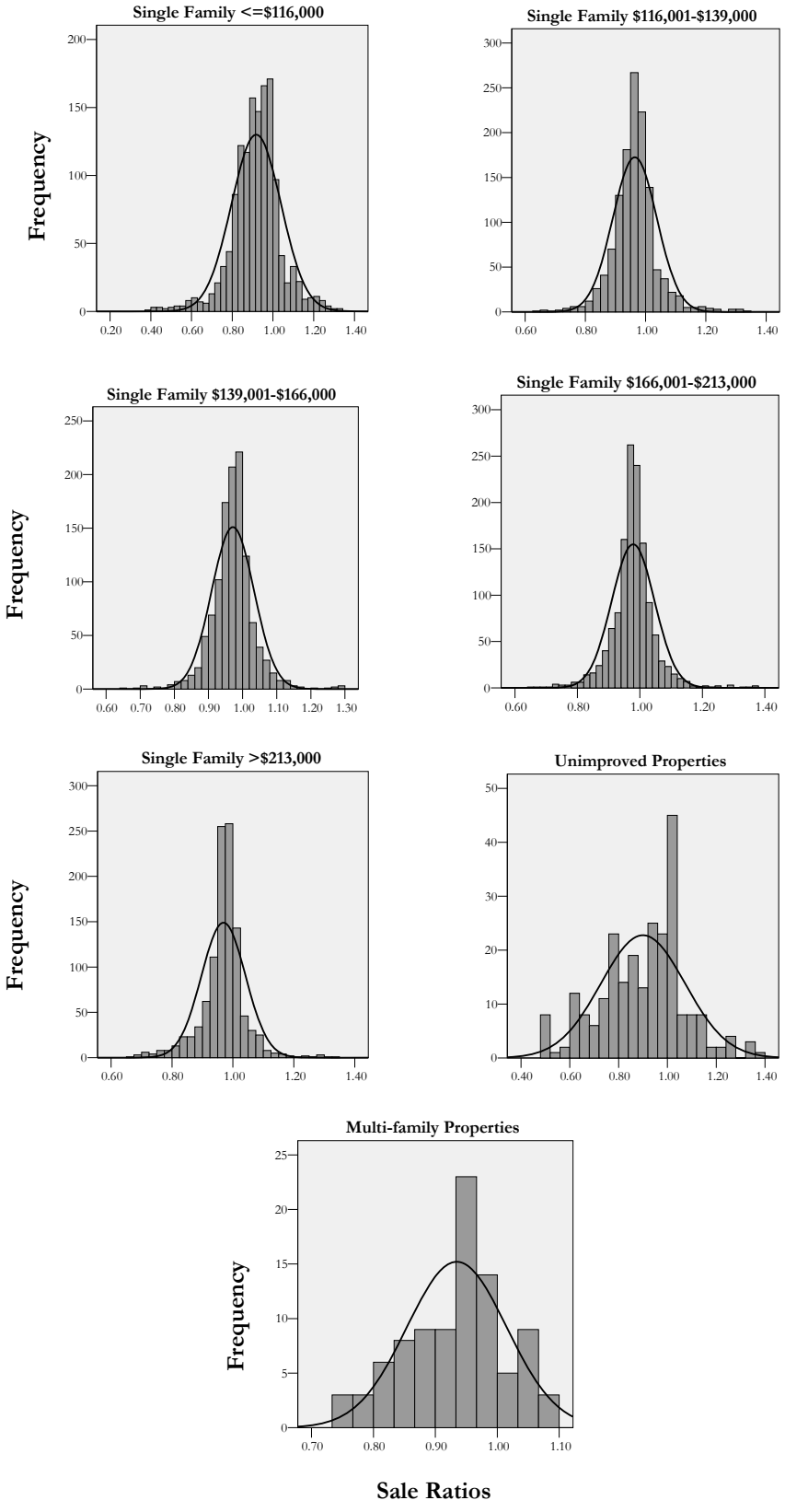



**Figure 2. Ratios after Outlier Trimming**



## Figure 3. Distribution of Final Sale Ratios



## Figure 3 (cont.). Distribution of Final Sale Ratios

### Shapiro-Francia W' Tests for Normality for Various Strata

| Strata | Observations | W' | V' | z | Prob* |
|---|---|---|---|---|---|
| Single Family | 6,242 | 0.91493 | 94.737 | 3.055 | 0.00113 |
| Multi-family | 92 | 0.97900 | 1.773 | 1.148 | 0.12554 |
| Unimproved Properties | 246 | 0.98247 | 3.367 | 2.564 | 0.00518 |
| Single Family <=$116,000 | 1,388 | 0.95927 | 35.119 | 6.946 | 0.00001 |
| Single Family $116,001-$139,000 | 1,265 | 0.93281 | 54.171 | 7.703 | 0.00001 |
| Single Family $139,001-$166,000 | 1,177 | 0.93302 | 51.107 | 7.695 | 0.00001 |
| Single Family $166,001-$213,000 | 1,331 | 0.91607 | 70.248 | 8.012 | 0.00001 |
| Single Family >$213,000 | 1,081 | 0.90179 | 69.998 | 8.276 | 0.00001 |
| Overall Un-weighted | 6,580 | 0.91067 | 98.261 | 2.842 | 0.00224 |

*This represents the indicated probability that the underlying population is normally distributed. A value of less than .05 indicates a distribution that is not normal.

### Skewness and Kurtosis Test for Normality for Strata with more than 5,000 Observations

| Strata | Pr(Skewness) | Pr(Kurtosis) | Adj chi2(2) | Prob>chi2* |
|---|---|---|---|---|
| Single Family | 0.000 | 0.000 | 1072.84 | 0.0000 |
| Overall Un-weighted | 0.000 | 0.000 | 1197.21 | 0.0000 |

*This represents the indicated probability that the underlying population is normally distributed. A value of less than .05 indicates a distribution that is not normal.

## Table 2. Sales Ratio Analysis: Stratified by Property Use

| | | Strata | | | |
|---|---|---|---|---|---|
| | | Single Family | Unimproved Properties | Multi-family | Overall Un-weighted |
| Number of Sales | | 6242 | 246 | 92 | 6580 |
| Median | | .967 | .937 | .946 | .966 |
| 95% Confidence Interval for Median | Lower Bound | .965 | .889 | .931 | .965 |
| | Upper Bound | .969 | .952 | .957 | .968 |
| Weighted Mean | | .958 | .867 | .920 | .956 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .956 | .813 | .899 | .953 |
| | Upper Bound | .960 | .921 | .940 | .959 |
| Minimum | | .389 | .500 | .740 | .389 |
| Maximum | | 1.362 | 1.382 | 1.092 | 1.382 |
| Std. Deviation | | .087 | .172 | .080 | .092 |
| Price Related Differential | | 1.001 | 1.038 | 1.016 | 1.001 |
| Coefficient of Dispersion | | .060 | .145 | .065 | .063 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 79.0% | 44.7% | 68.5% | 77.6% |

## Table 3. Combined Results – Post Stratification and Weighting

| | **Population Assessor's Value** | **Median** | **Estimated Actual Value** | **% of Total Est. Mkt. Value** | **Subtotal** |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Single Family | 14,892,227,403 | 0.967 | 15,400,441,989 | 93.7% | 0.906 |
| Unimproved Properties | 387,062,477 | 0.937 | 413,086,955 | 2.5% | 0.024 |
| Multi-family | 581,953,359 | 0.946 | 615,172,684 | 3.7% | 0.035 |
| Total | 15,861,243,239 | | 16,428,701,628 | 100.0% | 96.5% |

| | **Population Assessor's Value** | **Weighted Mean** | **Estimated Actual Value** | **% of Total Est. Mkt. Value** | **Subtotal** |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Single Family | 14,892,227,403 | 0.958 | 15,545,122,550 | 93.5% | 0.896 |
| Unimproved Properties | 387,062,477 | 0.867 | 446,438,843 | 2.7% | 0.023 |
| Multi-family | 581,953,359 | 0.92 | 632,557,999 | 3.8% | 0.035 |
| Total | 15,861,243,239 | | 16,624,119,393 | 100.0% | 95.4% |

## Table 4. Sales Ratio Analysis: Stratified by Use and Value

| | | Strata | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Single Family <$116,000 | Single Family $116,001 - $139,000 | Single Family $139,001- $166,000 | Single Family $166,001- $213,000 | Single Family >$213,000 | Un-improved Properties | Multi-family | Overall Un-weighted |
| Number of Sales | | 1388 | 1265 | 1177 | 1331 | 1081 | 246 | 92 | 6580 |
| Median | | .924 | .963 | .973 | .978 | .974 | .937 | .946 | .966 |
| 95% Confidence Interval for Median | Lower Bound | .916 | .960 | .969 | .976 | .971 | .889 | .931 | .965 |
| | Upper Bound | .929 | .965 | .976 | .981 | .977 | .952 | .957 | .968 |
| Weighted Mean | | .909 | .959 | .968 | .973 | .960 | .867 | .920 | .956 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .903 | .955 | .964 | .970 | .955 | .813 | .899 | .953 |
| | Upper Bound | .916 | .963 | .971 | .977 | .966 | .921 | .940 | .959 |
| Minimum | | .389 | .640 | .657 | .658 | .671 | .500 | .740 | .389 |
| Maximum | | 1.318 | 1.344 | 1.296 | 1.362 | 1.330 | 1.382 | 1.092 | 1.382 |
| Std. Deviation | | .122 | .073 | .062 | .069 | .072 | .172 | .080 | .092 |
| Price Related Differential | | 1.009 | 1.005 | 1.004 | 1.005 | 1.009 | 1.038 | 1.016 | 1.001 |
| Coefficient of Dispersion | | .095 | .052 | .044 | .047 | .048 | .145 | .065 | .063 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 54.1% | 82.7% | 88.4% | 87.5% | 86.0% | 44.7% | 68.5% | 77.6% |

## Table 5. Combined Results – Post Stratification and Weighting

| | Population Assessor's Value | Median | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Single Family <=$116,000 | 2,087,899,886 | 0.924 | 2,259,631,911 | 13.7% | 0.127 |
| Single Family $116,001 - $139,000 | 2,488,472,880 | 0.963 | 2,584,083,988 | 15.7% | 0.151 |
| Single Family $139,001 - $166,000 | 2,818,824,960 | 0.973 | 2,897,045,180 | 17.6% | 0.171 |
| Single Family $166,001 - $213,000 | 3,478,554,130 | 0.978 | 3,556,803,814 | 21.6% | 0.211 |
| Single Family >$213,000 | 4,018,475,547 | 0.974 | 4,125,744,915 | 25.1% | 0.244 |
| Unimproved Properties | 387,062,477 | 0.937 | 413,086,955 | 2.5% | 0.024 |
| Multi-family | 581,953,359 | 0.946 | 615,172,684 | 3.7% | 0.035 |
| Total | 15,861,243,239 | | 16,451,569,447 | 100.0% | 96.4% |

| | Population Assessor's Value | Weighted Mean | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Single Family <=$116,000 | 2,087,899,886 | 0.909 | 2,296,919,567 | 13.8% | 0.125 |
| Single Family $116,001 - $139,000 | 2,488,472,880 | 0.959 | 2,594,862,231 | 15.6% | 0.150 |
| Single Family $139,001 - $166,000 | 2,818,824,960 | 0.968 | 2,912,009,256 | 17.5% | 0.169 |
| Single Family $166,001 - $213,000 | 3,478,554,130 | 0.973 | 3,575,081,326 | 21.5% | 0.209 |
| Single Family >$213,000 | 4,018,475,547 | 0.96 | 4,185,912,028 | 25.2% | 0.241 |
| Unimproved Properties | 387,062,477 | 0.867 | 446,438,843 | 2.7% | 0.023 |
| Multi-family | 581,953,359 | 0.92 | 632,557,999 | 3.8% | 0.035 |
| Total | 15,861,243,239 | | 16,643,781,251 | 100.0% | 95.3% |

## Table 6. Sales Ratio Analysis: Stratified by Location

| | | Strata | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Other Fire Districts | Fire District 306 | Fire District 311 | Fire District 313 | Fire District 314 | Fire District 320 | Overall Un-weighted |
| Number of Sales | | 492 | 845 | 1590 | 990 | 1020 | 1643 | 6580 |
| Median | | .946 | .955 | .966 | .979 | .973 | .962 | .966 |
| 95% Confidence Interval for Median | Lower Bound | .934 | .949 | .964 | .976 | .969 | .959 | .965 |
| | Upper Bound | .958 | .960 | .969 | .983 | .976 | .965 | .968 |
| Weighted Mean | | .921 | .939 | .963 | .968 | .962 | .957 | .956 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .909 | .928 | .960 | .963 | .956 | .953 | .953 |
| | Upper Bound | .933 | .951 | .967 | .974 | .967 | .961 | .959 |
| Minimum | | .500 | .389 | .519 | .409 | .439 | .401 | .389 |
| Maximum | | 1.333 | 1.344 | 1.301 | 1.362 | 1.382 | 1.353 | 1.382 |
| Std. Deviation | | .124 | .095 | .073 | .093 | .100 | .087 | .092 |
| Price Related Differential | | 1.006 | 1.006 | 1.000 | .999 | .998 | 1.000 | 1.001 |
| Coefficient of Dispersion | | .096 | .070 | .049 | .057 | .065 | .064 | .063 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 59.8% | 70.4% | 84.3% | 83.6% | 79.9% | 75.0% | 77.6% |

## Table 7. Combined Results – Post Stratification and Weighting

| | Population Assessor's Value | Median | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Other Fire Districts | 1,308,910,583 | 0.946 | 1,383,626,409 | 8.4% | 0.080 |
| Fire District 306 | 2,666,904,362 | 0.955 | 2,792,570,013 | 17.0% | 0.162 |
| Fire District 311 | 3,321,927,258 | 0.966 | 3,438,848,093 | 20.9% | 0.202 |
| Fire District 313 | 1,793,176,843 | 0.979 | 1,831,641,311 | 11.1% | 0.109 |
| Fire District 314 | 2,842,897,067 | 0.973 | 2,921,785,269 | 17.8% | 0.173 |
| Fire District 320 | 3,927,427,127 | 0.962 | 4,082,564,581 | 24.8% | 0.239 |
| Total | 15,861,243,240 | | 16,451,035,676 | 100.0% | 96.4% |

| | Population Assessor's Value | Weighted Mean | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Other Fire Districts | 1,308,910,583 | 0.921 | 1,421,184,129 | 8.5% | 0.079 |
| Fire District 306 | 2,666,904,362 | 0.939 | 2,840,153,740 | 17.1% | 0.160 |
| Fire District 311 | 3,321,927,258 | 0.963 | 3,449,561,016 | 20.8% | 0.200 |
| Fire District 313 | 1,793,176,843 | 0.968 | 1,852,455,416 | 11.1% | 0.108 |
| Fire District 314 | 2,842,897,067 | 0.962 | 2,955,194,456 | 17.8% | 0.171 |
| Fire District 320 | 3,927,427,127 | 0.957 | 4,103,894,595 | 24.7% | 0.236 |
| Total | 15,861,243,240 | | 16,622,443,352 | 100.0% | 95.4% |

## Table 8. Sales Ratio Analysis: Stratified by Age

| | | Strata | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Un-improved Properties | Multi-family | Un-known Age | SF Built before 1950 | SF Built 1950s | SF Built 1960s | SF Built 1970s | SF Built 1980s | SF Built 1990-1995 | SF Built after 1995 | Overall Un-weighted |
| Number of Sales | | 2 | 92 | 255 | 163 | 184 | 401 | 859 | 1432 | 953 | 2239 | 6580 |
| Median | | .759 | .946 | .942 | .947 | .927 | .946 | .963 | .956 | .967 | .975 | .966 |
| 95% Confidence Interval for Median | Lower Bound | .518 | .931 | .897 | .908 | .905 | .929 | .958 | .952 | .962 | .974 | .965 |
| | Upper Bound | 1.000 | .957 | .960 | .967 | .953 | .957 | .968 | .960 | .971 | .977 | .968 |
| Weighted Mean | | .682 | .920 | .876 | .898 | .900 | .928 | .956 | .949 | .957 | .970 | .956 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | -2.073 | .899 | .823 | .875 | .877 | .917 | .950 | .944 | .952 | .967 | .953 |
| | Upper Bound | 3.437 | .940 | .928 | .921 | .923 | .940 | .963 | .955 | .963 | .973 | .959 |
| Minimum | | .518 | .740 | .409 | .389 | .401 | .425 | .513 | .453 | .548 | .671 | .389 |
| Maximum | | 1.000 | 1.092 | 1.382 | 1.318 | 1.286 | 1.322 | 1.330 | 1.353 | 1.314 | 1.362 | 1.382 |
| Std. Deviation | | .341 | .080 | .171 | .155 | .144 | .111 | .093 | .095 | .072 | .056 | .092 |
| Price Related Differential | | 1.112 | 1.016 | 1.031 | 1.015 | 1.022 | 1.010 | 1.006 | .999 | 1.006 | 1.004 | 1.001 |
| Coefficient of Dispersion | | .318 | .065 | .142 | .119 | .120 | .086 | .069 | .070 | .052 | .037 | .063 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 50.0% | 68.5% | 46.7% | 53.4% | 47.8% | 60.1% | 72.9% | 71.8% | 84.7% | 91.3% | 77.6% |

## Table 9. Combined Results – Post Stratification and Weighting

| | Population Assessor's Value | Median | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Unimproved Properties | 20,497,740 | 0.759 | 27,006,245 | 0.2% | 0.001 |
| Multi-family | 572,797,178 | 0.946 | 605,493,845 | 3.7% | 0.035 |
| Unknown Age | 428,200,919 | 0.942 | 454,565,731 | 2.8% | 0.026 |
| SF Built before 1950 | 299,279,604 | 0.947 | 316,029,149 | 1.9% | 0.018 |
| SF Built 1950's | 400,231,520 | 0.927 | 431,749,213 | 2.6% | 0.024 |
| SF Built 1960's | 1,088,066,220 | 0.946 | 1,150,175,708 | 7.0% | 0.066 |
| SF Built 1970's | 2,225,439,793 | 0.963 | 2,310,944,749 | 14.0% | 0.135 |
| SF Built 1980's | 3,356,386,316 | 0.956 | 3,510,864,347 | 21.3% | 0.204 |
| SF Built 1990-1995 | 2,741,803,190 | 0.967 | 2,835,370,414 | 17.2% | 0.166 |
| SF Built after 1995 | 4,728,540,760 | 0.975 | 4,849,785,395 | 29.4% | 0.287 |
| Total | 15,861,243,239 | | 16,491,984,796 | 100.0% | 96.2% |
| | **Population Assessor's Value** | **Weighted Mean** | **Estimated Actual Value** | **% of Total Est. Mkt. Value** | **Subtotal** |
| **Strata** | | | | | |
| Unimproved Properties | 20,497,740 | 0.682 | 30,055,337 | 0.2% | 0.001 |
| Multi-family | 572,797,178 | 0.92 | 622,605,628 | 3.7% | 0.034 |
| Unknown Age | 428,200,919 | 0.876 | 488,813,834 | 2.9% | 0.026 |
| SF Built before 1950 | 299,279,604 | 0.898 | 333,273,501 | 2.0% | 0.018 |
| SF Built 1950's | 400,231,520 | 0.9 | 444,701,689 | 2.7% | 0.024 |
| SF Built 1960's | 1,088,066,220 | 0.928 | 1,172,485,151 | 7.0% | 0.065 |
| SF Built 1970's | 2,225,439,793 | 0.956 | 2,327,865,892 | 13.9% | 0.133 |
| SF Built 1980's | 3,356,386,316 | 0.949 | 3,536,761,134 | 21.2% | 0.201 |
| SF Built 1990-1995 | 2,741,803,190 | 0.957 | 2,864,998,109 | 17.2% | 0.164 |
| SF Built after 1995 | 4,728,540,760 | 0.97 | 4,874,784,289 | 29.2% | 0.283 |
| Total | 15,861,243,239 | | 16,696,344,564 | 100.0% | 95.0% |

**Table 10. Sales Ratio Analysis: Stratified by Town and Rural Lots**

| | | Strata | | |
|---|---|---|---|---|
| | | Rural Lots | Town Lots | Overall Un-weighted |
| Number of Sales | | 1695 | 4885 | 6580 |
| Median | | .958 | .969 | .966 |
| 95% Confidence Interval for Median | Lower Bound | .953 | .967 | .965 |
| | Upper Bound | .962 | .971 | .968 |
| Weighted Mean | | .943 | .960 | .956 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .939 | .957 | .953 |
| | Upper Bound | .948 | .963 | .959 |
| Minimum | | .401 | .389 | .389 |
| Maximum | | 1.353 | 1.382 | 1.382 |
| Std. Deviation | | .103 | .088 | .092 |
| Price Related Differential | | 1.005 | 1.000 | 1.001 |
| Coefficient of Dispersion | | .076 | .058 | .063 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 69.4% | 80.4% | 77.6% |

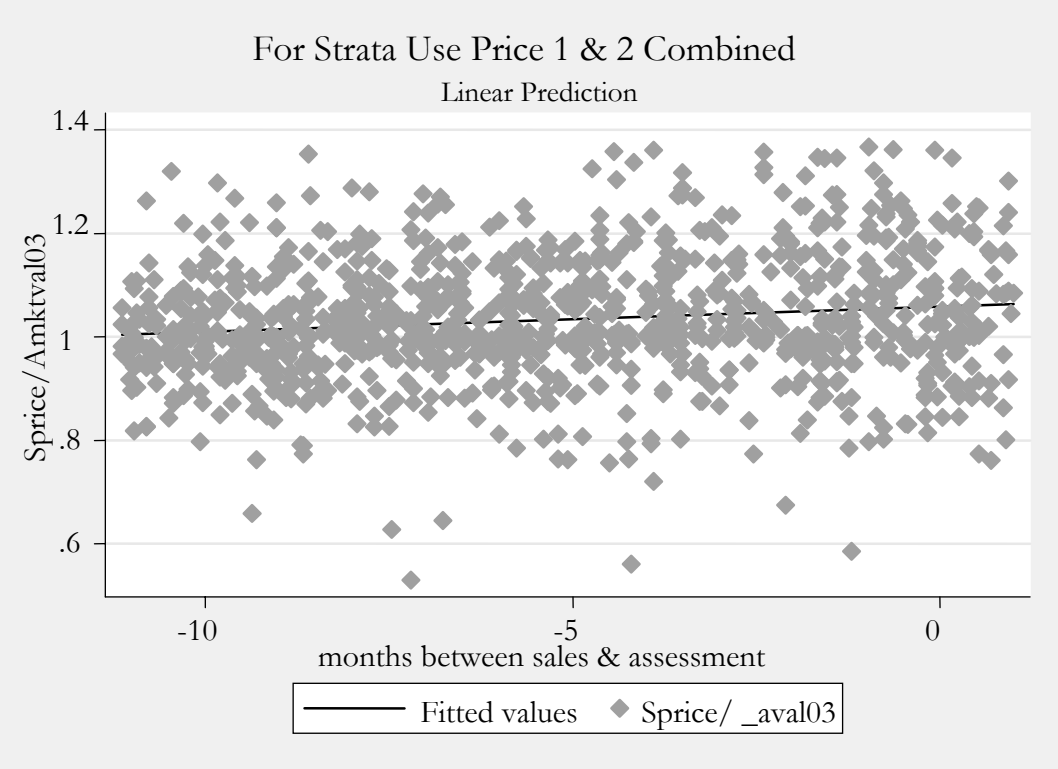
**Table 11. Combined Results – Post Stratification and Weighting**

| | Population Assessor's Value | Median | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Town Lot | 11,250,660,163 | 0.969 | 11,610,588,403 | 70.7% | 0.685 |
| Rural Lot | 4,610,583,077 | 0.958 | 4,812,717,199 | 29.3% | 0.281 |
| Total | 15,861,243,240 | | 16,423,305,603 | 100.0% | 96.6% |

| | Population Assessor's Value | Weighted Mean | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Town Lot | 11,250,660,163 | 0.96 | 11,719,437,670 | 70.6% | 0.677 |
| Rural Lot | 4,610,583,077 | 0.943 | 4,889,271,556 | 29.4% | 0.278 |
| Total | 15,861,243,240 | | 16,608,709,225 | 100.0% | 95.5% |

**Graph 1. Single Family Property Price Trend**

A thorough analysis of price-time trends by price strata determined that adjusting reported prices was desirable for the two lowest valued single family property strata. The prices for these strata ranged from $15,000 - $113,000. The resultant trend and statistical analysis is shown below.




**Price Trend Regression Statistics**

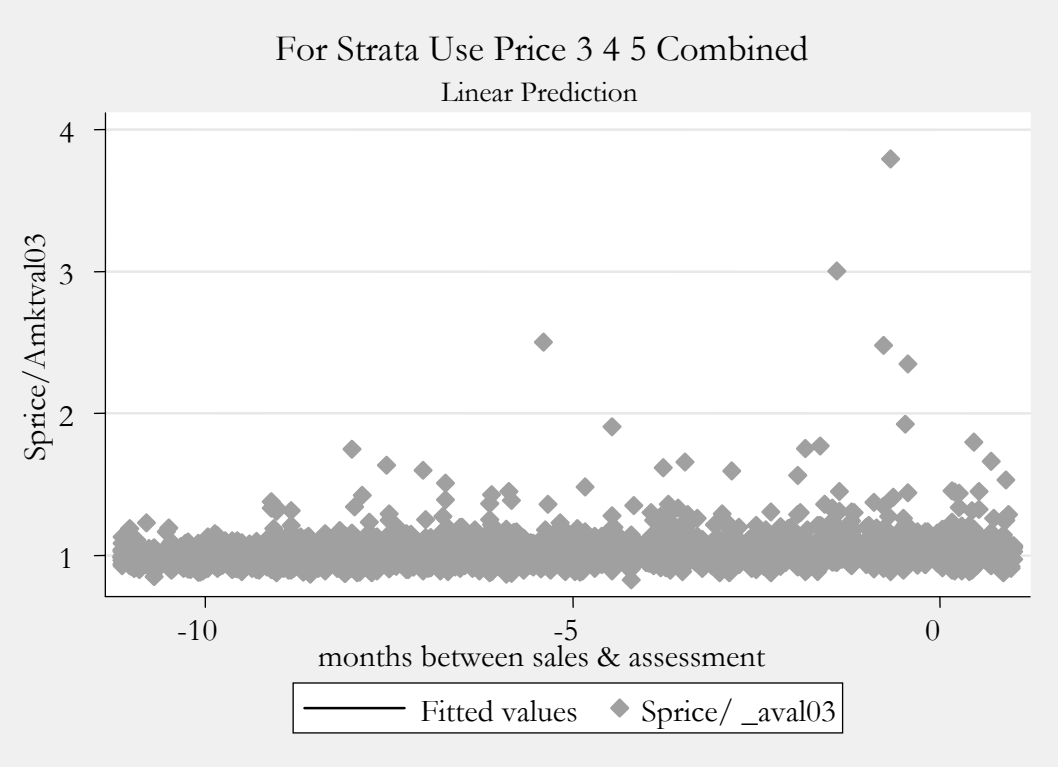
| Source | SS | df | MS | Number of obs = 1065 | R-squared = 0.0203 |
|---|---|---|---|---|---|
| Model | .30408928 | 1 | .30408928 | F( 1, 1063) = 22.08 | Adj R-squared= 0.0194 |
| Residual | 14.639017 | 1063 | .013771418 | Prob > F = 0.0000 | Root MSE = .11735 |
| Total | 14.9431063 | 1064 | .014044273 | | |

| _aratio | Coef. | Std. Err. | t | P> t | [80% Conf. Interval] | |
|---|---|---|---|---|---|---|
| _adjperiod | .0048981 | .0010423 | 4.70 | 0.000 | .0035614 | .0062347 |
| _cons | 1.05926 | .0065034 | 162.88 | 0.000 | 1.05092 | 1.0676 |

Monthly adjustment rate=.00462408 | Annualized adjustment rate=.05548896

**Graph 2. Single Family Property Price Trend**

A thorough analysis of price-time trends by price strata determined that adjusting reported prices was desirable for the three highest valued single family property strata. The prices for these strata ranged from $113,046 - $1,045,000. The resultant trend and statistical analysis is shown below.




**Price Trend Regression Statistics**

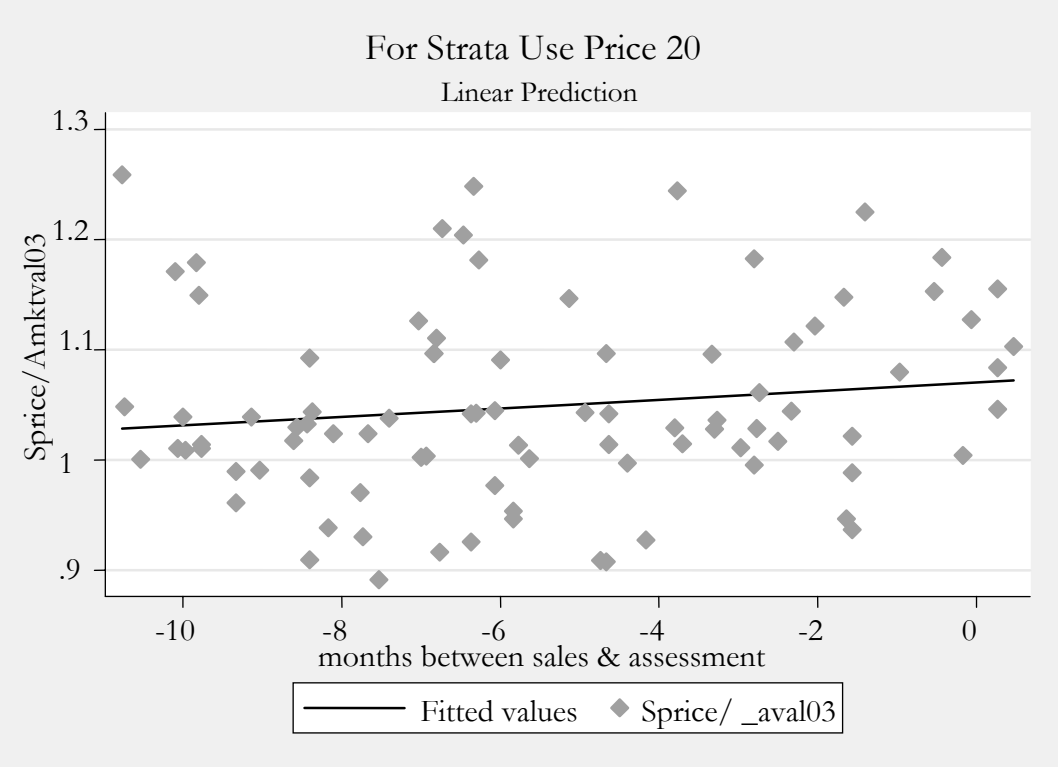
| Source | SS | df | MS | Number of obs = | |
|---|---|---|---|---|---|
| Model | 1.63031829 | 1 | 1.63031829 | 4777 | R-squared = 0.0357 |
| Residual | 43.9784346 | 4775 | .009210143 | F( 1, 4775) = 177.01 | Adj R-squared= 0.0355 |
| Total | 45.6087529 | 4776 | .009549571 | Prob > F = 0.0000 | Root MSE = .09597 |

| _aratio | Coef. | Std. Err. | t | P> t | [80% Conf. Interval] | |
|---|---|---|---|---|---|---|
| _adjperiod | .0054404 | .0004089 | 13.30 | 0.000 | .0049163 | .0059645 |
| _cons | 1.04554 | .002587 | 404.16 | 0.000 | 1.042224 | 1.048855 |

Monthly adjustment rate=.00520344 | Annualized adjustment rate=.06244128

**Graph 3. Multi-family Property Price Trend**

A thorough analysis if price-time trends by price strata determined that adjusting reported prices was desirable for multi-family properties. The prices for this stratum ranged from $51,000 - $400,000. The resultant trend and statistical analysis is shown below.




**Price Trend Regression Statistics**

| Source | SS | df | MS | | |
|---|---|---|---|---|---|
| Model | .013316154 | 1 | .013316154 | Number of obs = 89 | R-squared = 0.0205 |
| Residual | .637207828 | 87 | .007324228 | F( 1, 87) = 1.82 | Adj R-squared= 0.0092 |
| Total | .650523983 | 88 | .007392318 | Prob > F = 0.1810 | Root MSE = .08558 |

| _aratio | Coef. | Std. Err. | t | P> t | [80% Conf. Interval] | |
|---|---|---|---|---|---|---|
| _adjperiod | .0039022 | .002894 | 1.35 | 0.181 | .000165 | .0076395 |
| _cons | 1.070308 | .0184085 | 58.14 | 0.000 | 1.046536 | 1.09408 |

Monthly adjustment rate=.00364587 | Annualized adjustment rate=.04375044

# Chapter 23. St. Francois County

## 1. Significant Findings

1.1 Assessment Level: St. Francois County's 2003 residential property assessments were approximately 80% of market value (Section 3.5). The results from the corresponding STC study are invalid because the STC's appraisals did not meet the requirement that they reflect market values (Section 4.3). Furthermore, the STC's sample is not representative of residential property for the county (Section 4.2).

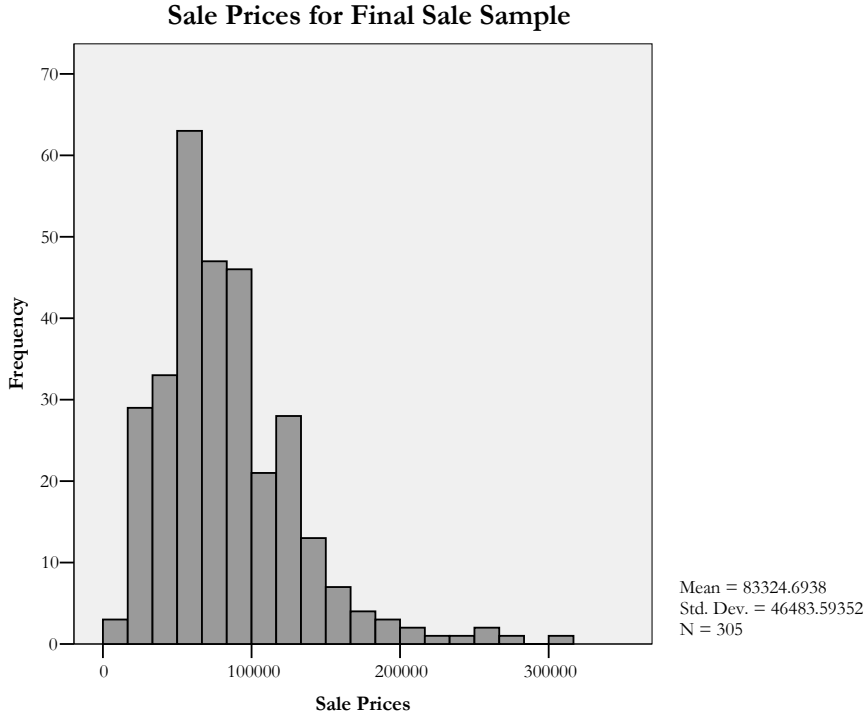
1.2 Assessment Equity: Lower-valued properties are assessed less uniformly and at a lower level than higher-valued properties (Section 3.6 and Table 3).

1.3 Reassessment History: One indicator of market value changes suggests that three of the past four biennial reassessments have consistently produced substantially lower value increases than the market. Cumulatively, the reassessments from 1997 through 2003 produced 63% of the expected rise in assessments, primarily due to the large increase in 2001. The net change in assessments in 2003 raises questions whether any serious revaluation occurred (Section 5.1).

## 2. Data and Related Issues

2.1 Assessment Data: Sales and assessment information were matched at the county offices. Subsequently, the assessor reviewed the matched parcels and provided further information that assisted our screening process.

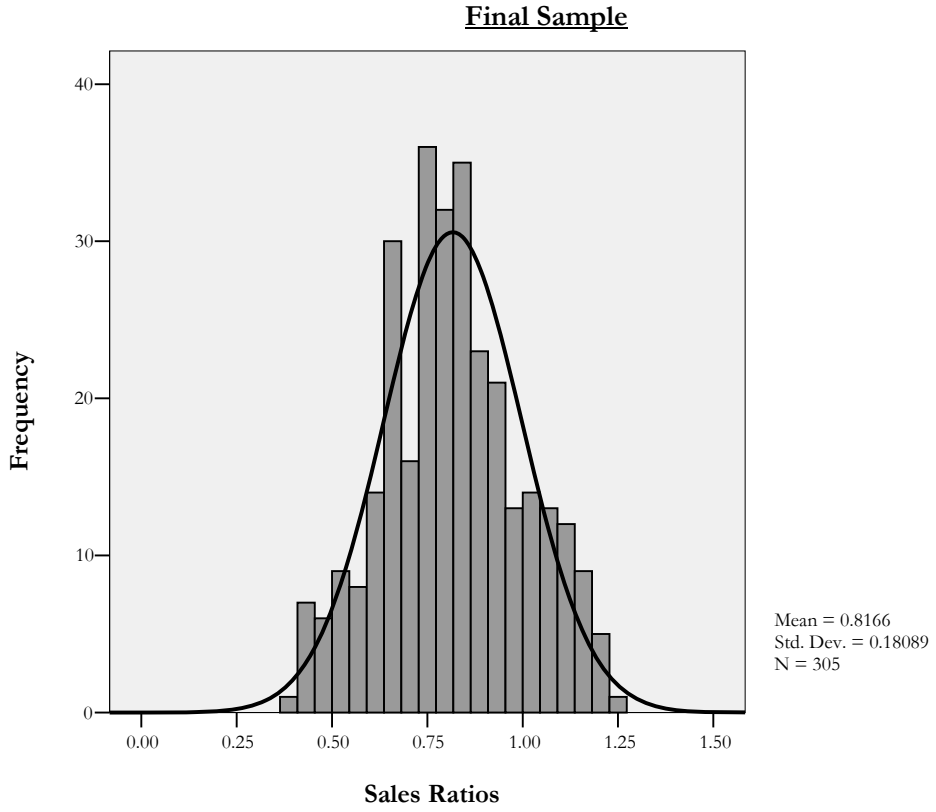
2.2 Sales and Ratio Data: The distribution of sale prices used is reflected in the following histogram.



The next table reports results of the data screening and trimming process. The "screened sales" represent the initial screened sample. The screened sales that were excluded from the final analysis because their ratios were deemed unrepresentative are identified as high or low trims. The "remaining ratios" represent the sample on which all the study's results are based.

| Trimming of Outliers | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Improved Properties <=$35,000 | Improved Properties >$35,000 & <=$51,000 | Improved Properties >$51,000 & <=$68,000 | Improved Properties >$68,000 & <=$94,500 | Improved Properties >$94,500 | Unimproved Properties | Total |
| **Screened Sales** | | 63 | 68 | 69 | 65 | 63 | 11 | 339 |
| Excluded | High Trims | 5 | 6 | 9 | 3 | 0 | 3 | 26 |
| | Low Trims | 1 | 3 | 1 | 0 | 2 | 1 | 8 |
| **Remaining Ratios** | | **57** | **59** | **59** | **62** | **61** | **7** | **305** |

The histogram below shows the distribution of the ratios for the sample.




2.3 Population: A copy of the assessment data in electronic form was unavailable, so we used the best available alternative as a pseudo-population (hereinafter, "the population"), i.e. four random samples that were drawn and used by the STC.

## 3. Ratio Study Results

3.1 The Sample: The following table shows that three strata, including the lowest and highest valued improved property strata and the unimproved stratum, vary from 3.0% to 9.9% from the population.

Initially, this exhibits excessive variability from the sample to the population. Upon closer examination, this variation has a cumulative material effect on the overall assessment level and thus we conclude that the un-stratified sample is insufficiently representative of the population.

| Comparing Representivity | | | | | | |
|---|---|---|---|---|---|---|
| | Population Distribution | | | PPRC 2003 Sale Sample | | |
| Strata | N | $ | $ Weight | N | $ | $ Weight |
| Improved Properties <=$35,000 | 27 | 509,737 | 10.7% | 57 | 1,518,560 | 7.3% |
| Improved Properties >$35,000 & <=$51,000 | 13 | 559,737 | 11.8% | 59 | 2,537,420 | 12.2% |
| Improved Properties >$51,000 & <=$68,000 | 16 | 933,168 | 19.6% | 59 | 3,571,570 | 17.1% |
| Improved Properties >$68,000 & <=$94,500 | 15 | 1,203,789 | 25.3% | 62 | 5,005,160 | 24.0% |
| Improved Properties >$94,500 | 9 | 1,386,895 | 29.2% | 61 | 8,167,780 | 39.1% |
| Unimproved Properties | 68 | 159,289 | 3.4% | 7 | 77,950 | 0.4% |
| Total | 148 | 4,752,616 | | 305 | 20,878,440 | |

3.2 Representing the Population with the Sample: Since the un-stratified sample is insufficiently representative of the population (Section 3.1), the use of stratification and weighting is essential. Furthermore, stratification provides additional analytical benefits.

3.3 Sales Chasing: There was no indication of sales chasing.

3.4 Study Validity: Once the sample has been stratified and weighted, all requirements for producing valid inferences about the county's population of residential properties are met.

3.5 Assessment Level: Measures of the assessment level are summarized below. For the purposes of this study, the weighted mean from combined stratification is the preferred measure as long as both of the requirements from using the weighted mean are met. In this case, the distributions are normal (Figure 3) and weighting is compromised by the use of seriously undersized samples. Since both requirements are not met, we focus on the median, though taking notice of the weighted mean, to conclude that the County's assessments for 2003 reflect approximately 80% of market value.

| Assessment Level (Based on Percent of Market Value) | | | | |
|---|---|---|---|---|
| | Stratification and Weighting | Reference | Weighted Mean | Median |
| **Overall Un-weighted** | None | Table 3 | 82.2% | 80.3% |
| **Combined** | By Property Use and Value Range | Table 4 | 79.7% | 79.9% |

3.6 Equity Measures and Evaluation:

i. Uniformity within Strata: Tables 2, 3, 5 & 6 show results for individual strata of sufficient sample size for evaluation. The following strata represent problem areas for internal uniformity.

| Strata with Inadequate Uniformity | |
|---|---|
| **Property Strata** | **COD** |
| Improved Properties <= $35,000 | 25.5% |
| Park Hill/Desloge Area | 21.6% |
| Built 1925 through 1944 | 22.8% |
| Built 1945 through 1959 | 21.2% |

ii. Uniformity between Strata: Another form of inequity exists when different strata are assessed at different levels. The IAAO has established guidelines for identifying such inequity, but compliance can be heavily affected by sample size and uniformity. Therefore, we confine our remarks to identifying where assessment levels differ markedly from the norm. We find the difference in medians between the lowest and the higher valued improved property strata (73% versus 78-88% respectively, Table 3) notable.

iii. Vertical Equity: The final form of potential inequity examined is vertical equity. The PRD for the overall sample of 0.994 complies with the IAAO standard.

## 4. STC Study

4.1 Comparative Results: The following table contrasts our results with those from the STC study. The STC found the level of assessment adequate, while ours does not. The STC reports a substandard horizontal equity measure and a poor measure for vertical equity, while our results find no such problems. We have already demonstrated that the PPRC study meets the criteria for achieving valid results. The rest of Section 4 examines the validity of the STC's study.

| Comparison of Study Results | | | |
|---|---|---|---|
| **Measure** | **STC Study*** | **PPRC Study*** | **PPRC Study Combined**** |
| Assessment Level - median | 101.9% | 80.3% | 79.9% |
| Assessment Level - wtd. mean | 97.8% | 82.2% | 79.7% |
| COD | 35.5% | 17.9% | |
| PRD | 1.10 | 0.99 | |
| Sample Size | 35 | 305 | |
| Relative Precision | 1.00 | 2.95 | |
| * Overall sample (un-stratified and un-weighted) | | | |
| ** Stratification and weighting by Property Use and Value Range | | | |

4.2 Representing the Population with the Sample: The STC does not examine the representivity of its sample, nor does it have the necessary sample size or information to do so. Therefore, in the following table, we provide that missing analysis. In this case, the table shows that the three highest improved value strata in the STC sample vary from 3.5% to 11.3%. Initially, this exhibits excessive variability from the sample to the population. Upon closer examination, this variation has a cumulative material effect on the overall assessment level and thus we conclude that the STC sample is insufficiently representative of the population.

| Comparing Representivity | | | | | | |
|---|---|---|---|---|---|---|
| | **Population** | | | **STC 2003 Appraisals** | | |
| **Strata** | **N** | **$** | **%** | **N** | **$** | **%** |
| Improved Properties <=$35,000 | 27 | 509,737 | 10.7% | 7 | 144,789 | 12.7% |
| Improved Properties >$35,000 & <=$51,000 | 13 | 559,737 | 11.8% | 3 | 129,526 | 11.3% |
| Improved Properties >$51,000 & <=$68,000 | 16 | 933,168 | 19.6% | 2 | 115,632 | 10.1% |
| Improved Properties >$68,000 & <=$94,500 | 15 | 1,203,789 | 25.3% | 3 | 249,789 | 21.8% |
| Improved Properties >$94,500 | 9 | 1,386,895 | 29.2% | 3 | 475,000 | 41.5% |
| Unimproved Properties | 68 | 159,289 | 3.4% | 17 | 28,895 | 2.5% |
| Total | 148 | 4,752,616 | | 35 | 1,143,632 | |

4.3 Market Value: The final requirement for producing a valid appraisal study is that appraisals must represent market values. As discussed in the introduction for this Section II, and in greater depth in the Procedure Manual (Section III), we use 4 tests to make this determination. The results of each test are reported in the following tables.

| Mann-Whitney Test | | | | |
|---|---|---|---|---|
| For the Entire Sample | | | | |
| Study | Observations | Rank sum | Expected | Ho: Ratios (35 STC Appraisals)=Ratios (305 Sales)<br>z = 3.345<br>Prob > \|z\| = 0.0008 |
| 0 | 35 | 7810 | 5967.5 | |
| 1 | 305 | 50160 | 52002.5 | |
| Combined | 340 | 57970 | 57970 | |
| For Single Family Properties Only | | | | |
| Study | Observations | Rank sum | Expected | Ho : Ratios (18 STC Appraisals)=Ratios (294 Sales)<br>z = 2.546<br>Prob > \|z\| = 0.0109 |
| 0 | 18 | 3763 | 2817 | |
| 1 | 294 | 45065 | 46011 | |
| Combined | 312 | 48828 | 48828 | |

| K-Sample Test | | | | |
|---|---|---|---|---|
| For the Entire Sample | | | | |
| Study | Not Greater than the median | Greater than the median | Total | Ho: Ratios (35 STC Appraisals)=Ratios(305 Sales)<br>Pearson chi2(1) = 5.3827 Pr = 0.020<br>Continuity corrected:<br>Pearson chi2(1) = 4.5864 Pr = 0.032 |
| 0 | 11 | 24 | 35 | |
| 1 | 159 | 146 | 305 | |
| Total | 170 | 170 | 340 | |
| For Single Family Properties Only | | | | |
| Study | Not Greater than the median | Greater than the median | Total | Ho: Ratios (18 STC Appraisals)=Ratios(294 Sales)<br>Pearson chi2(1) = 3.7732 Pr = 0.052<br>Continuity corrected:<br>Pearson chi2(1) = 2.8889 Pr = 0.089 |
| 0 | 5 | 13 | 18 | |
| 1 | 151 | 143 | 294 | |
| Total | 156 | 156 | 312 | |

Three of the four tests lead to the conclusion that the STC appraisals do not represent market values (all with 95% statistical confidence). The K-Sample test for single family properties supports the same conclusion but with only 90% statistical confidence.

## 5. Additional Analysis and Findings

5.1 Analysis of Reassessment History: The following table provides a comparison of actual assessment changes (net of new construction) to those that might have been expected for each of the last four reassessments as well as the six-year period leading up to 2003. Only one of the reassessments produced changes somewhat in line with the market indicator.

| Actual Value Changes from Reassessment vs. Expected Value Change | | | |
|---|---|---|---|
| Biennial Year | % Net Assessment Change | Missouri OFHEO Index | % Value Change: Actual vs. Expected |
| 1999 | 2.4 | 8.4 | 29% |
| 2001 | 19.4 | 11.4 | 170% |
| 2003 | -0.2 | 11.8 | -1% |
| 2005 | 3.5 | 12.4 | 28% |
| Cumulative 1997 - 2003 | 22.0 | 35.0 | 63% |

## 6. Figures and Tables

**Table 1. STC's Appraisal Ratio Studies**

| | | Group | | | |
|---|---|---|---|---|---|
| | | 1999 | 2001 | 2003 | 2005* |
| Number of Appraisals | | 39 | 40 | 35 | 34 |
| Median | | .871 | 1.039 | 1.019 | .980 |
| 95% Confidence Interval for Median | Lower Bound | .760 | .917 | .828 | .926 |
| | Upper Bound | 1.066 | 1.131 | 1.197 | 1.010 |
| Weighted Mean | | .817 | .974 | .978 | .921 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .734 | .788 | .847 | .868 |
| | Upper Bound | .899 | 1.159 | 1.108 | .975 |
| Minimum | | .132 | .175 | .175 | .579 |
| Maximum | | 4.947 | 3.158 | 2.749 | 1.238 |
| Std. Deviation | | .945 | .606 | .509 | .151 |
| Price Related Differential | | 1.407 | 1.190 | 1.098 | 1.024 |
| Coefficient of Dispersion | | .575 | .361 | .355 | .111 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 20.5% | 30.0% | 20.0% | 61.8% |

*The STC has not completed its studies for the 2005 reassessment cycle. These results may not represent final values.

**Figure 1. Ratios before Outlier Trimming**

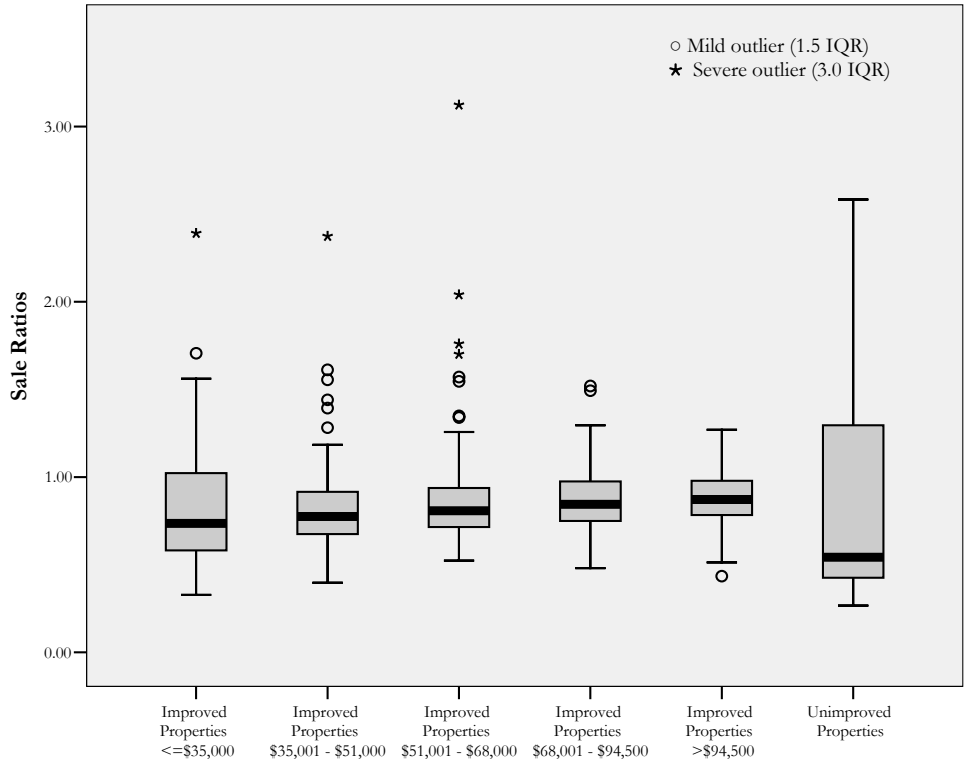
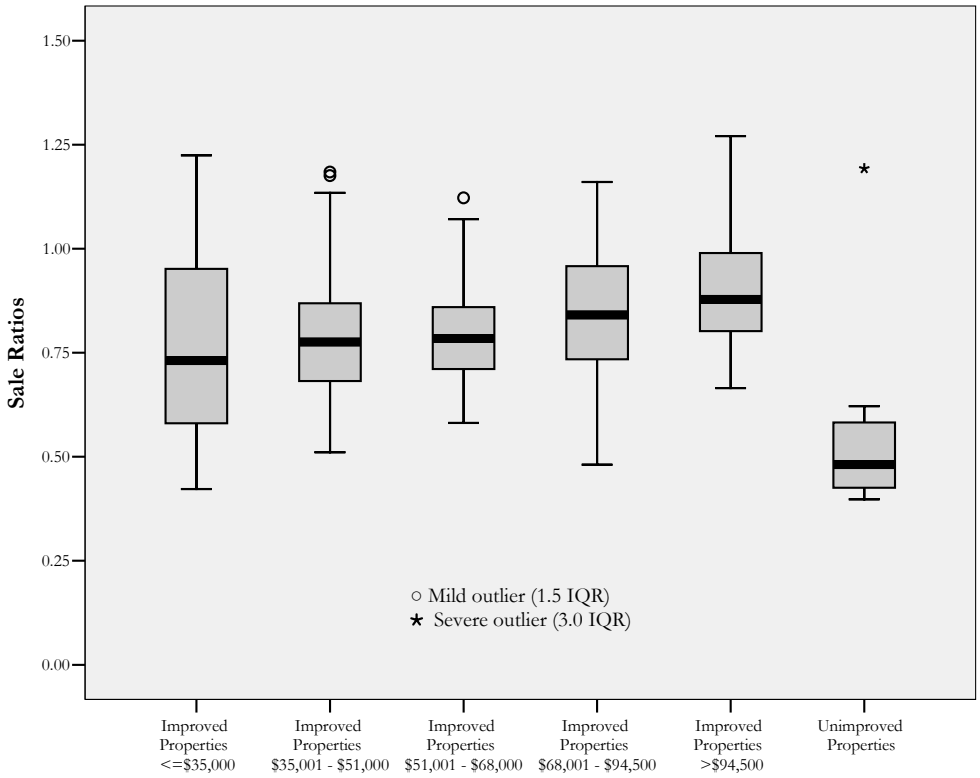
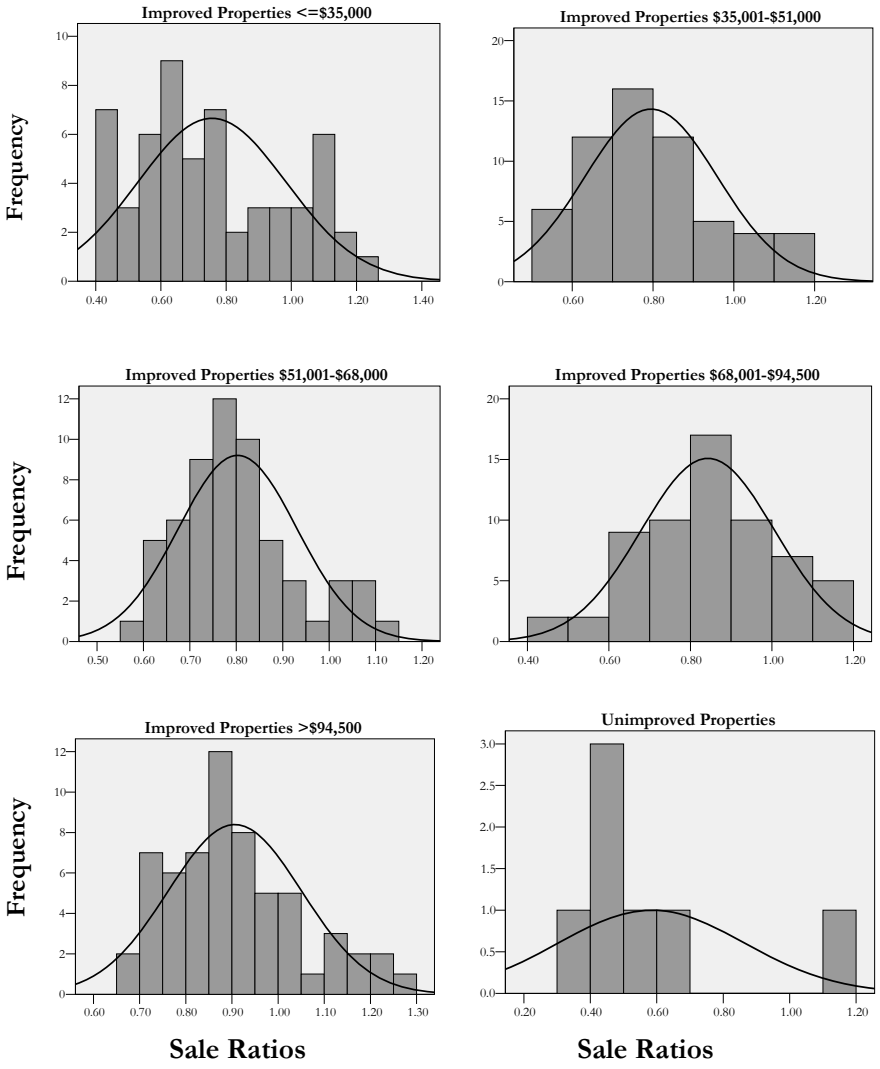



**Figure 2. Ratios after Outlier Trimming**



## Figure 3. Distribution of Final Sale Ratios




## Shapiro-Francia W' Tests for Normality for Various Strata

| Strata | Observations | W' | V' | z | Prob* |
|---|---|---|---|---|---|
| Single Family | 294 | 0.99261 | 1.656 | 1.091 | 0.13768 |
| Multi-family | 4 | . | . | . | . |
| Unimproved Properties | 7 | 0.68003 | 4.459 | 2.668 | 0.00382 |
| Improved Properties | 298 | 0.99214 | 1.781 | 1.248 | 0.10600 |
| Improved Properties<=$35,000 | 57 | 0.95231 | 2.741 | 1.925 | 0.02710 |
| Improved Properties>$35,000 & <=$51,000 | 59 | 0.96873 | 1.847 | 1.188 | 0.11746 |
| Improved Properties>$51,000 & <=$68,000 | 59 | 0.95138 | 2.872 | 2.017 | 0.02186 |
| Improved Properties>$68,000 & <=$94,500 | 62 | 0.98955 | 0.642 | -0.887 | 0.81255 |
| Improved Properties>$94,500 | 61 | 0.96120 | 2.353 | 1.649 | 0.04954 |
| Overall Un-weighted | 305 | 0.99267 | 1.697 | 1.145 | 0.12603 |
| *This value represents the indicated probability that the underlying population is normally distributed. A value of less than .05 indicates a distribution that is not normal. | | | | | |

## Table 2. Sales Ratio Analysis: Stratified by Property Use

| | | Strata | | | |
|---|---|---|---|---|---|
| | | Single Family | Unimproved Properties | Multi-family | Overall Un-weighted |
| Number of Sales | | 294 | 7 | 4 | 305 |
| Median | | .807 | .481 | 1.083 | .803 |
| 95% Confidence Interval for Median | Lower Bound | .781 | .398 | .575 | .780 |
| | Upper Bound | .839 | 1.193 | 1.222 | .837 |
| Weighted Mean | | .818 | .568 | 1.103 | .822 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .796 | .311 | .766 | .798 |
| | Upper Bound | .840 | .825 | 1.441 | .845 |
| Minimum | | .422 | .398 | .575 | .398 |
| Maximum | | 1.271 | 1.193 | 1.222 | 1.271 |
| Std. Deviation | | .173 | .280 | .287 | .181 |
| Price Related Differential | | 1.002 | 1.028 | .898 | .994 |
| Coefficient of Dispersion | | .170 | .329 | .171 | .179 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 22.4% | .0% | 25.0% | 22.0% |

## Table 3. Sales Ratio Analysis: Stratified by Use and Value

| | | Strata | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Improved Properties <=$35,000 | Improved Properties $35,001 - $51,000 | Improved Properties $51,001 - $68,000 | Improved Properties $68,001 - $94,500 | Improved Properties >$94,500 | Un-improved Properties | Overall Un-weighted |
| Number of Sales | | 57 | 59 | 59 | 62 | 61 | 7 | 305 |
| Median | | .731 | .776 | .784 | .841 | .878 | .481 | .803 |
| 95% Confidence Interval for Median | Lower Bound | .652 | .741 | .752 | .798 | .850 | .398 | .780 |
| | Upper Bound | .781 | .847 | .823 | .893 | .934 | 1.193 | .837 |
| Weighted Mean | | .688 | .768 | .785 | .808 | .905 | .568 | .822 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .631 | .728 | .754 | .763 | .861 | .311 | .798 |
| | Upper Bound | .744 | .808 | .816 | .853 | .950 | .825 | .845 |
| Minimum | | .422 | .511 | .581 | .481 | .665 | .398 | .398 |
| Maximum | | 1.225 | 1.184 | 1.122 | 1.160 | 1.271 | 1.193 | 1.271 |
| Std. Deviation | | .228 | .164 | .128 | .164 | .145 | .280 | .181 |
| Price Related Differential | | 1.100 | 1.035 | 1.022 | 1.043 | 1.001 | 1.028 | .994 |
| Coefficient of Dispersion | | .255 | .162 | .125 | .154 | .127 | .329 | .179 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 21.1% | 15.3% | 16.9% | 27.4% | 31.1% | .0% | 22.0% |

## Table 4. Combined Results – Post Stratification and Weighting

| | Population Assessor's Value | Median | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Improved Properties<=$35,000 | 509,737 | 0.731 | 697,314 | 11.7% | 0.086 |
| Improved Properties >$35,000 & <=$51,000 | 559,737 | 0.776 | 721,310 | 12.1% | 0.094 |
| Improved Properties >$51,000 & <=$68,000 | 933,168 | 0.784 | 1,190,266 | 20.0% | 0.157 |
| Improved Properties >$68,000 & <=$94,500 | 1,203,789 | 0.841 | 1,431,379 | 24.1% | 0.202 |
| Improved Properties>$94,500 | 1,386,895 | 0.878 | 1,579,607 | 26.5% | 0.233 |
| Unimproved Properties | 159,289 | 0.481 | 331,163 | 5.6% | 0.027 |
| Total | 4,752,616 | | 5,951,039 | 100.0% | 79.9% |

| | Population Assessor's Value | Weighted Mean | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Improved Properties<=$35,000 | 509,737 | 0.688 | 740,897 | 12.4% | 0.086 |
| Improved Properties >$35,000 & <=$51,000 | 559,737 | 0.768 | 728,824 | 12.2% | 0.094 |
| Improved Properties >$51,000 & <=$68,000 | 933,168 | 0.785 | 1,188,750 | 19.9% | 0.157 |
| Improved Properties >$68,000 & <=$94,500 | 1,203,789 | 0.808 | 1,489,838 | 25.0% | 0.202 |
| Improved Properties>$94,500 | 1,386,895 | 0.905 | 1,532,480 | 25.7% | 0.233 |
| Unimproved Properties | 159,289 | 0.568 | 280,439 | 4.7% | 0.027 |
| Total | 4,752,616 | | 5,961,228 | 100.0% | 79.7% |

## Table 5. Sales Ratio Analysis: Stratified by Location

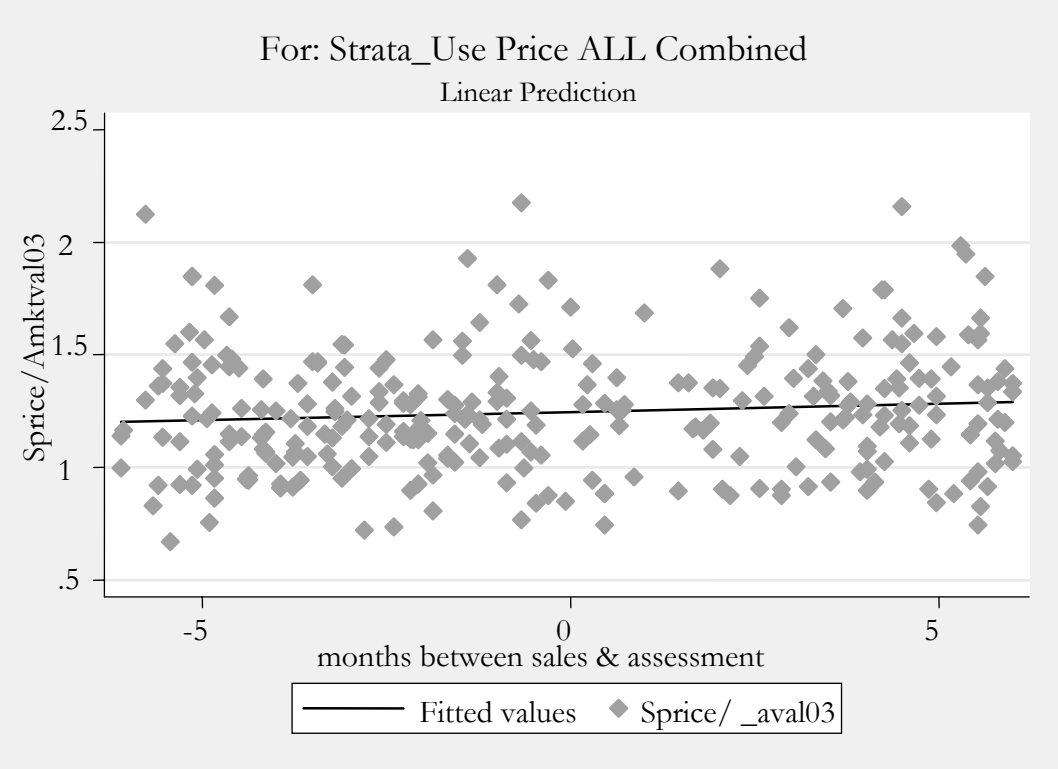
| | | Strata | | | |
|---|---|---|---|---|---|
| | | Park Hill/Desloge Area | Farmington Area | All other areas | Overall Un-weighted |
| Number of Sales | | 93 | 144 | 68 | 305 |
| Median | | .776 | .829 | .794 | .803 |
| 95% Confidence Interval for Median | Lower Bound | .740 | .796 | .742 | .780 |
| | Upper Bound | .837 | .850 | .867 | .837 |
| Weighted Mean | | .805 | .849 | .773 | .822 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .752 | .821 | .726 | .798 |
| | Upper Bound | .859 | .878 | .819 | .845 |
| Minimum | | .422 | .398 | .481 | .398 |
| Maximum | | 1.225 | 1.193 | 1.271 | 1.271 |
| Std. Deviation | | .206 | .160 | .185 | .181 |
| Price Related Differential | | .985 | .977 | 1.061 | .994 |
| Coefficient of Dispersion | | .216 | .147 | .190 | .179 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 23.7% | 20.1% | 23.5% | 22.0% |

## Table 6. Sales Ratio Analysis: Stratified by Age

| | | Strata | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Un-improved Properties | Built before 1925 | Built 1925 thru 1945 | Built 1945 thru 1960 | Built 1960 thru 1975 | Built 1975 thru 1985 | Built 1985 thru 1995 | Built 1995 thru 2001 | Overall Un-weighted |
| Number of Sales | | 7 | 44 | 39 | 38 | 50 | 48 | 41 | 35 | 302 |
| Median | | .481 | .785 | .737 | .774 | .846 | .786 | .803 | .846 | .802 |
| 95% Confidence Interval for Median | Lower Bound | .398 | .712 | .629 | .685 | .783 | .743 | .768 | .818 | .778 |
| | Upper Bound | 1.193 | .861 | .826 | .915 | .883 | .867 | .870 | .902 | .834 |
| Weighted Mean | | .568 | .776 | .715 | .796 | .831 | .796 | .846 | .895 | .820 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .311 | .724 | .656 | .731 | .786 | .750 | .784 | .829 | .797 |
| | Upper Bound | .825 | .827 | .774 | .861 | .875 | .843 | .907 | .961 | .843 |
| Minimum | | .398 | .457 | .424 | .422 | .442 | .485 | .623 | .481 | .398 |
| Maximum | | 1.193 | 1.225 | 1.160 | 1.135 | 1.137 | 1.130 | 1.271 | 1.165 | 1.271 |
| Std. Deviation | | .280 | .195 | .205 | .200 | .150 | .150 | .155 | .146 | .180 |
| Price Related Differential | | 1.028 | 1.048 | 1.067 | .990 | 1.005 | 1.023 | 1.002 | .978 | .992 |
| Coefficient of Dispersion | | .329 | .198 | .228 | .212 | .138 | .152 | .141 | .121 | .177 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | .0% | 20.5% | 15.4% | 26.3% | 28.0% | 25.0% | 14.6% | 22.9% | 21.5% |

**Graph 1. Improved Property Price Trend**

A thorough analysis of price-time trends by price strata determined that adjusting reported prices was desirable for all single family properties combined. The prices for these strata ranged from $10,000 - $305,000. The resultant trend and statistical analysis is shown below.




**Price Trend Regression Statistics**

| Source | SS | df | MS | | |
|---|---|---|---|---|---|
| Model | .271762455 | 1 | .271762455 | Number of obs = 315 | R-squared = 0. 0093 |
| Residual | 28.8563821 | 313 | .092192914 | F( 1, 313) = 2.95 | Adj R-squared= 0. 0062 |
| Total | 29.1281446 | 314 | .092764792 | Prob > F = 0. 0870 | Root MSE = .30363 |

| _aratio | Coef. | Std. Err. | t | P> t | [80% Conf. Interval] | |
|---|---|---|---|---|---|---|
| _adjperiod | .0079304 | .004619 | 1.72 | 0.087 | .0019984 | .0138624 |
| _cons | 1.211832 | .0171292 | 70.75 | 0.000 | 1.189834 | 1.233831 |
| Monthly adjustment rate=.0065441 | | | | Annualized adjustment rate=.0785297 | | |

# Chapter 24. St. Louis City

## 1. Significant Findings

1.1 Assessment Level: St. Louis City's 2003 residential property assessments were approximately 72% of market value (Section 3.5). The results from the corresponding STC study are invalid because the STC's appraisals did not meet the requirement that they reflect market values (Section 4.3).

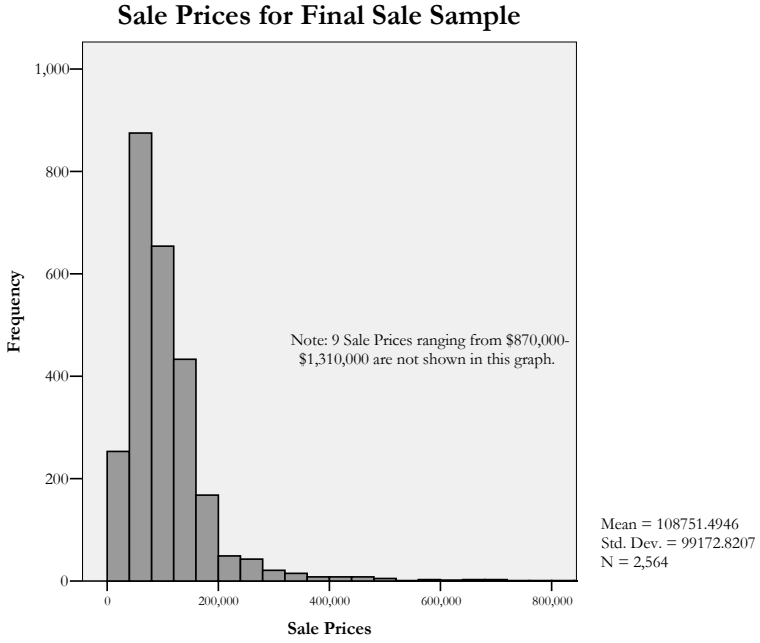
1.2 Assessment Equity: Unimproved properties and lower-valued properties are assessed less uniformly and at lower levels than other properties (Section 3.6 and Tables 2 & 3).

1.3 Reassessment History: Two indicators of market value changes suggest that the last two of the past four biennial reassessments have produced value increases somewhat in line with the market. Cumulatively, the reassessments from 1997 through 2003 produced 73% of the expected rise in assessments. This was followed by a large increase in 2005 (Section 5.1).

## 2. Data and Related Issues

2.1 Assessment Data: The assessor provided the assessment roll in electronic format. Therefore, sales were matched using a combination of computer techniques and software and then screened. The assessor answered all questions regarding the contents and coding of data when requested. The files received contained information allowing us to identify properties affected by new construction and to screen as appropriate.

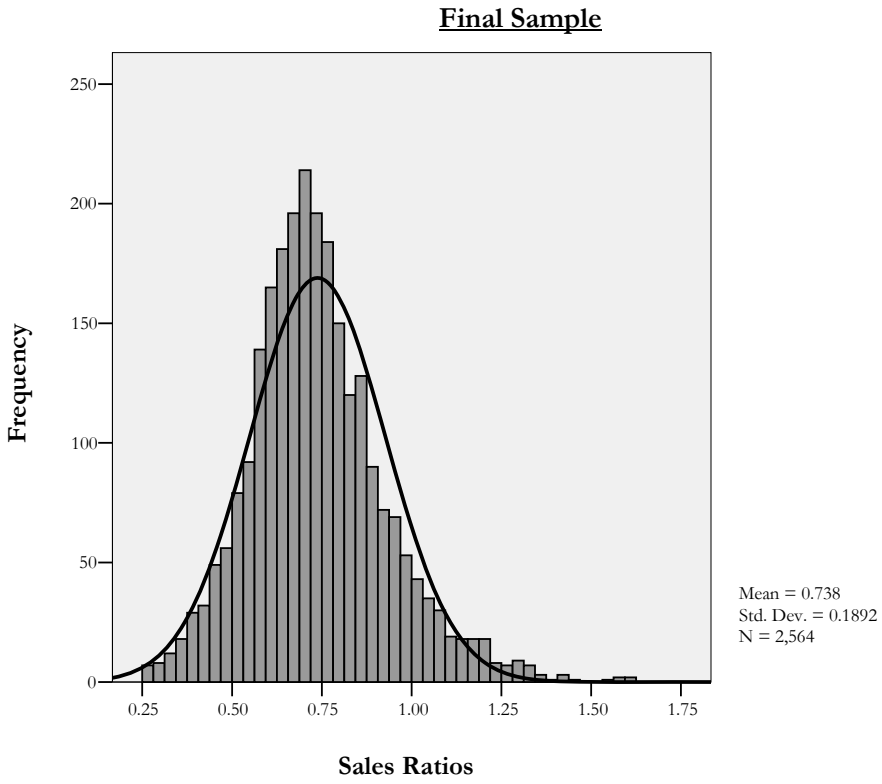
2.2 Sales and Ratio Data: The distribution of sale prices used is reflected in the following histogram.



The next table reports results of the data screening and trimming process. The "screened sales" represent the initial screened sample. The screened sales that were excluded from the final analysis because their ratios were deemed unrepresentative are identified as high or low trims. The "remaining ratios" represent the sample on which all the study's results are based.

| Trimming of Outliers | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Single Family <=$42,000 | Single Family $42,001 - $58,000 | Single Family $58,001 - $78,000 | Single Family $78,001 - $100,000 | Single Family >$100,000 | Multi-family | Total |
| **Screened Sales** | | 412 | 413 | 460 | 344 | 378 | 594 | 2,601 |
| Excluded | High Trims | 4 | 8 | 2 | 1 | 0 | 5 | 20 |
| | Low Trims | 9 | 3 | 3 | 0 | 0 | 2 | 17 |
| **Remaining Ratios** | | **399** | **402** | **455** | **343** | **378** | **587** | **2,564** |

The histogram below shows the distribution of the ratios for the sample.




2.3 Population: Since a complete copy of the 2003 assessment rolls in electronic form was available, we were able to analyze the county's population in detail. This allowed us to stratify and weight sales on a variety of property and location characteristics. Our analysis, confirmed by the assessor, indicated that the market for unimproved residential properties is dominated by government agencies; therefore, we dropped these from our study.

## 3. Ratio Study Results

3.1 The Sample: The following table shows that the single family strata vary from 1.1% to 8.0% from the population. This exhibits excessive variability from the sample to the population. Upon closer examination, this variation has a cumulative material effect on the overall assessment level and thus we conclude that the un-stratified sample is insufficiently representative of the population.

| Comparing Representivity | | | | | | |
|---|---|---|---|---|---|---|
| Strata | Population Distribution | | | PPRC 2003 Sales | | |
| | N | $ | % | N | $ | % |
| Single Family <=$42000 | 23,903 | 633,825,896 | 12.1% | 399 | 12,253,105 | 6.4% |
| Single Family $42,001-$58,000 | 12,946 | 645,924,527 | 12.3% | 402 | 20,368,158 | 10.7% |
| Single Family $58,001-$78,000 | 11,779 | 791,606,419 | 15.1% | 455 | 30,921,737 | 16.2% |
| Single Family $78,001-$100,000 | 7,781 | 683,290,629 | 13.0% | 343 | 30,205,895 | 15.8% |
| Single Family >100000 | 8,029 | 1,309,810,682 | 24.9% | 378 | 62,768,210 | 32.9% |
| Multi-family | 25,092 | 1,185,299,420 | 22.6% | 587 | 34,373,105 | 18.0% |
| Total | 89,530 | 5,249,757,572 | 100.0% | 2564 | 190,890,210 | 100.0% |

3.2 Representing the Population with the Sample: Since the un-stratified sample is insufficiently representative of the population (Section 3.1), the use of stratification and weighting is essential. Furthermore, stratification provides additional analytical benefits.

3.3 Sales Chasing: There was no indication of sales chasing.

3.4 Study Validity: Once the sample has been stratified and weighted, all requirements for producing valid inferences about the county's population of residential properties are met.

3.5 Assessment Level: Measures of the assessment level are summarized below. For the purposes of this study, the weighted mean from combined stratification is the preferred measure as long as both of the requirements from using the weighted mean are met. In this case, weighting is not compromised by the use of seriously undersized samples but the distributions are not sufficiently normal (Figure 3). Since both requirements are not met, we focus on the median, though taking notice of the weighted mean, to conclude that the City's assessments for 2003 reflect approximately 72% of market value.

| Assessment Level (Based on Market Value) | | | | |
|---|---|---|---|---|
| | Stratification and weighting | Reference | Weighted Mean | Median |
| Overall | None | Table 2 | 68.5% | 71.9% |
| Combined | By Property Use | Table 3 | 68.5% | 72.0% |
| Combined | By Property Use and Value | Table 5 | 68.7% | 71.9% |
| Combined | By Property Location | Table 7 | 68.6% | 72.2% |

3.6 Equity Measures and Evaluation:

i. Uniformity within Strata: Tables 2, 4 & 6 show results for individual strata of sufficient sample size for evaluation. The following strata represent problem areas for internal uniformity.

| Strata with Inadequate Uniformity | |
|---|---|
| **Property Strata** | **COD** |
| Multi-family | 23.4% |
| Single Family <=$42,000 | 25.5% |
| SF/MF in Lower-value Market Areas | 25.3% |
| SF/MF in Moderate-value Market Areas | 21.2% |

ii. Uniformity between Strata: Another form of inequity exists when different strata are assessed at different levels. The IAAO has established guidelines for identifying such inequity, but compliance can be heavily affected by sample size and uniformity. Therefore, we confine our remarks to identifying where assessment levels differ markedly form the norm. We find SF/MF in lower-value market areas assessed at a higher level than properties in other locations (76.7% versus 71.6% and 70.9% respectively, Table 6) notable.

iii. Vertical Equity: The final form of potential inequity examined is vertical equity. The PRD for the overall sample of 1.078 is slightly regressive according to the IAAO standard (Table 2).

## 4. STC Study

4.1 Comparative Results: The following table contrasts our results with those from the STC study. The STC found the level of assessment adequate, while ours does not. The STC reports a similar horizontal equity measure and vertical equity measure. We have already demonstrated that the PPRC study meets the criteria for achieving valid results. The rest of Section 4 examines the validity of the STC's study.

| Comparison of Study Results | | | |
|---|---|---|---|
| **Measure** | **STC Study*** | **PPRC Study*** | **PPRC Study Combined**** |
| Assessment Level - median | 90.4% | 71.9% | 71.9% |
| Assessment Level - wtd. mean | 84.1% | 68.5% | 68.7% |
| COD | 17.6% | 19.9% | |
| PRD | 1.08 | 1.08 | |
| Sample Size | 41 | 2,564 | |
| Relative Precision | 1.00 | 7.91 | |
| * Overall sample (un-stratified and un-weighted) | | | |
| ** Stratification and weighting by Property Use and Value Range | | | |
| NOTE: Value used for the Equivalent Sale Ratio from the 2003/2004 cycle: 100%, which was based on having a COD less than 25%. | | | |

4.2 Representing the Population with the Sample: The STC does not examine the representivity of its sample, nor does it have the necessary sample size or information to do so. Therefore, in the following table, we provide that missing analysis. In this case, the table shows that all single family strata vary by 2.3% to 3.4%. Initially, this exhibits excessive variability from the sample to the population. However, upon closer examination, this variation has no material effect and thus we conclude that the STC sample is sufficiently representative of the population.

| Comparing Representivity | | | | | | |
|---|---|---|---|---|---|---|
| Strata | Population Distribution | | | STC 2003 Appraisals | | |
| | N | $ | % | N | $ | % |
| Single Family <=$42000 | 23,903 | 633,825,896 | 12.1% | 8 | 245,316 | 9.8% |
| Single Family $42,001-$58,000 | 12,946 | 645,924,527 | 12.3% | 5 | 238,421 | 9.5% |
| Single Family $58,001-$78,000 | 11,779 | 791,606,419 | 15.1% | 7 | 465,000 | 18.5% |
| Single Family $78,001-$100,000 | 7,781 | 683,290,629 | 13.0% | 3 | 262,789 | 10.5% |
| Single Family >100000 | 8,029 | 1,309,810,682 | 24.9% | 5 | 711,158 | 28.3% |
| Unimproved | 0 | 0 | 0.0% | 4 | 9,684 | 0.4% |
| Multi-family | 25,092 | 1,185,299,420 | 22.6% | 9 | 577,737 | 23.0% |
| Total | 89,530 | 5,249,757,572 | 100.0% | 41 | 2,510,105 | 100.0% |

4.3 Market Value: The final requirement for producing a valid appraisal study is that appraisals must represent market values. As discussed in the introduction for this Section II, and in greater depth in the Procedure Manual (Section III), we use 4 tests to make this determination. The results of each test are reported in the following tables.

| Mann-Whitney Test | | | | |
|---|---|---|---|---|
| For the Entire Sample | | | | |
| Study | Observations | Rank sum | Expected | Ho: Ratios (41 STC Appraisals)=Ratios (2564 Sales)<br>z = 5.333<br>Prob > \|z\| = 0.0000 |
| 0 | 41 | 78906 | 53423 | |
| 1 | 2564 | 3315409 | 3340892 | |
| Combined | 2605 | 3394315 | 3394315 | |
| For Single Family Properties Only | | | | |
| Study | Observations | Rank sum | Expected | Ho : Ratios (28 STC Appraisals)=Ratios (1977 Sales)<br>z = 3.573<br>Prob > \|z\| = 0.0004 |
| 0 | 28 | 38954 | 28084 | |
| 1 | 1977 | 1972061 | 1982931 | |
| Combined | 2005 | 2011015 | 2011015 | |

| K-Sample Test | | | | |
|---|---|---|---|---|
| For the Entire Sample | | | | |
| Study | Not Greater than the median | Greater than the median | Total | Ho: Ratios (41 STC Appraisals)=Ratios(2564 Sales)<br>Pearson chi2(1) = 20.8628 Pr = 0.000<br>Continuity corrected:<br>Pearson chi2(1) = 19.4496 Pr = 0.000 |
| 0 | 6 | 35 | 41 | |
| 1 | 1297 | 1267 | 2564 | |
| Total | 1303 | 1302 | 2605 | |
| For Single Family Properties Only | | | | |
| Study | Not Greater than the median | Greater than the median | Total | Ho: Ratios (28 STC Appraisals)=Ratios(1977 Sales)<br>Pearson chi2(1) = 11.7900 Pr = 0.001<br>Continuity corrected:<br>Pearson chi2(1) = 10.5193 Pr = 0.001 |
| 0 | 5 | 23 | 28 | |
| 1 | 999 | 978 | 1977 | |
| Total | 1004 | 1001 | 2005 | |

All four tests lead to the conclusion that the STC appraisals do not represent market values (all with 99% statistical confidence). Therefore, the STC study is invalid and its reported results are unreliable.

## 5. Additional Analysis and Findings

5.1 Analysis of Reassessment History: The following table provides a comparison of actual assessment changes (net of new construction) to those that might have been expected for each of the last four reassessments as well as the six-year period leading up to 2003. Only one of the reassessments produced changes in line with the market indicator. In our study, previous assessment information was available for St. Louis City, so we were able to test for the real reassessment rate. Using this information, we found evidence that a real reassessment took place in 2003.

**Actual Value Changes from Reassessment vs. Expected Value Change**

| Biennial Year | % Net Assessment Change | Missouri OFHEO Index | % Value Change: Actual vs. Expected | St. Louis MSA OFHEO Index | % Value Change: Actual vs. Expected |
|---|---|---|---|---|---|
| 1999 | 3.4 | 8.4 | 41% | 9.6 | 36% |
| 2001 | 6.7 | 11.4 | 59% | 13.5 | 50% |
| 2003 | 13.8 | 11.8 | 117% | 12.9 | 107% |
| 2005 | 33.0 | 12.4 | 266% | 16.8 | 196% |
| Cumulative 1997 - 2003 | 25.6 | 35.0 | 73% | 40.4 | 63% |

## 6. Figures and Tables

**Table 1. STC's Appraisal Ratio Studies**

| | | Group | | | |
|---|---|---|---|---|---|
| | | 1999 | 2001 | 2003 | 2005* |
| Number of Appraisals | | 45 | 88 | 41 | 35 |
| Median | | .913 | .888 | .904 | .864 |
| 95% Confidence Interval | Lower Bound | .802 | .828 | .832 | .752 |
| for Median | Upper Bound | .984 | .958 | .992 | .933 |
| Weighted Mean | | .938 | .844 | .841 | .790 |
| 95% Confidence Interval | Lower Bound | .847 | .794 | .786 | .699 |
| for Weighted Mean | Upper Bound | 1.030 | .893 | .896 | .881 |
| Minimum | | .599 | .434 | .378 | .175 |
| Maximum | | 1.512 | 2.823 | 1.789 | 1.695 |
| Std. Deviation | | .184 | .375 | .235 | .298 |
| Price Related Differential | | .974 | 1.156 | 1.082 | 1.071 |
| Coefficient of Dispersion | | .158 | .263 | .176 | .228 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 42.2% | 29.5% | 39.0% | 28.6% |

*The STC has not completed its studies for the 2005 reassessment cycle. These results may not represent final values.

**Figure 1. Ratios before Outlier Trimming**

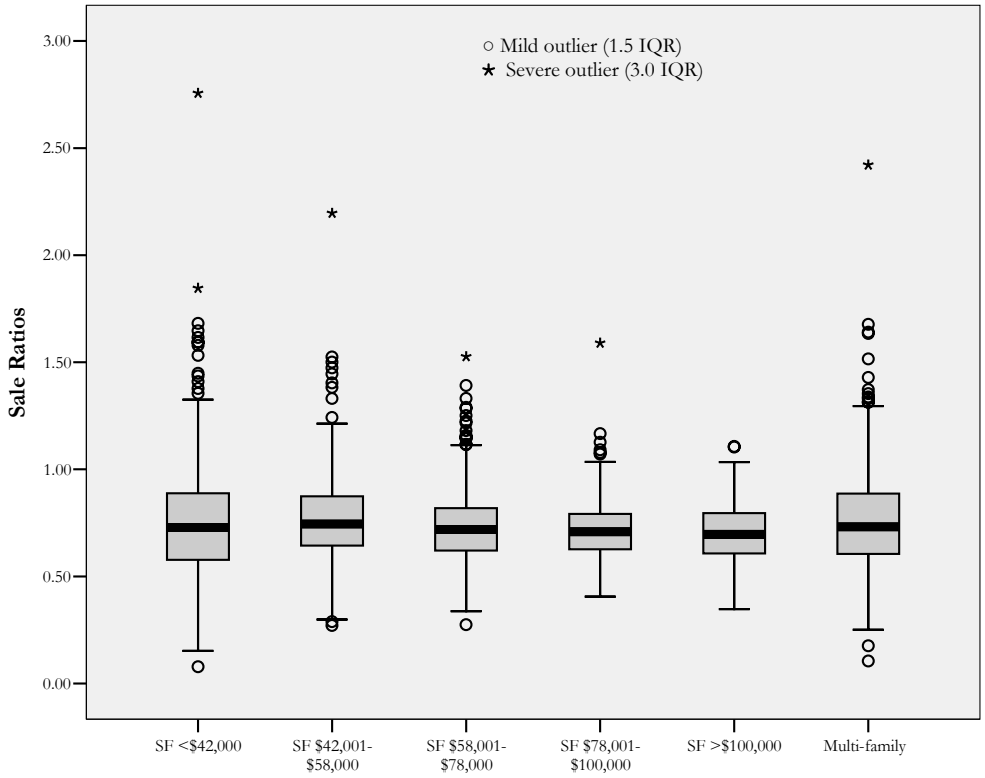
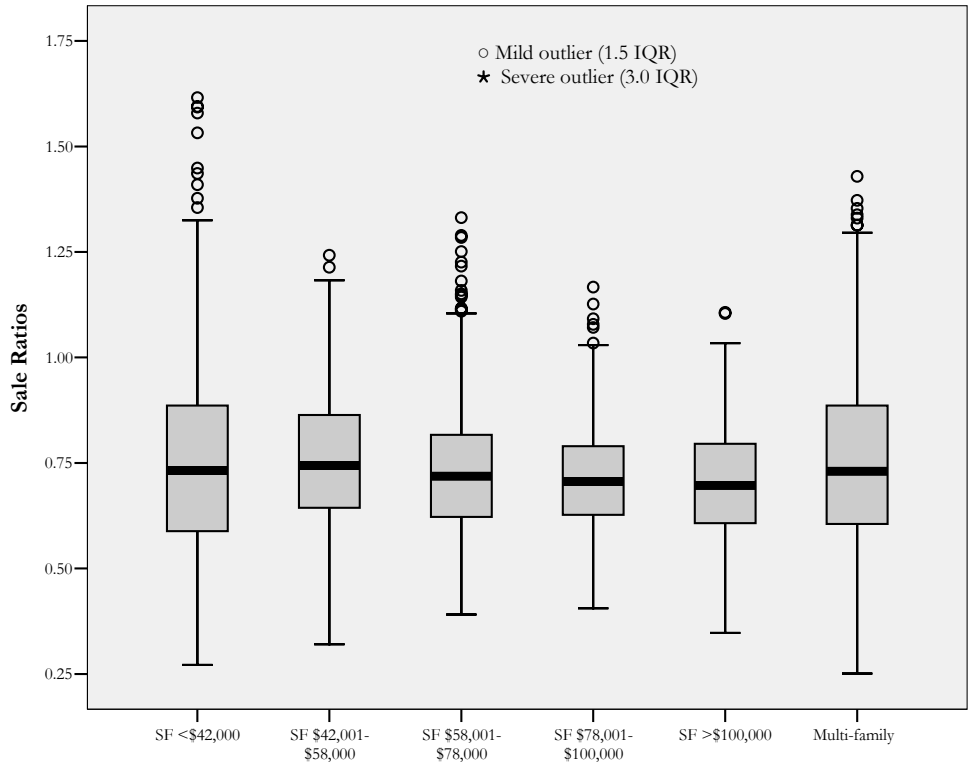
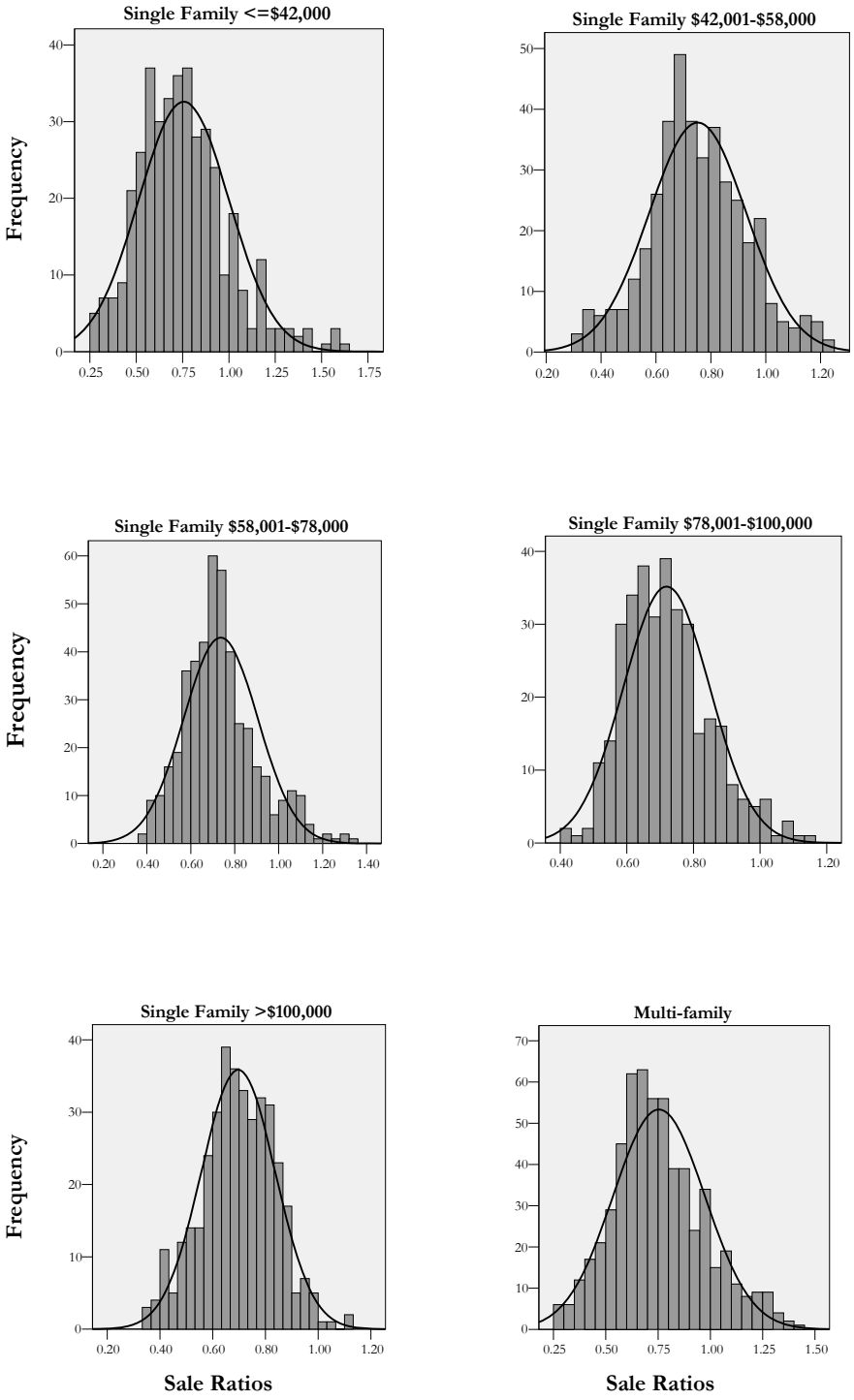



**Figure 2. Ratios after Outlier Trimming**



## Figure 3. Distribution of Final Sale Ratios



## Figure 3 (cont.). Distribution of Final Sale Ratios

### Shapiro-Francia W' Tests for Normality for Various Strata

| Strata | Observations | W' | V' | z | Prob* |
|---|---|---|---|---|---|
| Single Family | 1977 | 0.97240 | 29.189 | 6.222 | 0.00001 |
| Multi-family | 587 | 0.98465 | 6.377 | 4.022 | 0.00003 |
| Single Family <=$42,000 | 399 | 0.96587 | 10.007 | 4.889 | 0.00001 |
| Single Family $42,001-$58,000 | 402 | 0.99396 | 1.782 | 1.269 | 0.10222 |
| Single Family $58,001-$78,000 | 455 | 0.96722 | 10.810 | 5.069 | 0.00001 |
| Single Family $78,001-$100,000 | 343 | 0.97566 | 6.240 | 3.895 | 0.00005 |
| Single Family >$100,000 | 378 | 0.99636 | 1.018 | 0.039 | 0.48447 |
| Overall Un-weighted | 2564 | 0.97622 | 27.499 | 5.655 | 0.00001 |

*This value represents the indicated probability that the underlying population is normally distributed. A value of less than .05 indicates a distribution that is not normal.

## Table 2. Sales Ratio Analysis: Stratified by Property Use

| | | Strata | | |
|---|---|---|---|---|
| | | Single Family | Multi-family | Overall Un-weighted |
| Number of Sales | | 1977 | 587 | 2564 |
| Median | | .717 | .731 | .719 |
| 95% Confidence Interval for Median | Lower Bound | .710 | .707 | .712 |
| | Upper Bound | .725 | .750 | .727 |
| Weighted Mean | | .683 | .692 | .685 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .674 | .675 | .677 |
| | Upper Bound | .692 | .708 | .692 |
| Minimum | | .271 | .251 | .251 |
| Maximum | | 1.616 | 1.429 | 1.616 |
| Std. Deviation | | .179 | .219 | .189 |
| Price Related Differential | | 1.073 | 1.091 | 1.078 |
| Coefficient of Dispersion | | .188 | .234 | .199 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 11.3% | 15.8% | 12.3% |

## Table 3. Combined Results – Post Stratification and Weighting

| | Population Assessor's Value | Median | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Single Family | 4,064,458,153 | 0.717 | 5,668,700,353 | 77.8% | 0.558 |
| Multi-family | 1,185,299,420 | 0.731 | 1,621,476,635 | 22.2% | 0.163 |
| Total | 5,249,757,573 | | 7,290,176,988 | 100.0% | 72.0% |

| | Population Assessor's Value | Weighted Mean | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Single Family | 4,064,458,153 | 0.683 | 5,950,890,414 | 77.6% | 0.530 |
| Multi-family | 1,185,299,420 | 0.692 | 1,712,860,434 | 22.4% | 0.155 |
| Total | 5,249,757,573 | | 7,663,750,848 | 100.0% | 68.5% |

**Table 4. Sales Ratio Analysis: Stratified by Use and Value**

| | | Strata | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | SF <$42,000 | SF $42,001-$58,000 | SF $58,001-$78,000 | SF $78,001-$100,000 | SF >$100,000 | Multi-family | Overall Un-weighted |
| Number of Sales | | 399 | 402 | 455 | 343 | 378 | 587 | 2564 |
| Median | | .732 | .744 | .719 | .706 | .697 | .731 | .719 |
| 95% Confidence Interval for Median | Lower Bound | .706 | .717 | .706 | .686 | .684 | .707 | .712 |
| | Upper Bound | .761 | .773 | .729 | .725 | .713 | .750 | .727 |
| Weighted Mean | | .680 | .706 | .699 | .698 | .663 | .692 | .685 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .658 | .686 | .684 | .685 | .646 | .675 | .677 |
| | Upper Bound | .703 | .725 | .713 | .711 | .679 | .708 | .692 |
| Minimum | | .271 | .321 | .391 | .406 | .347 | .251 | .251 |
| Maximum | | 1.616 | 1.242 | 1.331 | 1.167 | 1.107 | 1.429 | 1.616 |
| Std. Deviation | | .244 | .177 | .169 | .130 | .140 | .219 | .189 |
| Price Related Differential | | 1.112 | 1.066 | 1.054 | 1.031 | 1.052 | 1.091 | 1.078 |
| Coefficient of Dispersion | | .255 | .187 | .176 | .144 | .160 | .234 | .199 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 15.0% | 15.4% | 11.6% | 8.5% | 5.0% | 15.8% | 12.3% |

**Table 5. Combined Results – Post Stratification and Weighting**

| | **Population Assessor's Value** | **Median** | **Estimated Actual Value** | **% of Total Est. Mkt. Value** | **Subtotal** |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Single Family <=$42,000 | 633,825,897 | 0.732 | 865,882,372 | 11.9% | 0.087 |
| Single Family $42,001 - $58,000 | 645,924,527 | 0.744 | 868,178,128 | 11.9% | 0.088 |
| Single Family $58,001 - $78,000 | 791,606,419 | 0.719 | 1,100,982,502 | 15.1% | 0.108 |
| Single Family $78,001 - $100,000 | 683,290,629 | 0.706 | 967,833,752 | 13.3% | 0.094 |
| Single Family >$100,000 | 1,309,810,682 | 0.697 | 1,879,211,882 | 25.7% | 0.179 |
| Multi-family | 1,185,299,420 | 0.731 | 1,621,476,635 | 22.2% | 0.162 |
| Total | 5,249,757,573 | | 7,303,565,271 | 100.0% | 71.9% |
| | | | | | |
| | **Population Assessor's Value** | **Weighted Mean** | **Estimated Actual Value** | **% of Total Est. Mkt. Value** | **Subtotal** |
| **Strata** | | | | | |
| Single Family <=$42,000 | 633,825,897 | 0.68 | 932,096,907 | 12.2% | 0.083 |
| Single Family $42,001 - $58,000 | 645,924,527 | 0.706 | 914,907,262 | 12.0% | 0.084 |
| Single Family $58,001 - $78,000 | 791,606,419 | 0.699 | 1,132,484,147 | 14.8% | 0.104 |
| Single Family $78,001 - $100,000 | 683,290,629 | 0.698 | 978,926,402 | 12.8% | 0.089 |
| Single Family >$100,000 | 1,309,810,682 | 0.663 | 1,975,581,722 | 25.8% | 0.171 |
| Multi-family | 1,185,299,420 | 0.692 | 1,712,860,434 | 22.4% | 0.155 |
| Total | 5,249,757,573 | | 7,646,856,874 | 100.0% | 68.7% |

## Table 6. Sales Ratio Analysis: Stratified by Location

| | | Strata | | | |
|---|---|---|---|---|---|
| | | SF/MF in Lower-value Market Areas | SF/MF in Moderate-value Market Areas | SF/MF in Higher-value Market Areas | Overall Un-weighted |
| Number of Sales | | 548 | 784 | 1232 | 2564 |
| Median | | .767 | .716 | .709 | .719 |
| 95% Confidence Interval for Median | Lower Bound | .746 | .703 | .700 | .712 |
| | Upper Bound | .786 | .729 | .717 | .727 |
| Weighted Mean | | .711 | .664 | .689 | .685 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .690 | .648 | .679 | .677 |
| | Upper Bound | .733 | .679 | .698 | .692 |
| Minimum | | .251 | .285 | .323 | .251 |
| Maximum | | 1.616 | 1.595 | 1.532 | 1.616 |
| Std. Deviation | | .248 | .195 | .147 | .189 |
| Price Related Differential | | 1.101 | 1.099 | 1.050 | 1.078 |
| Coefficient of Dispersion | | .253 | .212 | .158 | .199 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 18.6% | 13.6% | 8.7% | 12.3% |

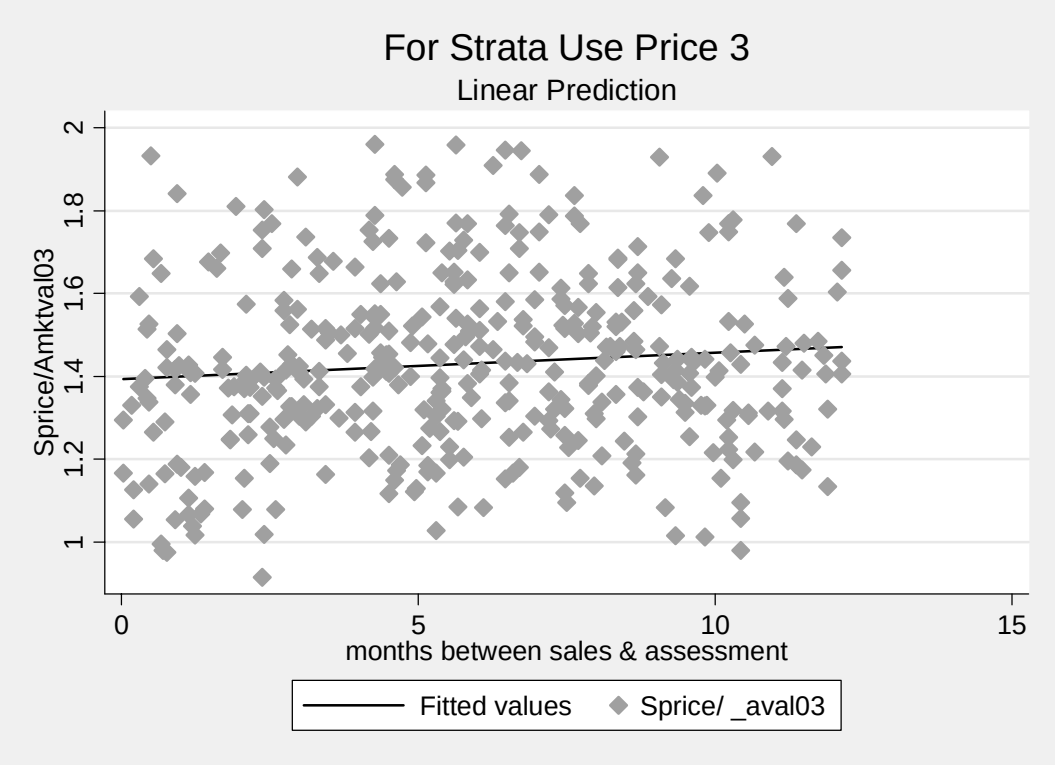
## Table 7. Combined Results – Post Stratification and Weighting

| | Population Assessor's Value | Median | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| SF/MF in Lower-value Market Areas | 1,032,229,107 | 0.767 | 1,345,800,661 | 18.5% | 0.142 |
| SF/MF in Moderate-value Market Areas | 1,497,734,525 | 0.716 | 2,091,807,996 | 28.8% | 0.206 |
| SF/MF in Higher-value Market Areas | 2,719,793,941 | 0.709 | 3,836,098,647 | 52.7% | 0.374 |
| Total | 5,249,757,573 | | 7,273,707,304 | 100.0% | 72.2% |

| | Population Assessor's Value | Weighted Mean | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| SF/MF in Lower-value Market Areas | 1,032,229,107 | 0.711 | 1,451,799,025 | 19.0% | 0.135 |
| SF/MF in Moderate-value Market Areas | 1,497,734,525 | 0.664 | 2,255,624,285 | 29.5% | 0.196 |
| SF/MF in Higher-value Market Areas | 2,719,793,941 | 0.689 | 3,947,451,293 | 51.6% | 0.355 |
| Total | 5,249,757,573 | | 7,654,874,603 | 100.0% | 68.6% |

**Graph 1. Single Family Property Price Trend**

A thorough analysis of price-time trends by price strata determined that adjusting reported prices was desirable for the middle valued single family stratum. The prices for this stratum ranged from $87,000 - $120,000. The resultant trend and statistical analysis is shown below.




**Price Trend Regression Statistics**

| Source | SS | df | MS | | |
|---|---|---|---|---|---|
| Model | .167807173 | 1 | .167807173 | Number of obs = 398 | R-squared = 0. 0093 |
| Residual | 17.9567608 | 396 | .045345356 | F( 1, 396) = 3.70 | Adj R-squared= 0. 0068 |
| Total | 18.124568 | 397 | .045653824 | Prob > F = 0.0551 | Root MSE = .21294 |

| _aratio | Coef. | Std. Err. | t | P> t | [80% Conf. Interval] | |
|---|---|---|---|---|---|---|
| _adjperiod | .0063687 | .0033107 | 1.92 | 0.055 | .0021189 | .0106186 |
| _cons | 1.392796 | .0219946 | 63.32 | 0.000 | 1.364562 | 1.421031 |
| Monthly adjustment rate=.0045726 | | | | Annualized adjustment rate=.0548712 | | |

# Chapter 25. St. Louis County

## 1. Significant Findings

1.1 Assessment Level: St. Louis County's 2003 residential property assessments were approximately 80% of market value (Section 3.5). The results from the corresponding STC study are invalid because the STC's appraisals did not meet the requirement that they reflect market values (Section 4.3).

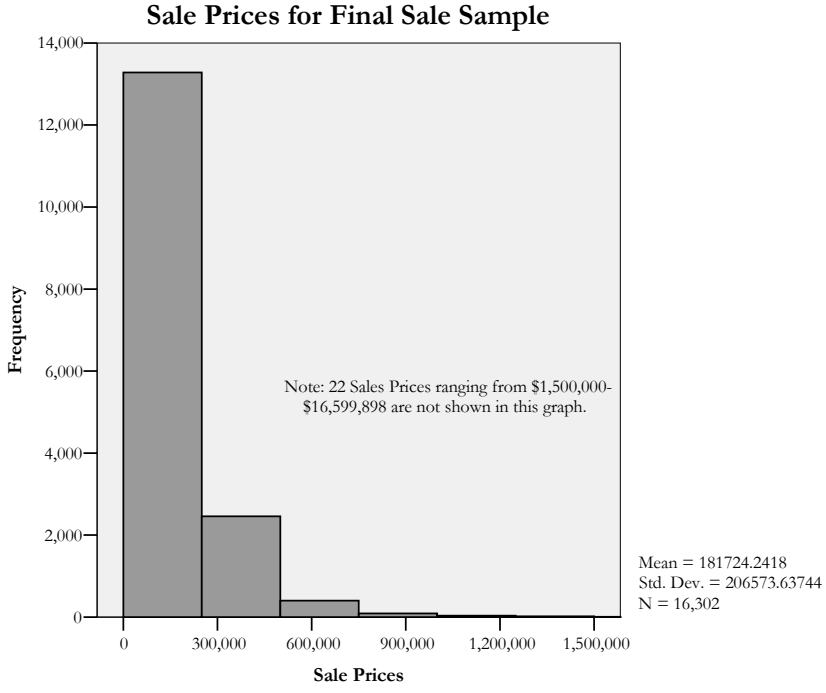
1.2 Assessment Equity: Several strata, including the lowest-valued and highest-valued properties, unimproved properties, and the oldest and newest properties are assessed at different levels than other strata (Section 3.6 and Tables 2, 4 & 8).

1.3 Reassessment History: Two indicators of market value changes suggest that two of the past four biennial reassessments have produced lower value increases than the market. Cumulatively, the reassessments from 1997 through 2003 produced 80% of the expected rise in assessments (Section 5.1).

## 2. Data and Related Issues

2.1 Assessment Data: The assessor provided the assessment roll in electronic format. Therefore, sales were matched using a combination of computer techniques and software and then screened. The assessor answered all questions regarding the contents and coding of data when requested. The files received contained information allowing us to identify properties affected by new construction and to screen as appropriate.

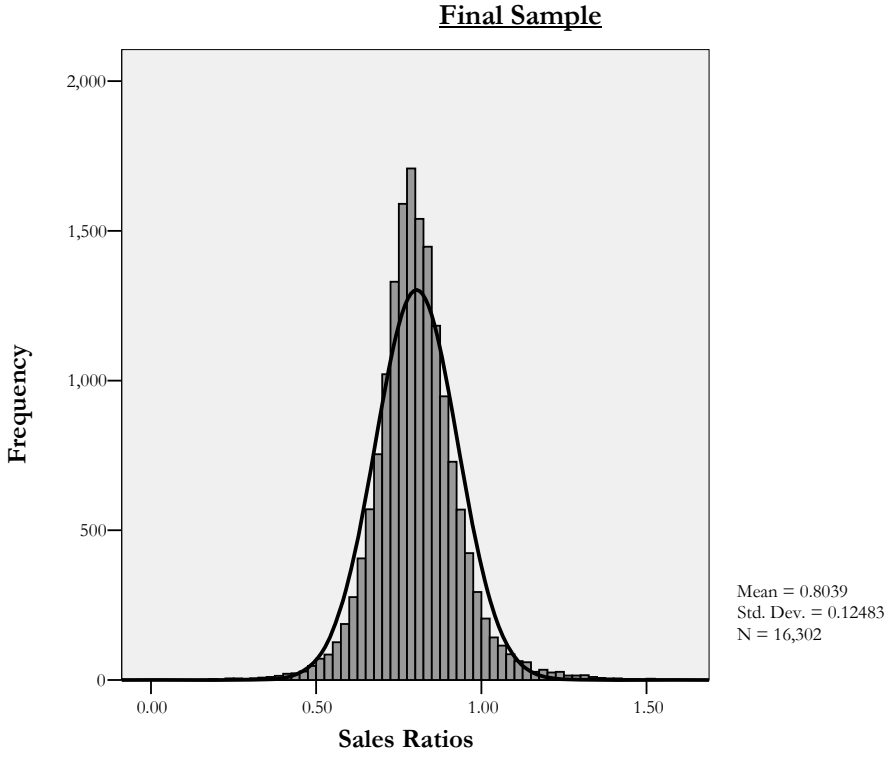
2.2 Sales and Ratio Data: The distribution of sale prices used is reflected in the following histogram.



The next table reports results of the data screening and trimming process. The "screened sales" represent the initial screened sample. The screened sales that were excluded from the final analysis because their ratios were deemed unrepresentative are identified as high or low trims. The "remaining ratios" represent the sample on which all the study's results are based.

| Trimming of Outliers | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Single Family <=$49,500 | Single Family $49,501 - $63,000 | Single Family $63,001 - $95,500 | Single Family $95,501 - $135,000 | Single Family $135,001 - $200,500 | Single Family >$200,500 | Unimproved Properties | Multi-family | Total |
| **Screened Sales** | | 1,399 | 1,673 | 3,331 | 3,565 | 3,027 | 3,044 | 75 | 278 | 16,392 |
| Excluded | High Trims | 25 | 10 | 5 | 4 | 5 | 8 | 4 | 4 | 66 |
| Excluded | Low Trims | 10 | 2 | 1 | 1 | 1 | 4 | 2 | 3 | 24 |
| **Remaining Ratios** | | **1,364** | **1,661** | **3,325** | **3,560** | **3,021** | **3,032** | **68** | **271** | **16,302** |

The histogram below shows the distribution of the ratios for the sample.




2.3 Population: Since a complete copy of the 2003 assessment rolls in electronic form was available, we were able to analyze the county's population in detail. This allowed us to stratify and weight sales on a variety of property and location characteristics.

## 3. Ratio Study Results

3.1 The Sample: The following table shows that none of the strata vary by more than 3 percent from the population. Upon initial examination, we conclude that the un-stratified sample is sufficiently representative of the population.

| Comparing Representivity | | | | | | |
|---|---|---|---|---|---|---|
| | Population Distribution | | | PPRC 2003 Sale Sample | | |
| Strata | N | $ | $ Weight | N | $ | $ Weight |
| Single Family <=$49,500 | 34,897 | 1,324,998,300 | 2.5% | 1364 | 54,905,100 | 2.3% |
| Single Family $49,501-$63,000 | 33779 | 1,903,581,900 | 3.5% | 1661 | 93,844,000 | 3.9% |
| Single Family $63,001-$95,500 | 66375 | 5,224,605,000 | 9.7% | 3325 | 262,789,900 | 11.0% |
| Single Family $95,501-$135,000 | 68724 | 7,847,016,100 | 14.6% | 3560 | 406,492,500 | 17.0% |
| Single Family $135,001-$200,500 | 64167 | 10,464,706,800 | 19.5% | 3021 | 490,709,400 | 20.6% |
| Single Family >$200,500 | 66670 | 23,036,534,000 | 42.9% | 3032 | 997,929,000 | 41.8% |
| Unimproved Properties | 12224 | 532,803,800 | 1.0% | 68 | 5,765,700 | 0.2% |
| Multi-family | 6714 | 3,391,696,900 | 6.3% | 271 | 72,627,600 | 3.0% |
| Total | 353,550 | 53,725,942,800 | | 16,302 | 2,385,063,200 | |

3.2 Representing the Population with the Sample: Since the un-stratified sample is sufficiently representative of the population (Section 3.1), the use of stratification and weighting is not essential. Nevertheless, we used stratification because it produces additional analytical benefits and further optimizes representivity.

3.3 Sales Chasing: There was no indication of sales chasing.

3.4 Study Validity: The sample meets the requirements for producing valid inferences about the county's population of residential properties.

3.5 Assessment Level: Measures of the assessment level are summarized below. For the purposes of this study, the weighted mean from combined stratification is the preferred measure as long as the both of the requirements from using the weighted mean are met. In this case, weighting is not compromised by the use of seriously undersized samples but the distributions are not sufficiently normal (Figure 3). Since both requirements are not met, we focus on the median, though taking notice of the weighted mean, to conclude that the County's assessments for 2003 reflect approximately 80% of market value.

| Assessment Level (Based on Percent of Market Value) | | | | |
|---|---|---|---|---|
| | Stratification and Weighting | Reference | Weighted Mean | Median |
| **Overall Un-weighted** | None | Table 2 | 80.5% | 79.8% |
| **Combined** | By Property Use | Table 3 | 79.9% | 79.5% |
| **Combined** | By Property Use and Value Range | Table 5 | 80.0% | 81.3% |
| **Combined** | By Property Location | Table 7 | 80.0% | 79.8% |
| **Combined** | By Property Age | Table 9 | 79.9% | 79.8% |

3.6 Equity Measures and Evaluation:

i. Uniformity within Strata: Tables 2, 4, 6 & 8 show results for individual strata of sufficient sample size for evaluation. The following strata represent problem areas for internal uniformity.

| Strata with Inadequate Uniformity | |
|---|---|
| **Property Strata** | **COD** |
| Unimproved Properties | 43.4% |

ii. Uniformity between Strata: Another form of inequity exists when different strata are assessed at different levels. The IAAO has established guidelines for identifying such inequity, but compliance can be heavily affected by sample size and uniformity. Therefore, we confine our remarks to identifying where assessment levels differ markedly from the norm. Unimproved properties (Table 2), the lowest and highest valued single family properties (Table 4), the lowest and highest ratio school districts (Table 6), and the oldest and newest properties (Table 8) are assessed at values lower than other comparison properties.

iii. Vertical Equity: The final form of potential inequity examined is vertical equity. The PRD for the overall sample of 0.999 complies with the IAAO standard.

## 4. STC Study

4.1 Comparative Results: The following table contrasts our results with those from the STC study. The STC found the level of assessment somewhat adequate, while ours does not. The STC reports a similar horizontal equity measure and vertical equity measure. We have already demonstrated that the PPRC study meets the criteria for achieving valid results. The rest of Section 4 examines the validity of the STC's study.

| Comparison of Study Results | | | |
|---|---|---|---|
| **Measure** | **STC Study*** | **PPRC Study*** | **PPRC Study Combined**** |
| Assessment Level - median | 90.4% | 79.8% | 81.3% |
| Assessment Level - wtd. mean | 87.7% | 80.5% | 80.0% |
| COD | 10.5% | 11.4% | |
| PRD | 1.02 | 1.00 | |
| Sample Size | 40 | 16,302 | |
| Relative Precision | 1.00 | 20.19 | |
| * Overall sample (un-stratified and un-weighted) | | | |
| ** Stratification and weighting by Property Use and Value Range | | | |

4.2 Representing the Population with the Sample: The STC does not examine the representivity of its sample, nor does it have the necessary sample size or information to do so. Therefore, in the following table, we provide that missing analysis. In this case, the table shows that the three single-family value strata in the STC sample vary from 3.3% to 3.7%. Initially, this exhibits excessive variability from the sample to the population. However, upon closer examination, this variation has no material effect and thus we conclude that the STC sample is sufficiently representative of the population.

| Comparing Representivity | | | | | | |
|---|---|---|---|---|---|---|
| | Population | | | STC 2003 Appraisals | | |
| Strata | N | $ | % | N | $ | % |
| Single Family <=$49,500 | 34,897 | 1,324,998,300 | 2.5% | 4 | 140,895 | 2.6% |
| Single Family $49,501-$63,000 | 33779 | 1,903,581,900 | 3.5% | 4 | 225,895 | 4.1% |
| Single Family $63,001-$95,500 | 66375 | 5,224,605,000 | 9.7% | 4 | 341,737 | 6.2% |
| Single Family $95,501-$135,000 | 68724 | 7,847,016,100 | 14.6% | 9 | 989,579 | 17.9% |
| Single Family $135,001- $200,500 | 64167 | 10,464,706,800 | 19.5% | 5 | 870,789 | 15.8% |
| Single Family >$200,500 | 66670 | 23,036,534,000 | 42.9% | 8 | 2,422,384 | 43.9% |
| Unimproved Properties | 12224 | 532,803,800 | 1.0% | 2 | 188,526 | 3.4% |
| Multi-family | 6714 | 3,391,696,900 | 6.3% | 4 | 335,789 | 6.1% |
| Total | 353,550 | 53,725,942,800 | | 40 | 5,515,595 | |

4.3 Market Value: The final requirement for producing a valid appraisal study is that appraisals must represent market values. As discussed in the introduction for this Section II, and in greater depth in the Procedure Manual (Section III), we use 4 tests to make this determination. The results of each test are reported in the following tables.

| Mann-Whitney Test | | | | |
|---|---|---|---|---|
| For the Entire Sample | | | | |
| Study | Observations | Rank sum | Expected | Ho: Ratios (40 STC Appraisals)=Ratios (16302 Sales)<br>z = 4.742<br>Prob > \|z\| = 0.0000 |
| 0 | 40 | 468179 | 326860 | |
| 1 | 16302 | 1.331e+08 | 1.332e+08 | |
| Combined | 16342 | 1.335e+08 | 1.335e+08 | |
| For Single Family Properties Only | | | | |
| Study | Observations | Rank sum | Expected | Ho : Ratios (34 STC Appraisals)=Ratios (15963 Sales)<br>z = 4.401<br>Prob > \|z\| = 0.0000 |
| 0 | 34 | 390340 | 271966 | |
| 1 | 15963 | 1.276e+08 | 1.277e+08 | |
| Combined | 15997 | 1.280e+08 | 1.280e+08 | |

| K-Sample Test | | | | |
|---|---|---|---|---|
| For the Entire Sample | | | | |
| Study | Not Greater than the median | Greater than the median | Total | Ho: Ratios (40 STC Appraisals)=Ratios(16302 Sales)<br>Pearson chi2(1) = 14.4353 Pr = 0.000<br>Continuity corrected:<br>Pearson chi2(1) = 13.2575 Pr = 0.000 |
| 0 | 8 | 32 | 40 | |
| 1 | 8163 | 8139 | 16302 | |
| Total | 8171 | 8171 | 16342 | |
| For Single Family Properties Only | | | | |
| Study | Not Greater than the median | Greater than the median | Total | Ho: Ratios (34 STC Appraisals)=Ratios(15963 Sales)<br>Pearson chi2(1) = 11.7923 Pr = 0.001<br>Continuity corrected:<br>Pearson chi2(1) = 10.6426 Pr = 0.001 |
| 0 | 7 | 27 | 34 | |
| 1 | 7992 | 7971 | 15963 | |
| Total | 7999 | 7998 | 15997 | |

All four tests lead to the conclusion that the STC appraisals do not represent market values (all with 99% statistical confidence). Therefore, the STC study is invalid and its reported results are unreliable.

## 5. Additional Analysis and Findings

5.1 Analysis of Reassessment History: The following table provides a comparison of actual assessment changes (net of new construction) to those that might have been expected for each of the last four reassessments as well as the six-year period leading up to 2003. Two of the reassessments produced changes in line with the market indicator. In our study, previous assessment information was available for St. Louis County, so we were able to test for the real reassessment rate. Using this information, we found evidence that a real reassessment took place in 2003.

| Actual Value Changes from Reassessment vs. Expected Value Change | | | | | |
|---|---|---|---|---|---|
| Biennial Year | % Net Assessment Change | Missouri OFHEO Index | % Value Change: Actual vs. Expected | St. Louis MSA OFHEO Index | % Value Change: Actual vs. Expected |
| 1999 | 5.0 | 8.4 | 59% | 9.6 | 52% |
| 2001 | 14.5 | 11.4 | 127% | 13.5 | 107% |
| 2003 | 6.5 | 11.8 | 55% | 12.9 | 50% |
| 2005 | 13.2 | 12.4 | 106% | 16.8 | 78% |
| Cumulative 1997 - 2003 | 27.9 | 35.0 | 80% | 40.4 | 69% |

## 6. Figures and Tables

**Table 1. STC's Appraisal Ratio Studies**

| | | Group | | |
|---|---|---|---|---|
| | | 1999 | 2001 | 2003 |
| Number of Appraisals | | 38 | 39 | 40 |
| Median | | 1.000 | .987 | .904 |
| 95% Confidence Interval | Lower Bound | .972 | .926 | .851 |
| for Median | Upper Bound | 1.026 | 1.006 | .942 |
| Weighted Mean | | .991 | .978 | .877 |
| 95% Confidence Interval | Lower Bound | .966 | .939 | .836 |
| for Weighted Mean | Upper Bound | 1.016 | 1.016 | .917 |
| Minimum | | .829 | .751 | .469 |
| Maximum | | 1.199 | 1.300 | 1.307 |
| Std. Deviation | | .076 | .114 | .132 |
| Price Related Differential | | 1.005 | .995 | 1.015 |
| Coefficient of Dispersion | | .057 | .081 | .105 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 84.2% | 69.2% | 50.0% |

**Figure 1. Ratios before Outlier Trimming**

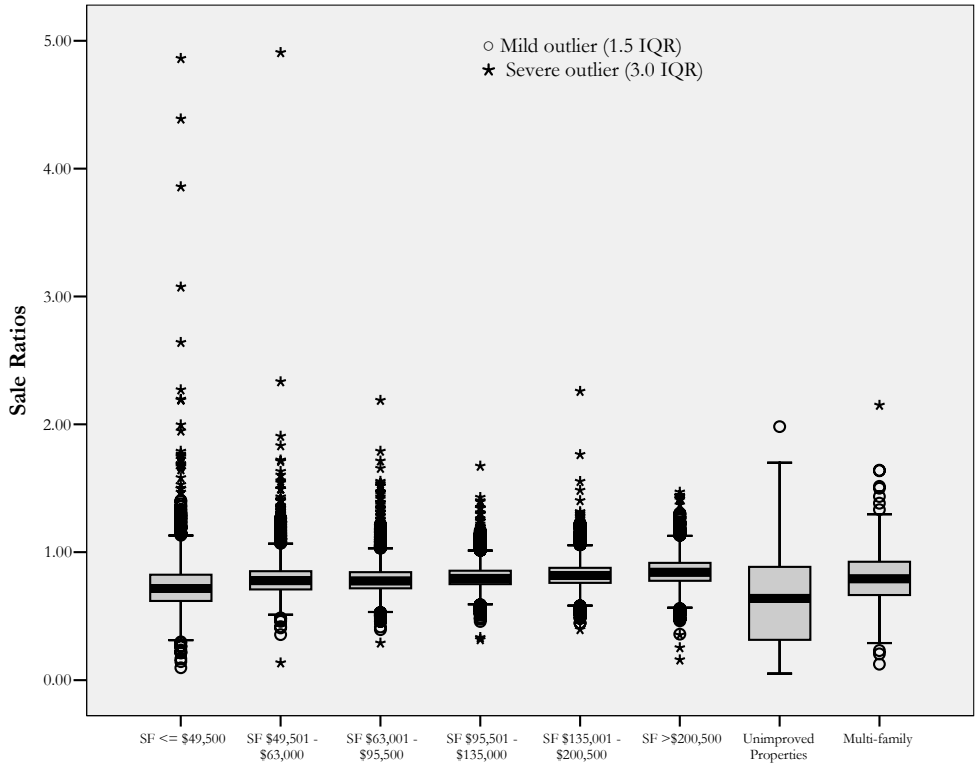
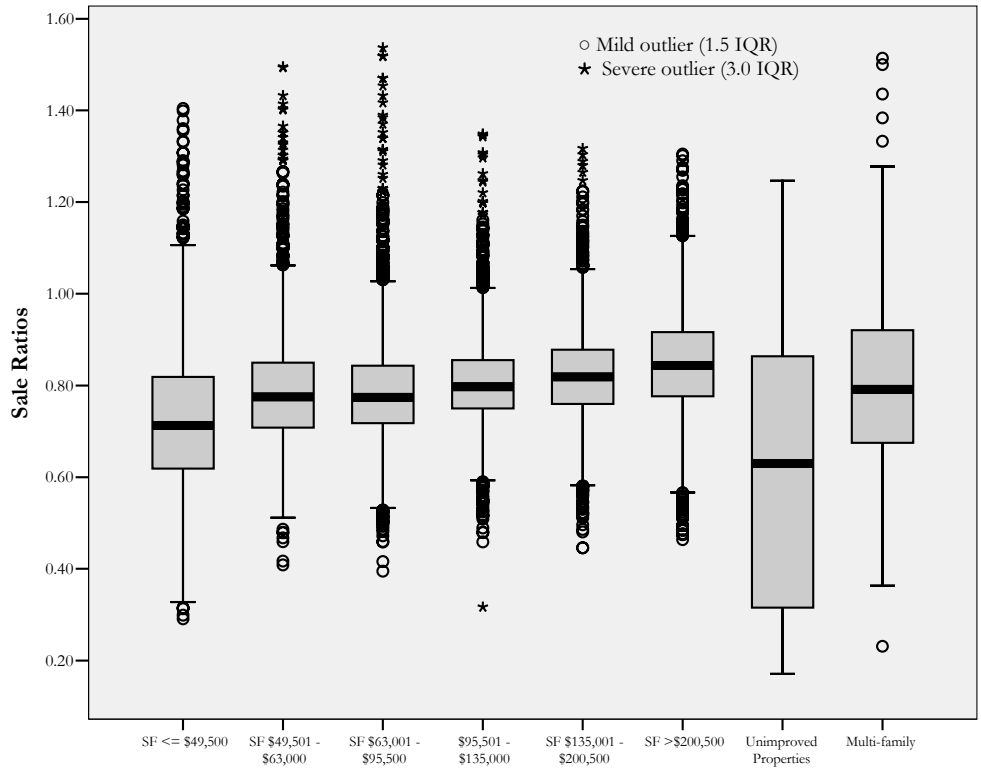
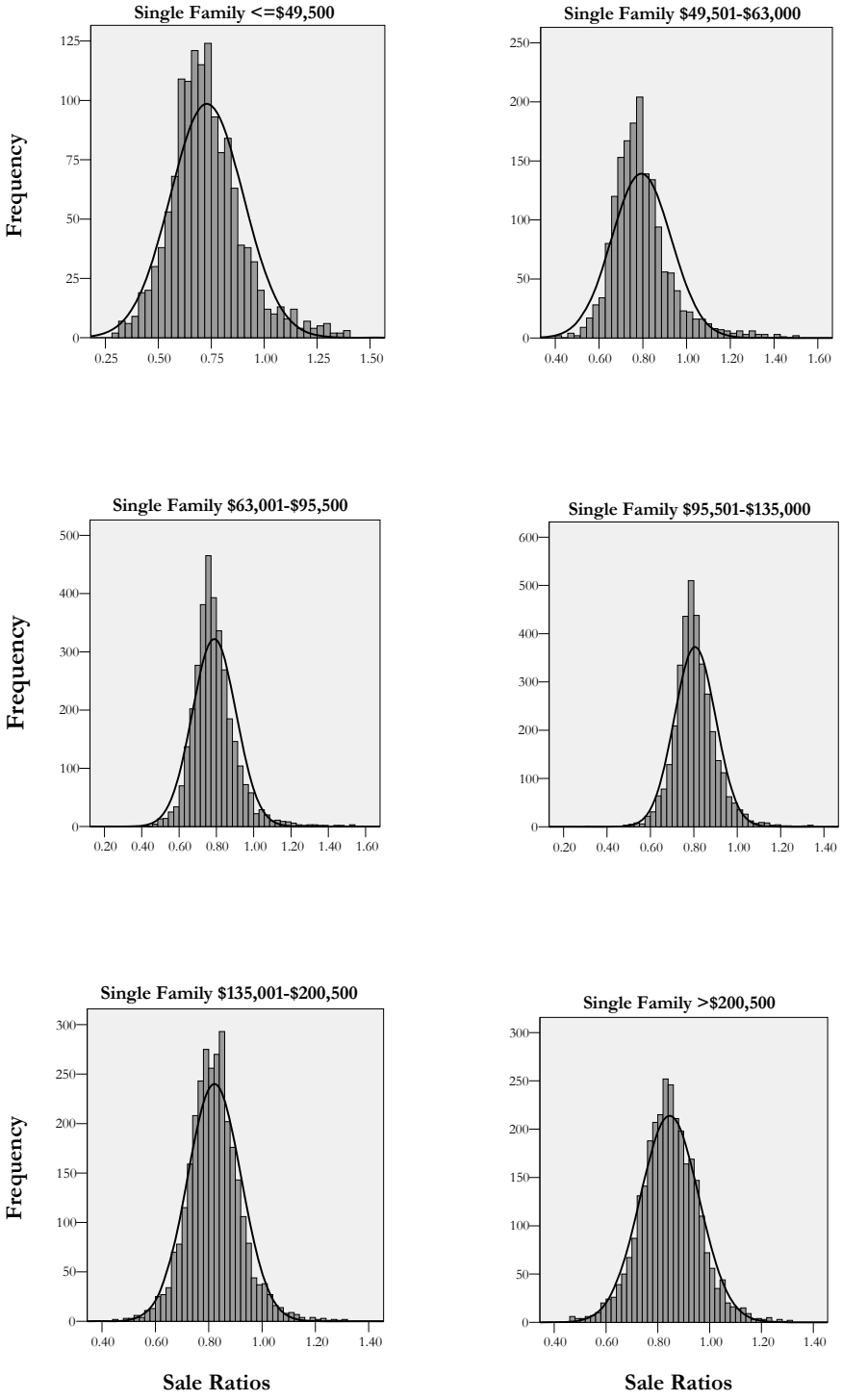


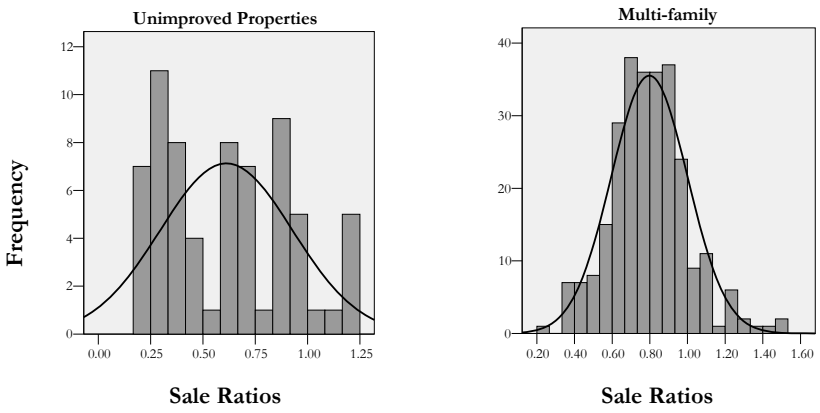

**Figure 2. Ratios after Outlier Trimming**



## Figure 3. Distribution of Final Sale Ratios



## Figure 3 (cont.). Distribution of Final Sale Ratios




## Shapiro-Francia W' Tests for Normality for Various Strata

| Strata | Observations | W' | V' | z | Prob* |
|---|---|---|---|---|---|
| Single Family | 15,963 | 0.97011 | 26.513 | 0.463 | 0.32168 |
| Multi-family | 271 | 0.97951 | 4.278 | 3.074 | 0.00106 |
| Unimproved Properties | 68 | 0.93995 | 3.972 | 2.640 | 0.00414 |
| Single Family <=$49,500 | 1,364 | 0.96657 | 28.471 | 6.639 | 0.00001 |
| Single Family $49,501-$63,000 | 1,661 | 0.91886 | 78.477 | 7.767 | 0.00001 |
| Single Family $63,001-$95,500 | 3,325 | 0.93034 | 83.511 | 5.727 | 0.00001 |
| Single Family $95,501-$135,000 | 3,560 | 0.96248 | 45.050 | 5.111 | 0.00001 |
| Single Family $135,001-$200,500 | 3,021 | 0.98000 | 23.800 | 5.119 | 0.00001 |
| Single Family >$200,500 | 3,032 | 0.99219 | 9.291 | 4.083 | 0.00002 |
| Overall Un-weighted | 16,302 | 0.96668 | 29.440 | 0.439 | 0.33033 |
| *This value represents the indicated probability that the underlying population is normally distributed. A value of less than .05 indicates a distribution that is not normal. | | | | | |

## Skewness and Kurtosis Test for Normality for Strata with more than 5,000 Observations

| Strata | Pr(Skewness) | Pr(Kurtosis) | Chi2(2) | Prob>chi2* |
|---|---|---|---|---|
| Single Family | 0.000 | 0.000 | 1508.07 | 0.000. |
| Overall Un-weighted | 0.000 | 0.000 | 1617.88 | 0.000 |
| *This value represents the indicated probability that the underlying population is normally distributed. A value of less than .05 indicates a distribution that is not normal. | | | | |

## Table 2. Sales Ratio Analysis: Stratified by Property Use

| | | Strata | | | |
|---|---|---|---|---|---|
| | | Single Family | Unimproved Properties | Multi-family | Overall Un-weighted |
| Number of Sales | | 15963 | 68 | 271 | 16302 |
| Median | | .798 | .629 | .792 | .798 |
| 95% Confidence Interval for Median | Lower Bound | .796 | .402 | .750 | .796 |
| | Upper Bound | .800 | .736 | .823 | .800 |
| Weighted Mean | | .808 | .535 | .737 | .805 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .806 | .415 | .701 | .802 |
| | Upper Bound | .811 | .656 | .774 | .808 |
| Minimum | | .291 | .171 | .231 | .171 |
| Maximum | | 1.537 | 1.247 | 1.514 | 1.537 |
| Std. Deviation | | .121 | .317 | .203 | .125 |
| Price Related Differential | | .996 | 1.143 | 1.082 | .999 |
| Coefficient of Dispersion | | .112 | .434 | .197 | .114 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 15.6% | 10.3% | 22.9% | 15.7% |

## Table 3. Combined Results – Post Stratification and Weighting

| | **Population Assessor's Value** | **Median** | **Estimated Actual Value** | **% of Total Est. Mkt. Value** | **Subtotal** |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Single Family | 49,801,442,100 | 0.798 | 62,407,822,180 | 92.4% | 0.737 |
| Unimproved Properties | 532,803,800 | 0.629 | 847,064,865 | 1.3% | 0.008 |
| Multi-family | 3,391,696,900 | 0.792 | 4,282,445,581 | 6.3% | 0.050 |
| Total | 53,725,942,800 | | 67,537,332,626 | 100.0% | 79.5% |
| | | | | | |
| | **Population Assessor's Value** | **Weighted Mean** | **Estimated Actual Value** | **% of Total Est. Mkt. Value** | **Subtotal** |
| **Strata** | | | | | |
| Single Family | 49,801,442,100 | 0.808 | 61,635,448,144 | 91.7% | 0.741 |
| Unimproved Properties | 532,803,800 | 0.535 | 995,894,953 | 1.5% | 0.008 |
| Multi-family | 3,391,696,900 | 0.737 | 4,602,031,072 | 6.8% | 0.050 |
| Total | 53,725,942,800 | | 67,233,374,169 | 100.0% | 79.9% |

## Table 4. Sales Ratio Analysis: Stratified by Use and Value

| | | Strata | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | SF <= $49,500 | SF $49,501-$63,000 | SF $63,001-$95,500 | SF $95,501 - $135,000 | SF $135,001 - $200,500 | SF > $200,500 | Un-improved Properties | Multi-family | Overall Un-weighted |
| Number of Sales | | 1364 | 1661 | 3325 | 3560 | 3021 | 3032 | 68 | 271 | 16302 |
| Median | | .713 | .775 | .774 | .797 | .819 | .844 | .629 | .792 | .798 |
| 95% Confidence Interval for Median | Lower Bound | .703 | .770 | .770 | .795 | .815 | .838 | .402 | .750 | .796 |
| | Upper Bound | .721 | .780 | .779 | .800 | .822 | .848 | .736 | .823 | .800 |
| Weighted Mean | | .701 | .773 | .772 | .796 | .809 | .834 | .535 | .737 | .805 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .693 | .767 | .768 | .793 | .806 | .829 | .415 | .701 | .802 |
| | Upper Bound | .709 | .779 | .776 | .799 | .813 | .839 | .656 | .774 | .808 |
| Minimum | | .291 | .408 | .395 | .317 | .446 | .464 | .171 | .231 | .171 |
| Maximum | | 1.404 | 1.495 | 1.537 | 1.349 | 1.317 | 1.305 | 1.247 | 1.514 | 1.537 |
| Std. Deviation | | .173 | .136 | .118 | .095 | .100 | .113 | .317 | .203 | .125 |
| Price Related Differential | | 1.040 | 1.027 | 1.021 | 1.012 | 1.015 | 1.013 | 1.143 | 1.082 | .999 |
| Coefficient of Dispersion | | .181 | .124 | .109 | .087 | .092 | .103 | .434 | .197 | .114 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 9.8% | 11.9% | 11.4% | 12.4% | 16.9% | 27.5% | 10.3% | 22.9% | 15.7% |

## Table 5. Combined Results – Post Stratification and Weighting

| | Population Assessor's Value | Median | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Single Family <=$49,500 | 1,324,998,300 | 0.713 | 1,858,342,637 | 2.8% | 0.020 |
| Single Family $49,501 - $63,000 | 1,903,581,900 | 0.775 | 2,456,234,710 | 3.7% | 0.029 |
| Single Family $63,001 - $95,500 | 5,224,605,000 | 0.774 | 6,750,135,659 | 10.2% | 0.079 |
| Single Family $95,501 - $135,000 | 7,847,016,100 | 0.797 | 9,845,691,468 | 14.9% | 0.119 |
| Single Family $135,001 - $200,500 | 10,464,706,800 | 0.819 | 12,777,419,780 | 19.3% | 0.158 |
| Single Family >$200,500 | 23,036,534,000 | 0.844 | 27,294,471,564 | 41.3% | 0.348 |
| Unimproved Properties | 532,803,800 | 0.629 | 847,064,865 | 1.3% | 0.008 |
| Multi-family | 3,391,696,900 | 0.792 | 4,282,445,581 | 6.5% | 0.051 |
| Total | 53,725,942,800 | | 66,111,806,263 | 100.0% | 81.3% |

| | Population Assessor's Value | Weighted Mean | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Single Family <=$49,500 | 1,324,998,300 | 0.701 | 1,890,154,494 | 2.8% | 0.020 |
| Single Family $49,501 - $63,000 | 1,903,581,900 | 0.773 | 2,462,589,780 | 3.7% | 0.028 |
| Single Family $63,001 - $95,500 | 5,224,605,000 | 0.772 | 6,767,623,057 | 10.1% | 0.078 |
| Single Family $95,501 - $135,000 | 7,847,016,100 | 0.796 | 9,858,060,427 | 14.7% | 0.117 |
| Single Family $135,001 - $200,500 | 10,464,706,800 | 0.809 | 12,935,360,692 | 19.3% | 0.156 |
| Single Family >$200,500 | 23,036,534,000 | 0.834 | 27,621,743,405 | 41.1% | 0.343 |
| Unimproved Properties | 532,803,800 | 0.535 | 995,894,953 | 1.5% | 0.008 |
| Multi-family | 3,391,696,900 | 0.737 | 4,602,031,072 | 6.9% | 0.051 |
| Total | 53,725,942,800 | | 67,133,457,880 | 100.0% | 80.0% |

## Table 6. Sales Ratio Analysis: Stratified by Location

| | | Strata | | | | | |
|---|---|---|---|---|---|---|---|
| | | SF Lowest Ratio School District | SF Middle Ratio School District | SF Highest Ratio School District | Unimproved Properties | Multi-family | Overall Un-weighted |
| Number of Sales | | 1452 | 11195 | 3316 | 68 | 271 | 16302 |
| Median | | .728 | .796 | .824 | .629 | .792 | .798 |
| 95% Confidence Interval for Median | Lower Bound | .720 | .794 | .820 | .402 | .750 | .796 |
| | Upper Bound | .736 | .798 | .829 | .736 | .823 | .800 |
| Weighted Mean | | .743 | .805 | .830 | .535 | .737 | .805 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .734 | .802 | .825 | .415 | .701 | .802 |
| | Upper Bound | .752 | .807 | .835 | .656 | .774 | .808 |
| Minimum | | .291 | .343 | .352 | .171 | .231 | .171 |
| Maximum | | 1.519 | 1.537 | 1.384 | 1.247 | 1.514 | 1.537 |
| Std. Deviation | | .167 | .114 | .109 | .317 | .203 | .125 |
| Price Related Differential | | .996 | 1.002 | .999 | 1.143 | 1.082 | .999 |
| Coefficient of Dispersion | | .173 | .105 | .099 | .434 | .197 | .114 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 11.9% | 14.6% | 20.7% | 10.3% | 22.9% | 15.7% |

## Table 7. Combined Results – Post Stratification and Weighting

| | Population Assessor's Value | Median | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Single Family Lowest Ratio School District | 3,040,274,800 | 0.728 | 4,176,201,648 | 6.2% | 0.045 |
| Single Family Middle Ratio School District | 30,485,437,100 | 0.796 | 38,298,287,814 | 56.9% | 0.453 |
| Single Family Highest Ratio School District | 16,275,730,200 | 0.824 | 19,752,099,757 | 29.3% | 0.242 |
| Unimproved Properties | 532,803,800 | 0.629 | 847,064,865 | 1.3% | 0.008 |
| Multi-family | 3,391,696,900 | 0.792 | 4,282,445,581 | 6.4% | 0.050 |
| Total | 53,725,942,800 | | 67,356,099,665 | 100.0% | 79.8% |

| | Population Assessor's Value | Weighted Mean | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Single Family Lowest Ratio School District | 3,040,274,800 | 0.743 | 4,091,890,713 | 6.1% | 0.045 |
| Single Family Middle Ratio School District | 30,485,437,100 | 0.805 | 37,870,108,199 | 56.4% | 0.454 |
| Single Family Highest Ratio School District | 16,275,730,200 | 0.83 | 19,609,313,494 | 29.2% | 0.242 |
| Unimproved Properties | 532,803,800 | 0.535 | 995,894,953 | 1.5% | 0.008 |
| Multi-family | 3,391,696,900 | 0.737 | 4,602,031,072 | 6.9% | 0.050 |
| Total | 53,725,942,800 | | 67,169,238,431 | 100.0% | 80.0% |

## Table 8. Sales Ratio Analysis: Stratified by Age

| | | Strata | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Un-improved Property | Multi-family | Built before 1950 | Built 1950's | Built 1960's | Built 1970's | Built 1980's | Built 1990 thru 1995 | Built 1996 and newer | Overall Un-weighted |
| Number of Sales | | 68 | 271 | 3246 | 3622 | 2958 | 2168 | 2076 | 1094 | 799 | 16302 |
| Median | | .629 | .792 | .763 | .787 | .797 | .800 | .814 | .827 | .858 | .798 |
| 95% Confidence Interval for Median | Lower Bound | .402 | .750 | .757 | .783 | .794 | .795 | .808 | .820 | .853 | .796 |
| | Upper Bound | .736 | .823 | .769 | .790 | .800 | .804 | .819 | .834 | .865 | .800 |
| Weighted Mean | | .535 | .737 | .772 | .794 | .805 | .814 | .823 | .832 | .857 | .805 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .415 | .701 | .766 | .789 | .799 | .809 | .817 | .825 | .848 | .802 |
| | Upper Bound | .656 | .774 | .779 | .800 | .810 | .819 | .829 | .839 | .866 | .808 |
| Minimum | | .171 | .231 | .291 | .299 | .395 | .490 | .475 | .516 | .484 | .171 |
| Maximum | | 1.247 | 1.514 | 1.518 | 1.537 | 1.404 | 1.308 | 1.370 | 1.147 | 1.142 | 1.537 |
| Std. Deviation | | .317 | .203 | .157 | .130 | .106 | .098 | .093 | .086 | .081 | .125 |
| Price Related Differential | | 1.143 | 1.082 | 1.001 | 1.008 | .999 | .998 | .997 | .998 | 1.005 | .999 |
| Coefficient of Dispersion | | .434 | .197 | .155 | .119 | .099 | .092 | .087 | .080 | .073 | .114 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 10.3% | 22.9% | 14.4% | 14.0% | 13.5% | 15.5% | 16.4% | 18.3% | 30.5% | 15.7% |

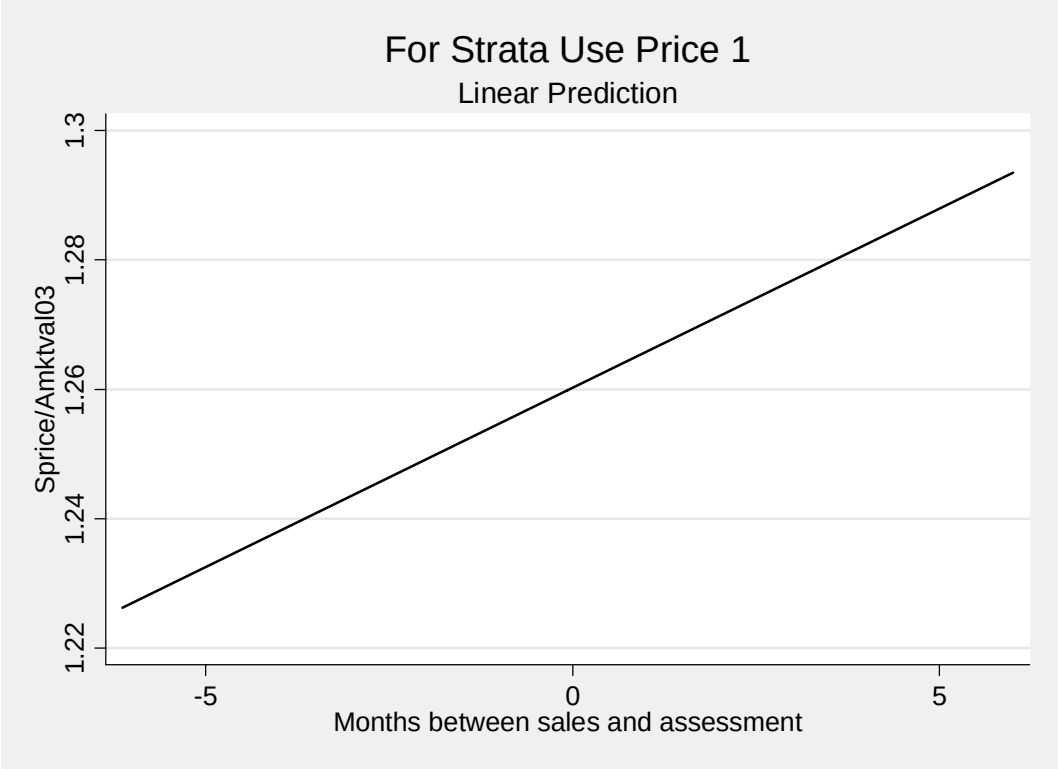
## Table 9. Combined Results – Post Stratification and Weighting

| | Population Assessor's Value | Median | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Unimproved Properties | 532,803,800 | 0.629 | 847,064,865 | 1.3% | 0.008 |
| Multi-family | 3,391,696,900 | 0.792 | 4,282,445,581 | 6.4% | 0.050 |
| Built before 1950 | 8,927,898,300 | 0.763 | 11,701,046,265 | 17.4% | 0.133 |
| Built 1950's | 8,086,186,500 | 0.787 | 10,274,696,950 | 15.3% | 0.120 |
| Built 1960's | 8,650,754,000 | 0.797 | 10,854,145,546 | 16.1% | 0.128 |
| Built 1970's | 7,214,091,300 | 0.8 | 9,017,614,125 | 13.4% | 0.107 |
| Built 1980's | 7,231,627,800 | 0.814 | 8,884,063,636 | 13.2% | 0.107 |
| Built 1990 through 1995 | 4,729,326,100 | 0.827 | 5,718,653,083 | 8.5% | 0.070 |
| Built 1996 and newer | 4,961,558,100 | 0.858 | 5,782,701,748 | 8.6% | 0.074 |
| Total | 53,725,942,800 | | 67,362,431,800 | 100.0% | 79.8% |

| | Population Assessor's Value | Weighted Mean | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Unimproved Properties | 532,803,800 | 0.535 | 995,894,953 | 1.5% | 0.008 |
| Multi-family | 3,391,696,900 | 0.737 | 4,602,031,072 | 6.8% | 0.050 |
| Built before 1950 | 8,927,898,300 | 0.772 | 11,564,635,104 | 17.2% | 0.133 |
| Built 1950's | 8,086,186,500 | 0.794 | 10,184,113,980 | 15.2% | 0.120 |
| Built 1960's | 8,650,754,000 | 0.805 | 10,746,278,261 | 16.0% | 0.129 |
| Built 1970's | 7,214,091,300 | 0.814 | 8,862,520,025 | 13.2% | 0.107 |
| Built 1980's | 7,231,627,800 | 0.823 | 8,786,911,057 | 13.1% | 0.108 |
| Built 1990 through 1995 | 4,729,326,100 | 0.832 | 5,684,286,178 | 8.5% | 0.070 |
| Built 1996 and newer | 4,961,558,100 | 0.857 | 5,789,449,358 | 8.6% | 0.074 |
| Total | 53,725,942,800 | | 67,216,119,987 | 100.0% | 79.9% |

**Graph 1. Single Family Property Price Trend**

A thorough analysis of price-time trends by price strata determined that adjusting reported prices was desirable for the lowest valued single family property stratum. The prices for this stratum ranged from $10,000 - $85,500. The resultant trend and statistical analysis is shown below.



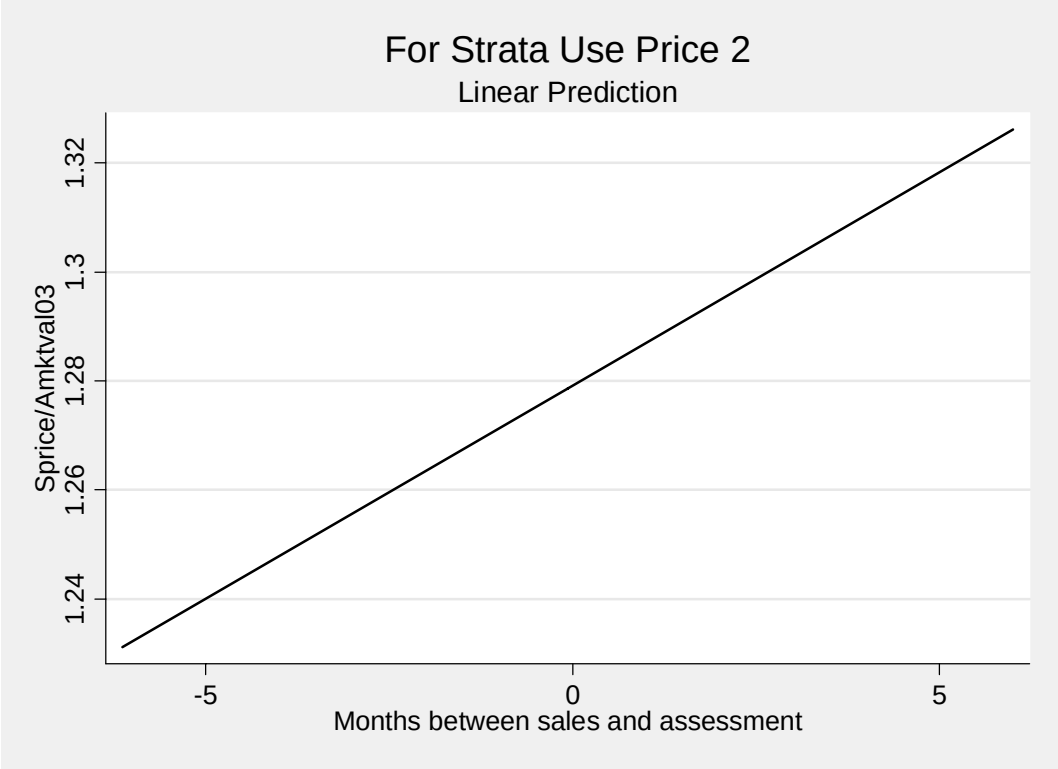

**Price Trend Regression Statistics**

| Source | SS | df | MS | Number of obs = 3294 | R-squared = 0. 0090 |
|---|---|---|---|---|---|
| Model | 1.33775052 | 1 | 1.33775052 | F( 1, 3292) = 29.99 | Adj R-squared= 0. 0087 |
| Residual | 146.85244 | 3292 | .044608882 | Prob > F = 0. 0000 | Root MSE = .21121 |
| Total | 148.19019 | 3293 | .045001576 | | |

| _aratio | Coef. | Std. Err. | t | P> t | [80% Conf. Interval] | |
|---|---|---|---|---|---|---|
| _adjperiod | .0055406 | .0010118 | 5.48 | 0.000 | .0042437 | .0068375 |
| _cons | 1.26025 | .0037181 | 338.95 | 0.000 | 1.255484 | 1.265016 |
| Monthly adjustment rate=.00439643 | | | | Annualized adjustment rate=.05275716 | | |

**Graph 2. Single Family Property Price Trend**

A thorough analysis of price-time trends by price strata determined that adjusting reported prices was desirable for the second single family property stratum. The prices for this stratum ranged from $85,001 - $130,000. The resultant trend and statistical analysis is shown below.



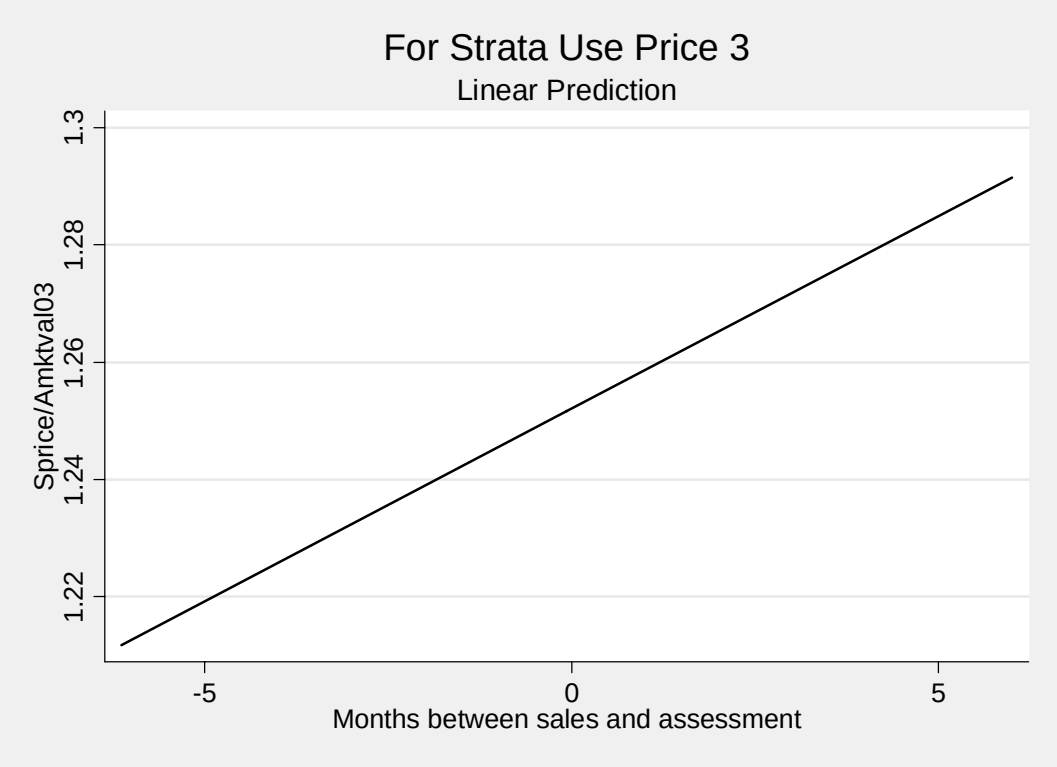

**Price Trend Regression Statistics**

| Source | SS | df | MS | Number of obs = | |
|---|---|---|---|---|---|
| Model | 2.95691066 | 1 | 2.95691066 | 3635 | R-squared = 0. 0343 |
| Residual | 83.2061465 | 3633 | .022902875 | F( 1, 3633) = 129.11 | Adj R-squared= 0. 0341 |
| Total | 86.1630572 | 3634 | .023710252 | Prob > F = 0. 0000 | Root MSE = .15134 |

| _aratio | Coef. | Std. Err. | t | P> t | [80% Conf. Interval] | |
|---|---|---|---|---|---|---|
| _adjperiod | .0078277 | .0006889 | 11.36 | 0.000 | .0069447 | .0087108 |
| _cons | 1.279161 | .0025434 | 502.94 | 0.000 | 1.275901 | 1.282421 |
| Monthly adjustment rate=.0061194 | | | | Annualized adjustment rate=.0734328 | | |

**Graph 3. Single Family Property Price Trend**

A thorough analysis of price-time trends by price strata determined that adjusting reported prices was desirable for the third single family property stratum. The prices for this stratum ranged from $130,001 - $175,000. The resultant trend and statistical analysis is shown below.



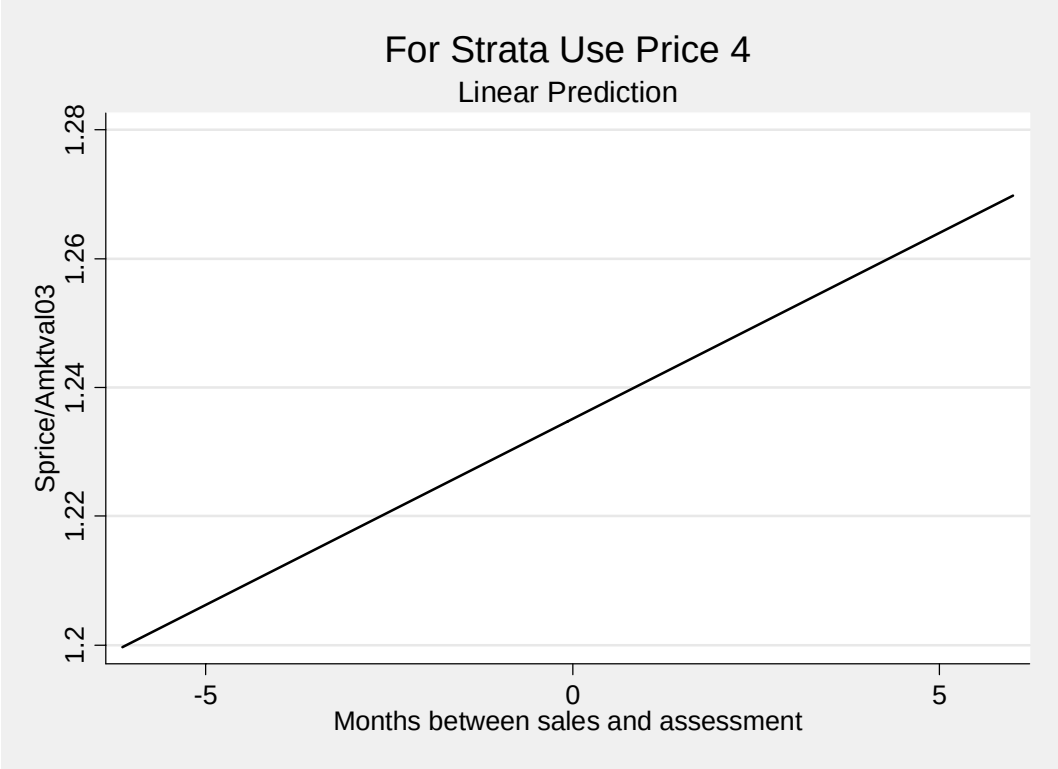

**Price Trend Regression Statistics**

| Source | SS | df | MS | Number of obs = | |
|---|---|---|---|---|---|
| Model | 1.95848789 | 1 | 1.95848789 | 3204 | R-squared = 0. 0373 |
| Residual | 50.5205563 | 3202 | .015777813 | F( 1, 3202) = 124.13 | Adj R-squared= 0. 0370 |
| Total | 52.4790442 | 3203 | .016384341 | Prob > F = 0. 0000 | Root MSE = .12561 |

| _aratio | Coef. | Std. Err. | t | P> t | [80% Conf. Interval] | |
|---|---|---|---|---|---|---|
| _adjperiod | .0065782 | .0005904 | 11.14 | 0.000 | .0058214 | .0073351 |
| _cons | 1.252061 | .0022274 | 562.11 | 0.000 | 1.249205 | 1.254916 |
| Monthly adjustment rate=.0052539 | | | | Annualized adjustment rate=.0630468 | | |

**Graph 4. Single Family Property Price Trend**

A thorough analysis of price-time trends by price strata determined that adjusting reported prices was desirable for the fourth single family property stratum. The prices for this stratum ranged from $175,001 - $270,000. The resultant trend and statistical analysis is shown below.



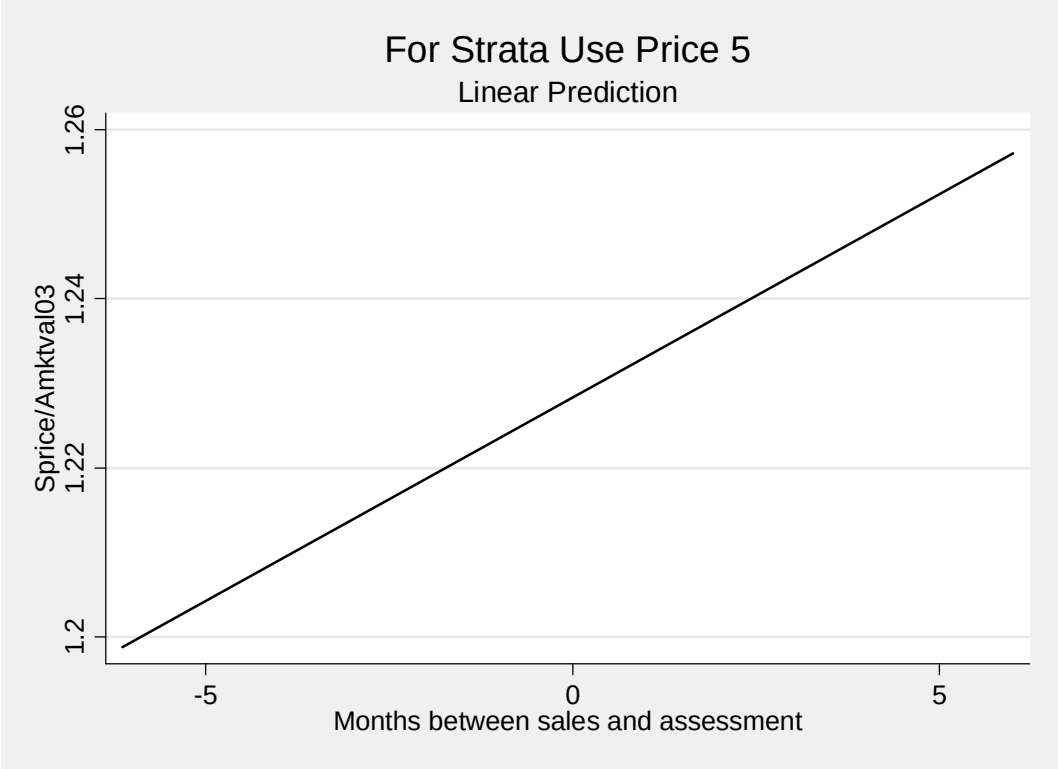

**Price Trend Regression Statistics**

| Source | SS | df | MS | Number of obs = | |
|---|---|---|---|---|---|
| Model | 1.34426884 | 1 | 1.34426884 | 2922 | R-squared = 0. 0250 |
| Residual | 52.3582551 | 2920 | .017930909 | F( 1, 2920) = 74.97 | Adj R-squared= 0. 0247 |
| Total | 53.7025239 | 2921 | .018384979 | Prob > F = 0. 0000 | Root MSE = .13391 |

| _aratio | Coef. | Std. Err. | t | P> t | [80% Conf. Interval] | |
|---|---|---|---|---|---|---|
| _adjperiod | .0057769 | .0006672 | 8.66 | 0.000 | .0049217 | .0066322 |
| _cons | 1.235114 | .0024869 | 496.64 | 0.000 | 1.231927 | 1.238302 |
| Monthly adjustment rate=.00467722 | | | | Annualized adjustment rate=.05612664 | | |

**Graph 5. Single Family Property Price Trend**

A thorough analysis of price-time trends by price strata determined that adjusting reported prices was desirable for the highest valued single family property stratum. The prices for this stratum ranged from $271,001 - $2,350,000. The resultant trend and statistical analysis is shown below.



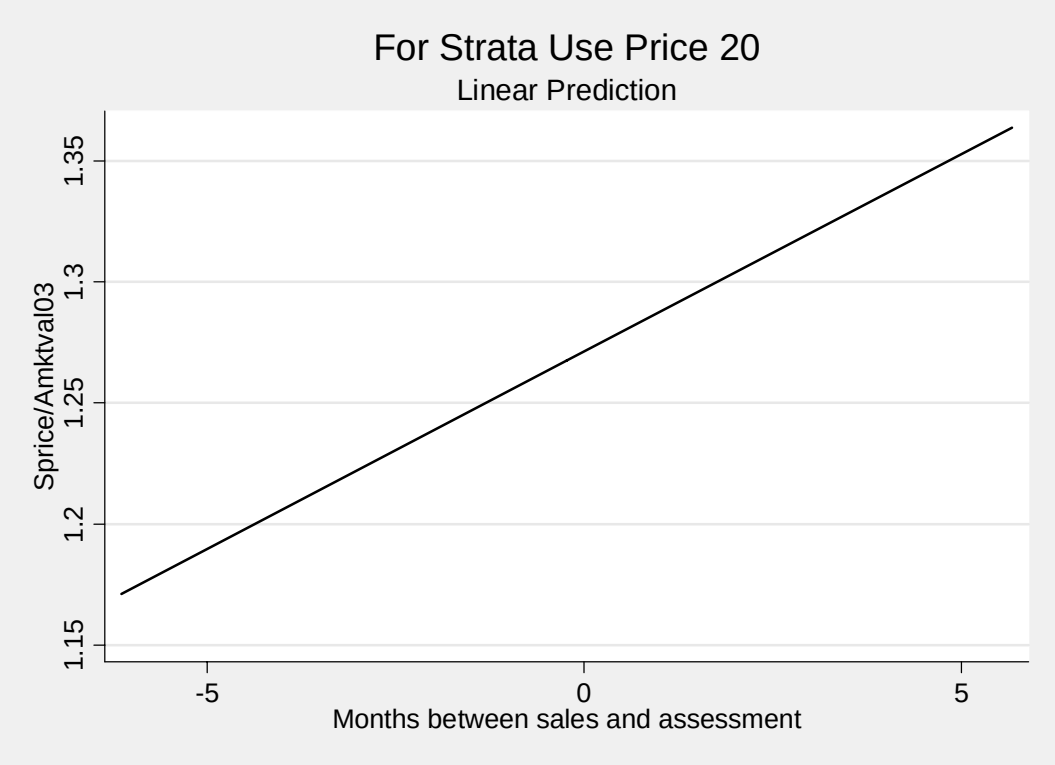

**Price Trend Regression Statistics**

| Source | SS | df | MS | | |
|---|---|---|---|---|---|
| Model | .770383839 | 1 | .770383839 | Number of obs = 2348 | R-squared = 0. 0125 |
| Residual | 60.7570463 | 2346 | .025898144 | F( 1, 2346) = 29.75 | Adj R-squared= 0. 0121 |
| Total | 61.5274301 | 2347 | .026215352 | Prob > F = 0.0000 | Root MSE = .16093 |

| _aratio | Coef. | Std. Err. | t | P> t | [80% Conf. Interval] | |
|---|---|---|---|---|---|---|
| _adjperiod | .0048147 | .0008828 | 5.45 | 0.000 | .0036831 | .0059464 |
| _cons | 1.22833 | .0033412 | 367.64 | 0.000 | 1.224047 | 1.232613 |
| Monthly adjustment rate=.00391971 | | | | Annualized adjustment rate=.04703652 | | |

**Graph 6. Multi-family Property Price Trend**

A thorough analysis of price-time trends by price strata determined that adjusting reported prices was desirable for multi-family properties. The prices of this stratum ranged from $41,900 - $15,650,000. The resultant trend and statistical analysis is shown below.




**Price Trend Regression Statistics**

| Source | SS | df | MS | | |
|---|---|---|---|---|---|
| Model | .810692201 | 1 | .810692201 | Number of obs = 259 | R-squared = 0.0389 |
| Residual | 20.0146202 | 257 | .0778779 | F( 1, 257) = 10.41 | Adj R-squared= 0.0352 |
| Total | 20.8253124 | 258 | .080718265 | Prob > F = 0.0014 | Root MSE = .27907 |

| _aratio | Coef. | Std. Err. | t | P> t | [80% Conf. Interval] | |
|---|---|---|---|---|---|---|
| _adjperiod | .016301 | .0050524 | 3.23 | 0.001 | .0098095 | .0227926 |
| _cons | 1.271214 | .0173613 | 73.22 | 0.000 | 1.248907 | 1.29352 |
| Monthly adjustment rate=.01282318 | | | | Annualized adjustment rate=.15387816 | | |

# Chapter 26. Warren County

## 1. Significant Findings

1.1 Assessment Level: Warren County's 2003 residential property assessments were approximately 73% of market value (Section 3.5). The results from the corresponding STC study are invalid because the STC's appraisals did not meet the requirement that they reflect market values (Section 4.3). Furthermore, the STC's sample is not representative of residential property for the county (Section 4.2).

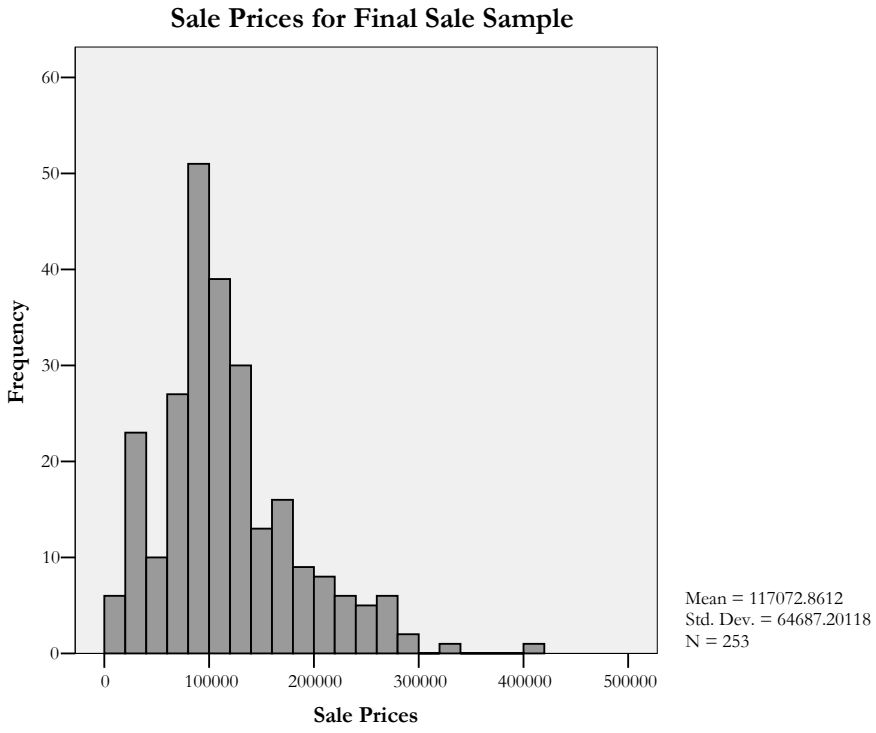
1.2 Assessment Equity: Lower-valued properties, older properties, and properties in certain locations in the county are assessed at lower levels than other strata (Section 3.6 and Tables 3, 5 & 6).

1.3 Reassessment History: Two indicators of market value changes suggest that three of the past four biennial reassessments have produced lower value increases than the market. Cumulatively, the reassessments from 1997 through 2003 produced only 41% of the expected rise in assessments. (Section 5.1).

## 2. Data and Related Issues

2.1 Assessment Data: Sales and assessment information were matched at the county offices. Subsequently, the assessor reviewed the matched parcels and provided further information that assisted our screening process.

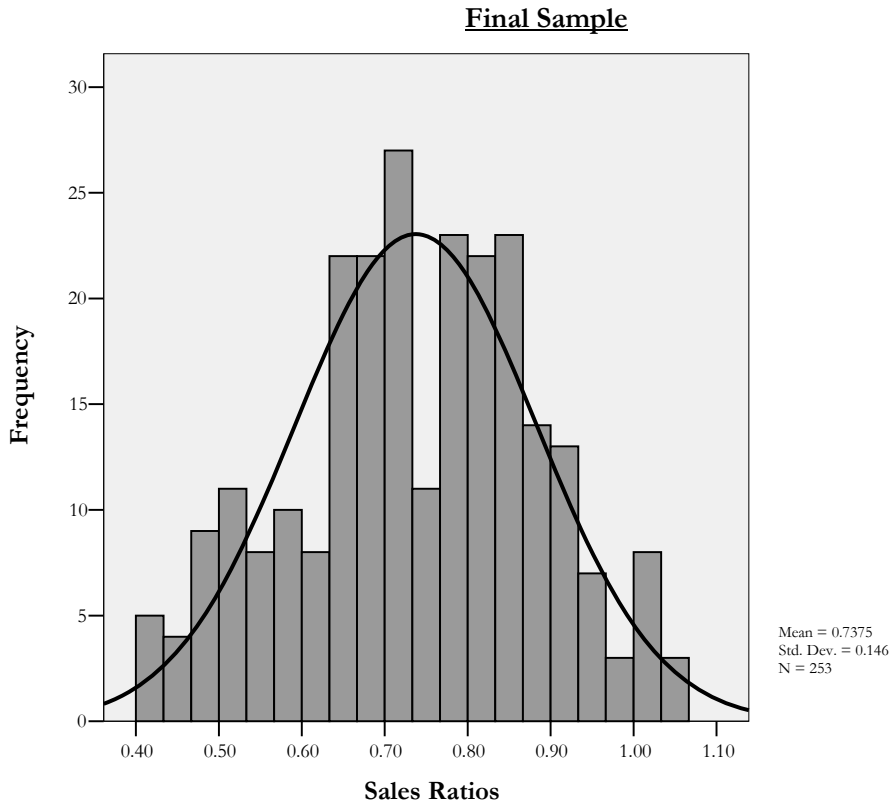
2.2 Sales and Ratio Data: The distribution of sale prices used is reflected in the following histogram.



The next table reports results of the data screening and trimming process. The "screened sales" represent the initial screened sample. The screened sales that were excluded from the final analysis because their ratios were deemed unrepresentative are identified as high or low trims. The "remaining ratios" represent the sample on which all the study's results are based.

| Trimming of Outliers | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Improved Properties <=$88,000 | Improved Properties >$58,000 & <=$78,500 | Improved Properties >$78,500 & <=$99,000 | Improved Properties >$99,000 & <=$125,000 | Improved Properties >$125,000 | Unimproved Properties | Total |
| **Screened Sales** | | 42 | 46 | 45 | 42 | 45 | 51 | 271 |
| Excluded | High Trims | 3 | 2 | 0 | 1 | 2 | 5 | 13 |
| | Low Trims | 1 | 1 | 1 | 1 | 0 | 1 | 5 |
| **Remaining Ratios** | | **38** | **43** | **44** | **40** | **43** | **45** | **253** |

The histogram below shows the distribution of the ratios for the sample.




2.3 Population: A copy of the assessment data in electronic form was unavailable, so we used the best available alternative as a pseudo-population (hereinafter, "the population"), i.e. four random samples that were drawn and used by the STC.

## 3. Ratio Study Results

3.1 The Sample: The following table shows that two of the improved property strata and the unimproved stratum vary from 4.2% to 5.8% from the population. Initially, this exhibits excessive variability from the sample to the population. Upon closer examination, this variation has a cumulative material effect on the overall assessment level and thus we conclude that the un-stratified sample is insufficiently representative of the population.

| Comparing Representivity | | | | | | |
|---|---|---|---|---|---|---|
| | Population Distribution | | | PPRC 2003 Sale Sample | | |
| Strata | N | $ | $ Weight | N | $ | $ Weight |
| Improved Properties <=$58,000 | 29 | 1,041,053 | 11.9% | 38 | 1,604,510 | 7.4% |
| Improved Properties >$58,000 & <=78,500 | 21 | 1,429,526 | 16.3% | 43 | 2,924,530 | 13.5% |
| Improved Properties >$78,500 & <=99,000 | 12 | 1,067,263 | 12.2% | 44 | 3,905,710 | 18.0% |
| Improved Properties >$99,000 & <=125,000 | 18 | 2,032,526 | 23.2% | 40 | 4,428,390 | 20.4% |
| Improved Properties >$125,000 | 17 | 2,809,263 | 32.1% | 43 | 6,957,890 | 32.1% |
| Unimproved Properties | 49 | 377,105 | 4.3% | 45 | 1,850,650 | 8.5% |
| Total | 146 | 8,756,737 | | 253 | 21,671,680 | |

3.2 Representing the Population with the Sample: Since the un-stratified sample is insufficiently representative of the population (Section 3.1), the use of stratification and weighting is essential. Furthermore, stratification provides additional analytical benefits.

3.3 Sales Chasing: There was no indication of sales chasing.

3.4 Study Validity: Once the sample has been stratified and weighted, all requirements for producing valid inferences about the county's population of residential properties are met.

3.5 Assessment Level: Measures of the assessment level are summarized below. For the purposes of this study, the weighted mean from combined stratification is the preferred measure as long as the both of the requirements from using the weighted mean are met. In this case, weighting is not compromised by the use of seriously undersized samples but the distributions are not sufficiently normal (Figure 3). Since both requirements are not met, we focus on the median, though taking notice of the weighted mean, to conclude that the County's assessments for 2003 reflect approximately 73% of market value.

| Assessment Level (Based on Percent of Market Value) | | | | |
|---|---|---|---|---|
| | Stratification and Weighting | Reference | Weighted Mean | Median |
| **Overall Un-weighted** | None | Table 3 | 73.2% | 74.0% |
| **Combined** | By Property Use and Value Range | Table 4 | 71.5% | 72.9% |

3.6 Equity Measures and Evaluation:

i. Uniformity within Strata: Results from Tables 2, 3, 5 & 6 for the strata with sufficient sample size for individual evaluation indicate no problem areas for internal uniformity.

ii. Uniformity between Strata: Another form of inequity exists when different strata are assessed at different levels. The IAAO has established guidelines for identifying such inequity, but compliance can be heavily affected by sample size and uniformity. Therefore, we confine our remarks to identifying where assessment levels differ markedly from the norm. The difference in assessment level (medians) between the lower and higher valued improved property strata (53% versus 71-86% respectively, Table 3), that properties in the Warrenton R3 & Washington areas are assessed higher than Wright City and other areas of the county (77% versus 68-70% respectively, Table 5), and the difference in assessment level between older properties and newer (65% versus 81% respectively, Table 6) is notable.

iii. Vertical Equity: The final form of potential inequity examined is vertical equity. The PRD for the overall sample of 1.008 complies with the IAAO standard.

## 4. STC Study

4.1 Comparative Results: The following table contrasts our results with those from the STC study. The STC found the level of assessment adequate, while ours does not. The STC reports a similarly acceptable measure for horizontal equity, however it also reports a substandard measure for vertical equity, while our analysis finds otherwise. We have already demonstrated that the PPRC study meets the criteria for achieving valid results. The rest of Section 4 examines the validity of the STC's study.

| Comparison of Study Results | | | |
|---|---|---|---|
| **Measure** | **STC Study*** | **PPRC Study*** | **PPRC Study Combined**** |
| Assessment Level - median | 97.2% | 74.0% | 72.9% |
| Assessment Level - weighted mean | 96.5% | 73.2% | 71.5% |
| COD | 14.6% | 16.1% | |
| PRD | 1.07 | 1.01 | |
| Sample Size | 35 | 253 | |
| Relative Precision | 1.00 | 2.69 | |
| * Overall sample (un-stratified and un-weighted) | | | |
| ** Stratification and weighting by Property Use and Value Range | | | |

4.2 Representing the Population with the Sample: The STC does not examine the representivity of its sample, nor does it have the necessary sample size or information to do so. Therefore, in the following table, we provide that missing analysis. In this case, the table shows that the four highest improved value strata vary from 4.2% to 8.6%. Initially, this exhibits excessive variability from the sample to the population. Upon closer examination, this variation has a cumulative material effect on the overall assessment level and thus we conclude that the STC sample is insufficiently representative of the population.

| Comparing Representivity | | | | | | |
|---|---|---|---|---|---|---|
| | Population | | | STC 2003 Appraisals | | |
| Strata | N | $ | % | N | $ | % |
| Improved Properties <=$58,000 | 29 | 1,041,053 | 11.9% | 8 | 309,053 | 13.4% |
| Improved Properties >$58,000 & <=78,500 | 21 | 1,429,526 | 16.3% | 8 | 550,789 | 23.8% |
| Improved Properties >$78,500 & <=99,000 | 12 | 1,067,263 | 12.2% | 2 | 168,737 | 7.3% |
| Improved Properties >$99,000 & <=125,000 | 18 | 2,032,526 | 23.2% | 3 | 336,789 | 14.6% |
| Improved Properties >$125,000 | 17 | 2,809,263 | 32.1% | 5 | 839,053 | 36.3% |
| Unimproved Properties | 49 | 377,105 | 4.3% | 9 | 105,000 | 4.5% |
| Total | 146 | 8,756,737 | | 35 | 2,309,421 | |

4.3 Market Value: The final requirement for producing a valid appraisal study is that appraisals must represent market values. As discussed in the introduction for this Section II, and in greater depth in the Procedure Manual (Section III), we use 4 tests to make this determination. The results of each test are reported in the following tables.

| Mann-Whitney Test | | | | |
|---|---|---|---|---|
| For the Entire Sample | | | | |
| Study | Observations | Rank sum | Expected | Ho: Ratios (35 STC Appraisals)=Ratios (253 Sales)<br>z = 7.771<br>Prob > \|z\| = 0.0000 |
| 0 | 35 | 8646 | 5057.5 | |
| 1 | 253 | 32970 | 36558.5 | |
| Combined | 288 | 41616 | 41616 | |
| For Single Family Properties Only | | | | |
| Study | Observations | Rank sum | Expected | Ho : Ratios (26 STC Appraisals)=Ratios (205 Sales)<br>z = 7.006<br>Prob > \|z\| = 0.0000 |
| 0 | 26 | 5265 | 3016 | |
| 1 | 205 | 21531 | 23780 | |
| Combined | 231 | 26796 | 26796 | |

| K-Sample Test | | | | |
|---|---|---|---|---|
| For the Entire Sample | | | | |
| Study | Not Greater than the median | Greater than the median | Total | Ho: Ratios (35 STC Appraisals)=Ratios (253 Sales)<br>Pearson chi2(1) = 35.4186 Pr = 0.000<br>Continuity corrected:<br>Pearson chi2(1) = 33.3046 Pr = 0.000 |
| 0 | 1 | 34 | 35 | |
| 1 | 143 | 110 | 253 | |
| Total | 144 | 144 | 288 | |
| For Single Family Properties Only | | | | |
| Study | Not Greater than the median | Greater than the median | Total | Ho: Ratios (26 STC Appraisals)=Ratios (205 Sales)<br>Pearson chi2(1) = 25.1988 Pr = 0.000<br>Continuity corrected:<br>Pearson chi2(1) = 23.1520 Pr = 0.000 |
| 0 | 1 | 25 | 26 | |
| 1 | 115 | 90 | 205 | |
| Total | 116 | 115 | 231 | |

All four tests lead to the conclusion that the STC appraisals do not represent market values (all with 99% statistical confidence). Therefore, the STC study is invalid and its reported results are unreliable.

## 5. Additional Analysis and Findings

5.1 Analysis of Reassessment History: The following table provides a comparison of actual assessment changes (net of new construction) to those that might have been expected for each of the last four reassessments as well as the six-year period leading up to 2003. Only one of the reassessments produced changes somewhat in line with the market indicator.

| Actual Value Changes from Reassessment vs. Expected Value Change | | | | | |
|---|---|---|---|---|---|
| Biennial Year | % Net Assessment Change | Missouri OFHEO Index | % Value Change: Actual vs. Expected | St. Louis MSA OFHEO Index | % Value Change: Actual vs. Expected |
| 1999 | 3.3 | 8.4 | 39% | 9.6 | 34% |
| 2001 | 5.3 | 11.4 | 47% | 13.5 | 39% |
| 2003 | 5.1 | 11.8 | 43% | 12.9 | 39% |
| 2005 | 11.9 | 12.4 | 96% | 16.8 | 71% |
| Cumulative 1997 - 2003 | 14.3 | 35.0 | 41% | 40.4 | 35% |

## 6. Figures and Tables

**Table 1. STC's Appraisal Ratio Studies**

| | | Group | | | |
|---|---|---|---|---|---|
| | | 1999 | 2001 | 2003 | 2005* |
| Number of Appraisals | | 37 | 39 | 35 | 35 |
| Median | | 1.014 | .998 | .972 | 1.006 |
| 95% Confidence Interval for Median | Lower Bound | 1.000 | .948 | .949 | .920 |
| | Upper Bound | 1.058 | 1.036 | 1.004 | 1.047 |
| Weighted Mean | | .967 | .985 | .965 | .972 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .910 | .955 | .928 | .922 |
| | Upper Bound | 1.024 | 1.014 | 1.002 | 1.022 |
| Minimum | | .487 | .585 | .701 | .719 |
| Maximum | | 1.913 | 2.667 | 2.168 | 1.714 |
| Std. Deviation | | .205 | .301 | .269 | .201 |
| Price Related Differential | | 1.071 | 1.030 | 1.074 | 1.057 |
| Coefficient of Dispersion | | .116 | .134 | .146 | .127 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 64.9% | 66.7% | 57.1% | 60.0% |
| *The STC has not completed its studies for the 2005 reassessment cycle. These results may not represent final values. | | | | | |

**Figure 1. Ratios before Outlier Trimming**

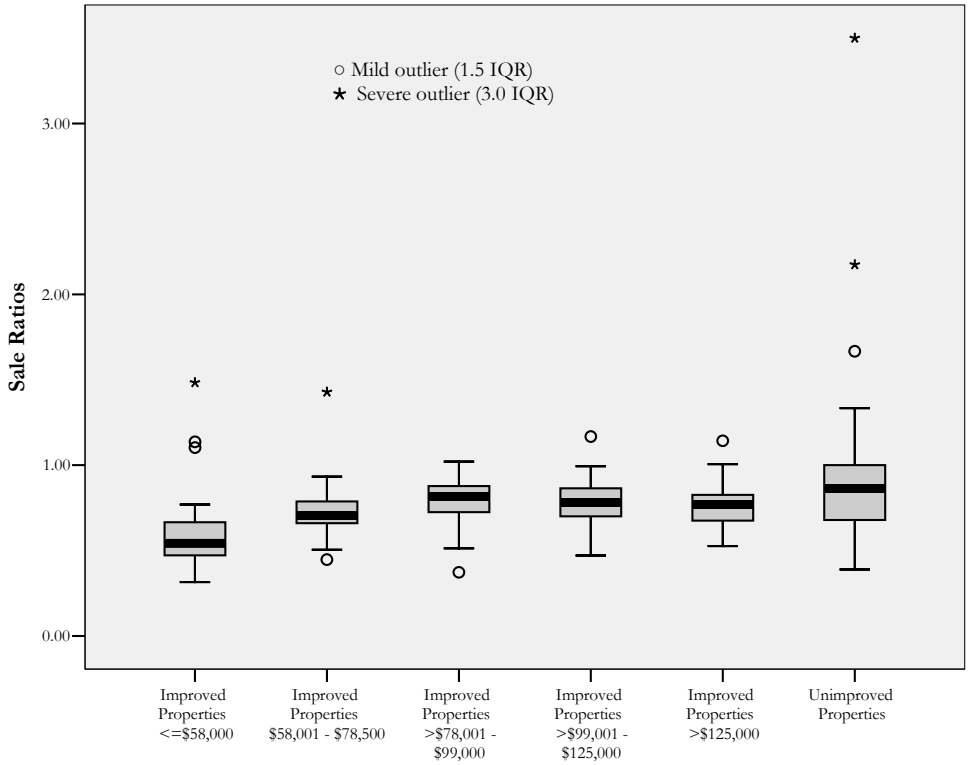
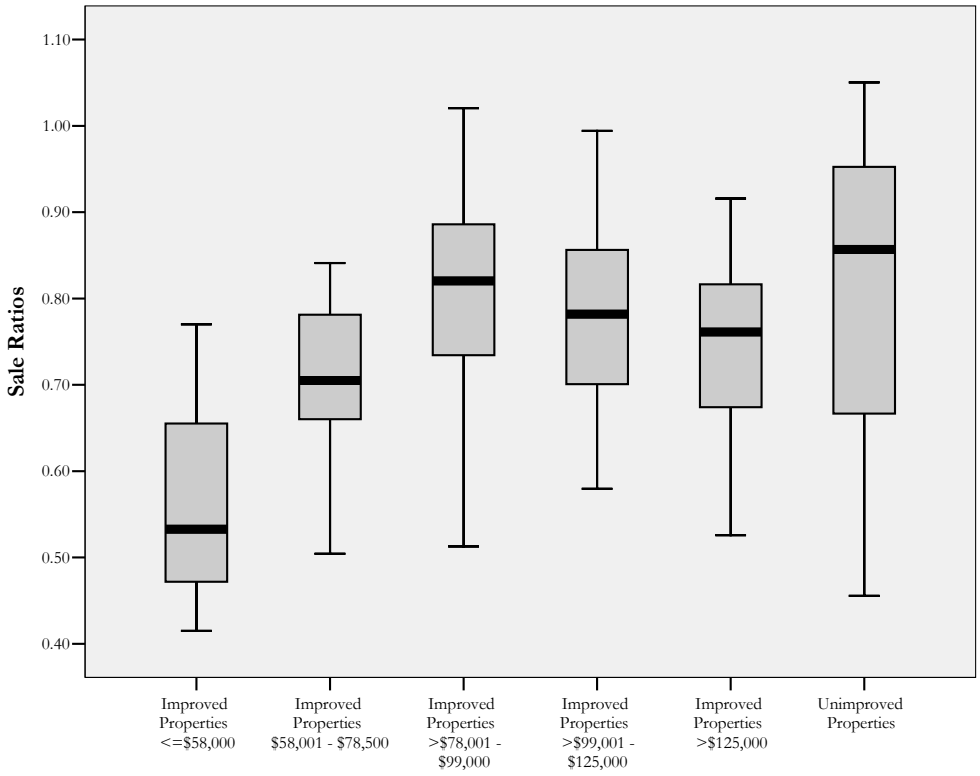
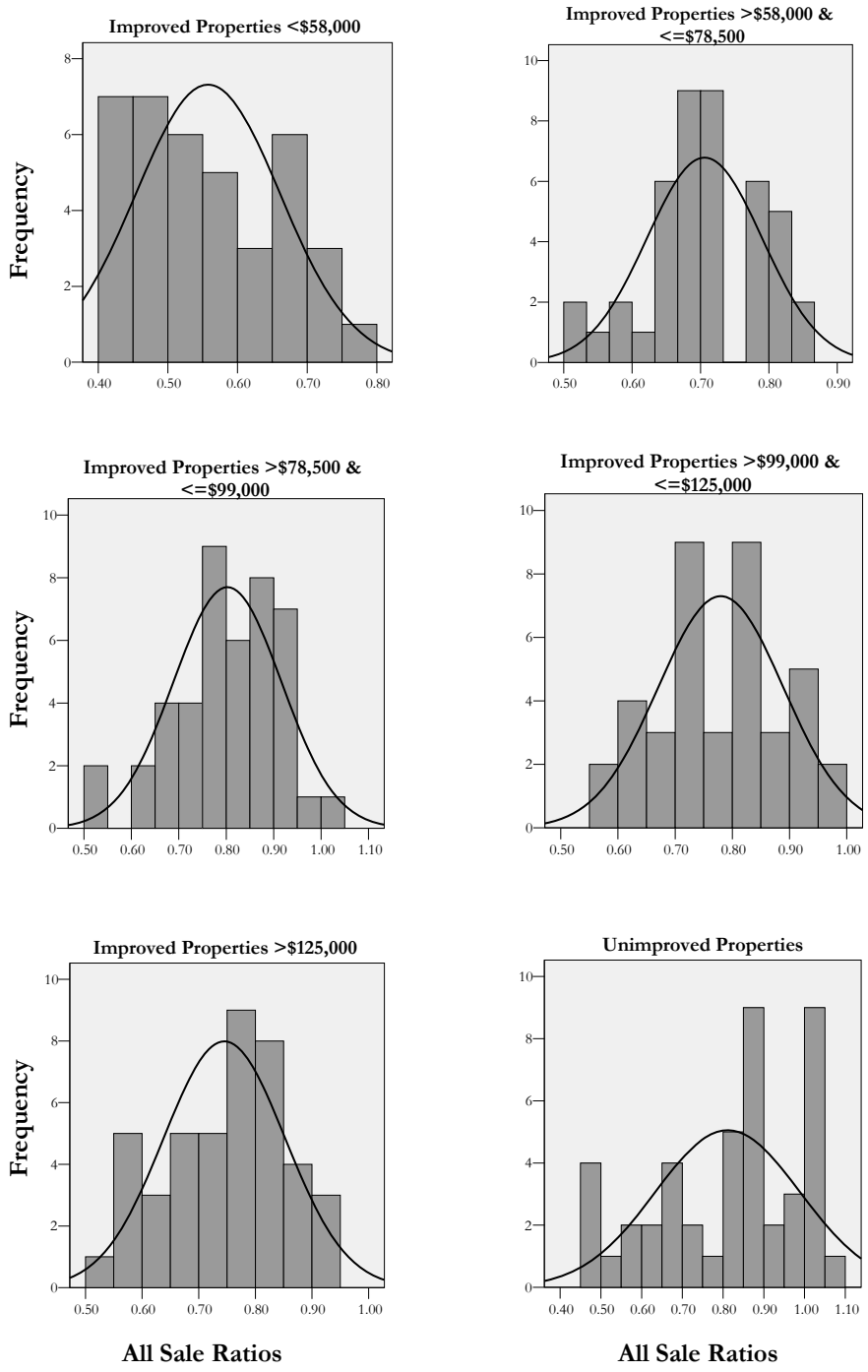



**Figure 2. Ratios after Outlier Trimming**



## Figure 3. Distribution of Final Sale Ratios



## Figure 3 (cont.). Distribution of Final Sale Ratios

**Shapiro-Francia W' Tests for Normality for Various Strata**

| Strata | Observations | W' | V' | z | Prob* |
|---|---|---|---|---|---|
| Single Family | 205 | 0.98707 | 2.125 | 1.589 | 0.05602 |
| Unimproved Properties | 45 | 0.93571 | 3.071 | 2.099 | 0.01790 |
| Multi-family | 3 | . | . | . | . |
| Improved Properties | 208 | 0.98673 | 2.208 | 1.670 | 0.04744 |
| Improved Properties <=$58,000 | 38 | 0.95213 | 2.008 | 1.302 | 0.09648 |
| Improved Properties >$58,000 & <=$78,500 | 43 | 0.96752 | 1.498 | 0.767 | 0.22146 |
| Improved Properties >$78,500 & <=$99,000 | 44 | 0.97318 | 1.259 | 0.440 | 0.32984 |
| Improved Properties >$99,000 & <=$125,000 | 40 | 0.98422 | 0.689 | -0.717 | 0.76336 |
| Improved Properties >$125,000 | 43 | 0.96916 | 1.422 | 0.670 | 0.25147 |
| Overall Un-weighted | 253 | 0.99000 | 1.968 | 1.448 | 0.07386 |
| *This value represents the indicated probability that the underlying population is normally distributed. A value of less than .05 indicates a distribution that is not normal. | | | | | |

## Table 2. Sales Ratio Analysis: Stratified by Property Use

| | | Strata | | | |
|---|---|---|---|---|---|
| | | Single Family | Unimproved Properties | Multi-family | Overall Un-weighted |
| Number of Sales | | 205 | 45 | 3 | 253 |
| Median | | .725 | .857 | .799 | .740 |
| 95% Confidence Interval for Median | Lower Bound | .701 | .768 | .728 | .715 |
| | Upper Bound | .755 | .887 | .801 | .772 |
| Weighted Mean | | .724 | .819 | .780 | .732 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .707 | .762 | .690 | .715 |
| | Upper Bound | .741 | .877 | .871 | .748 |
| Minimum | | .415 | .456 | .728 | .415 |
| Maximum | | 1.021 | 1.050 | .801 | 1.050 |
| Std. Deviation | | .134 | .178 | .041 | .146 |
| Price Related Differential | | .996 | .990 | .994 | 1.008 |
| Coefficient of Dispersion | | .150 | .164 | .030 | .161 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 9.3% | 33.3% | .0% | 13.4% |

## Table 3. Sales Ratio Analysis: Stratified by Use and Value

| | | Strata | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Improved Properties <=$58,000 | Improved Properties $58,001 - $78,500 | Improved Properties $78,501 - $99,000 | Improved Properties $99,001 - $125,000 | Improved Properties >$125,000 | Un-improved Property | Overall Un-weighted |
| Number of Sales | | 38 | 43 | 44 | 40 | 43 | 44 | 253 |
| Median | | .533 | .705 | .820 | .782 | .761 | .857 | .740 |
| 95% Confidence Interval for Median | Lower Bound | .493 | .668 | .769 | .721 | .701 | .768 | .715 |
| | Upper Bound | .632 | .733 | .857 | .834 | .807 | .887 | .772 |
| Weighted Mean | | .555 | .697 | .785 | .764 | .732 | .819 | .732 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .521 | .669 | .746 | .728 | .700 | .762 | .715 |
| | Upper Bound | .590 | .725 | .824 | .800 | .765 | .877 | .748 |
| Minimum | | .415 | .504 | .513 | .580 | .526 | .456 | .415 |
| Maximum | | .770 | .841 | 1.021 | .994 | .916 | 1.050 | 1.050 |
| Std. Deviation | | .104 | .084 | .114 | .109 | .107 | .178 | .146 |
| Price Related Differential | | 1.004 | 1.013 | 1.023 | 1.020 | 1.018 | .990 | 1.008 |
| Coefficient of Dispersion | | .165 | .094 | .110 | .117 | .114 | .164 | .161 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | .0% | .0% | 20.5% | 17.5% | 7.0% | 33.3% | 13.4% |

## Table 4. Combined Results – Post Stratification and Weighting

| | Population Assessor's Value | Median | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Improved Properties <=$58,000 | 1,041,053 | 0.533 | 1,953,195 | 16.3% | 0.087 |
| Improved Properties >$58,000 & <=78,500 | 1,429,526 | 0.705 | 2,027,696 | 16.9% | 0.119 |
| Improved Properties >$78,500 & <=99,000 | 1,067,263 | 0.82 | 1,301,540 | 10.8% | 0.089 |
| Improved Properties >$99,000 & <=125,000 | 2,032,526 | 0.782 | 2,599,138 | 21.6% | 0.169 |
| Improved Properties >$125,000 | 2,809,263 | 0.761 | 3,691,541 | 30.7% | 0.234 |
| Unimproved Properties | 377,105 | 0.857 | 440,029 | 3.7% | 0.031 |
| Total | 8,756,737 | | 12,013,140 | 100.0% | 72.9% |

| | Population Assessor's Value | Weighted Mean | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Improved Properties <=$58,000 | 1,041,053 | 0.555 | 1,875,771 | 15.3% | 0.085 |
| Improved Properties >$58,000 & <=78,500 | 1,429,526 | 0.697 | 2,050,970 | 16.7% | 0.117 |
| Improved Properties >$78,500 & <=99,000 | 1,067,263 | 0.785 | 1,359,571 | 11.1% | 0.087 |
| Improved Properties >$99,000 & <=125,000 | 2,032,526 | 0.764 | 2,660,374 | 21.7% | 0.166 |
| Improved Properties >$125,000 | 2,809,263 | 0.732 | 3,837,791 | 31.3% | 0.229 |
| Unimproved Properties | 377,105 | 0.819 | 460,446 | 3.8% | 0.031 |
| Total | 8,756,737 | | 12,244,923 | 100.0% | 71.5% |

## Table 5. Sales Ratio Analysis: Stratified by Location

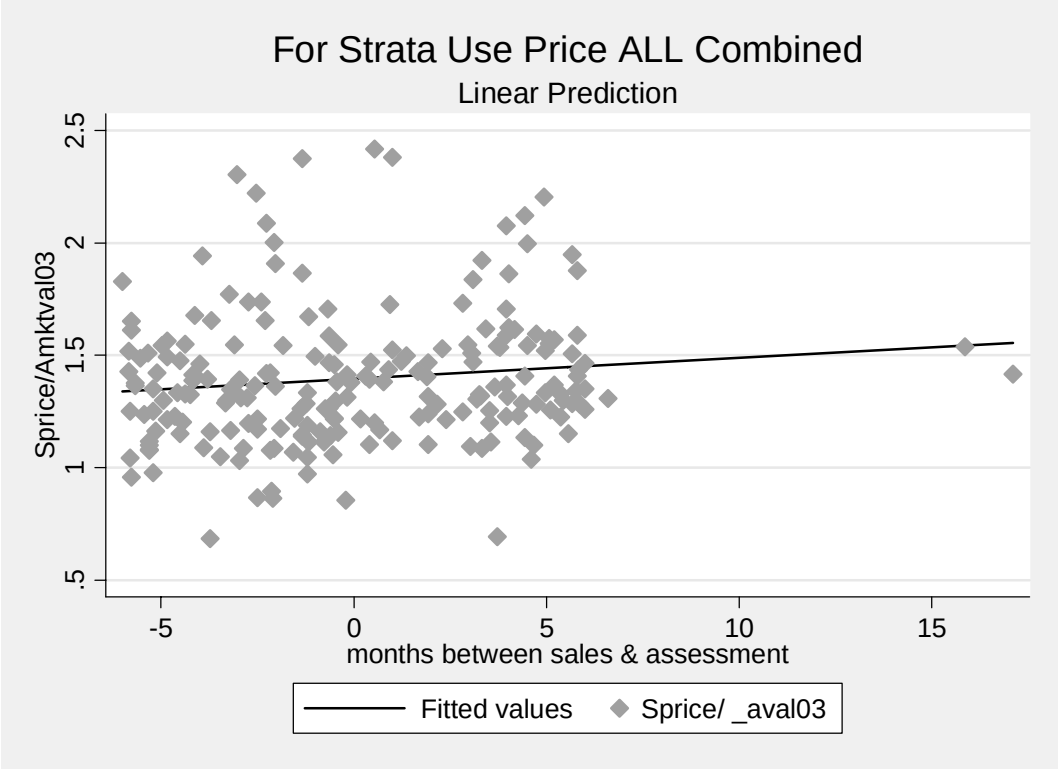
| | | Strata | | | | |
|---|---|---|---|---|---|---|
| | | Warrenton R-3 | Wright City R-2 | Washington | All Other School Districts | Overall Un-weighted |
| Number of Sales | | 141 | 72 | 36 | 4 | 253 |
| Median | | .775 | .698 | .771 | .677 | .740 |
| 95% Confidence Interval for Median | Lower Bound | .724 | .658 | .680 | .590 | .715 |
| | Upper Bound | .814 | .733 | .801 | .826 | .772 |
| Weighted Mean | | .757 | .706 | .707 | .711 | .732 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .735 | .677 | .661 | .546 | .715 |
| | Upper Bound | .780 | .735 | .754 | .876 | .748 |
| Minimum | | .415 | .423 | .503 | .590 | .415 |
| Maximum | | 1.050 | 1.021 | 1.000 | .826 | 1.050 |
| Std. Deviation | | .154 | .139 | .112 | .098 | .146 |
| Price Related Differential | | 1.003 | .985 | 1.046 | .974 | 1.008 |
| Coefficient of Dispersion | | .163 | .160 | .115 | .097 | .161 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 19.9% | 5.6% | 5.6% | .0% | 13.4% |

## Table 6. Sales Ratio Analysis: Stratified by Age

| | | Strata | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Unimproved Properties | Built before 1975 | Built 1975 through 1985 | Built 1985 through 1991 | Built 1991 through 1997 | Built 1998 and newer | Overall Un-weighted |
| Number of Sales | | 32 | 31 | 43 | 32 | 38 | 31 | 207 |
| Median | | .860 | .655 | .676 | .723 | .777 | .805 | .727 |
| 95% Confidence Interval for Median | Lower Bound | .727 | .632 | .639 | .674 | .724 | .755 | .705 |
| | Upper Bound | .952 | .694 | .721 | .771 | .813 | .837 | .769 |
| Weighted Mean | | .811 | .675 | .677 | .713 | .742 | .773 | .727 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .738 | .628 | .640 | .672 | .703 | .736 | .709 |
| | Upper Bound | .884 | .721 | .714 | .754 | .781 | .809 | .744 |
| Minimum | | .456 | .453 | .415 | .417 | .495 | .582 | .415 |
| Maximum | | 1.047 | 1.021 | .908 | .943 | .943 | .952 | 1.047 |
| Std. Deviation | | .191 | .132 | .115 | .133 | .117 | .097 | .142 |
| Price Related Differential | | 1.000 | .994 | 1.002 | .995 | 1.025 | 1.021 | 1.010 |
| Coefficient of Dispersion | | .177 | .142 | .132 | .135 | .120 | .093 | .158 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 40.6% | 6.5% | 4.7% | 6.3% | 10.5% | 16.1% | 13.5% |

**Graph 1. Improved Property Price Trend**

A thorough analysis of price-time trends by price strata determined that adjusting reported prices was desirable for all improved properties combined. The prices for these strata ranged from $10,000 - $401,000. The resultant trend and statistical analysis is shown below.




**Price Trend Regression Statistics**

| Source | SS | df | MS | | |
|---|---|---|---|---|---|
| Model | .29664498 | 1 | .29664498 | Number of obs = 208 | R-squared = 0. 0161 |
| Residual | 18.1150934 | 206 | .087937346 | F( 1, 206) = 3.37 | Adj R-squared= 0. 0113 |
| Total | 18.4117383 | 207 | .088945596 | Prob > F = 0. 0677 | Root MSE = .29654 |

| _aratio | Coef. | Std. Err. | t | P> t | [80% Conf. Interval] | |
|---|---|---|---|---|---|---|
| _adjperiod | .0094189 | .0051282 | 1.84 | 0.068 | .0028257 | .0160122 |
| _cons | 1.394527 | .0205642 | 67.81 | 0.000 | 1.368088 | 1.420966 |

Monthly adjustment rate=.00675419 | Annualized adjustment rate=.08105028

# Chapter 27. Washington County

## 1. Significant Findings

1.1 Assessment Level: Washington County's 2003 residential property assessments were approximately 57% of market value (Section 3.5). The results from the corresponding STC study are invalid because the STC's appraisals did not meet the requirement that they reflect market values (Section 4.3).

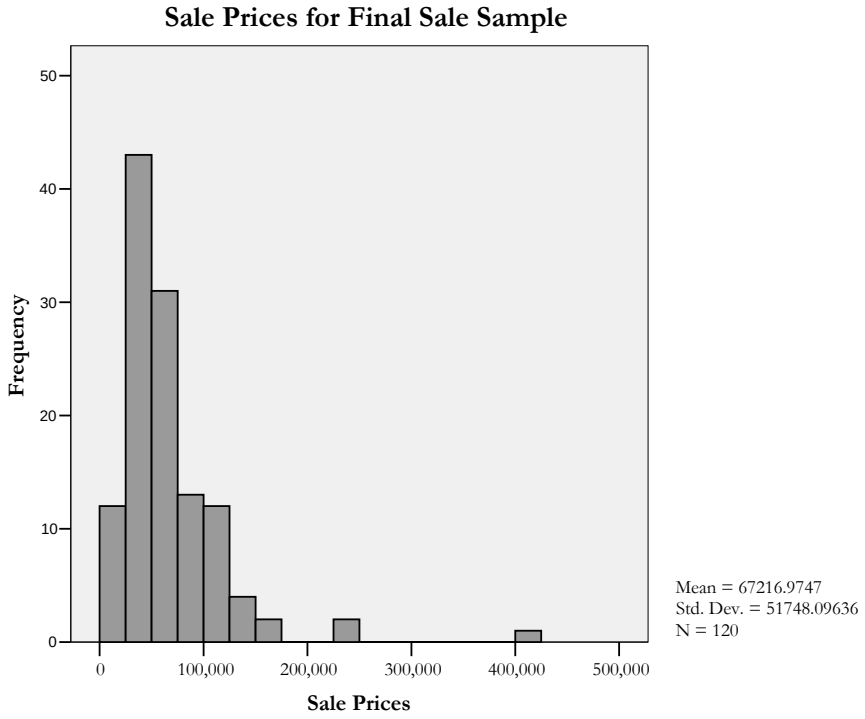
1.2 Assessment Equity: Lower-valued properties are assessed at a lower level than higher-valued properties (Section 3.6 and Table 3).

1.3 Reassessment History: One indicator of market value changes suggests that three of the past four biennial reassessments have produced lower value increases than the market. Cumulatively, the reassessments from 1997 through 2003 produced -5% of the expected rise in assessments. The net change in assessments in 1999, 2001, and 2003 raises questions regarding whether any serious revaluation occurred. Improvement in 2005 is clear (Section 5.1).

## 2. Data and Related Issues

2.1 Assessment Data: Sales and assessment information were matched at the county offices. Subsequently, the assessor reviewed the matched parcels and provided further information that assisted our screening process.

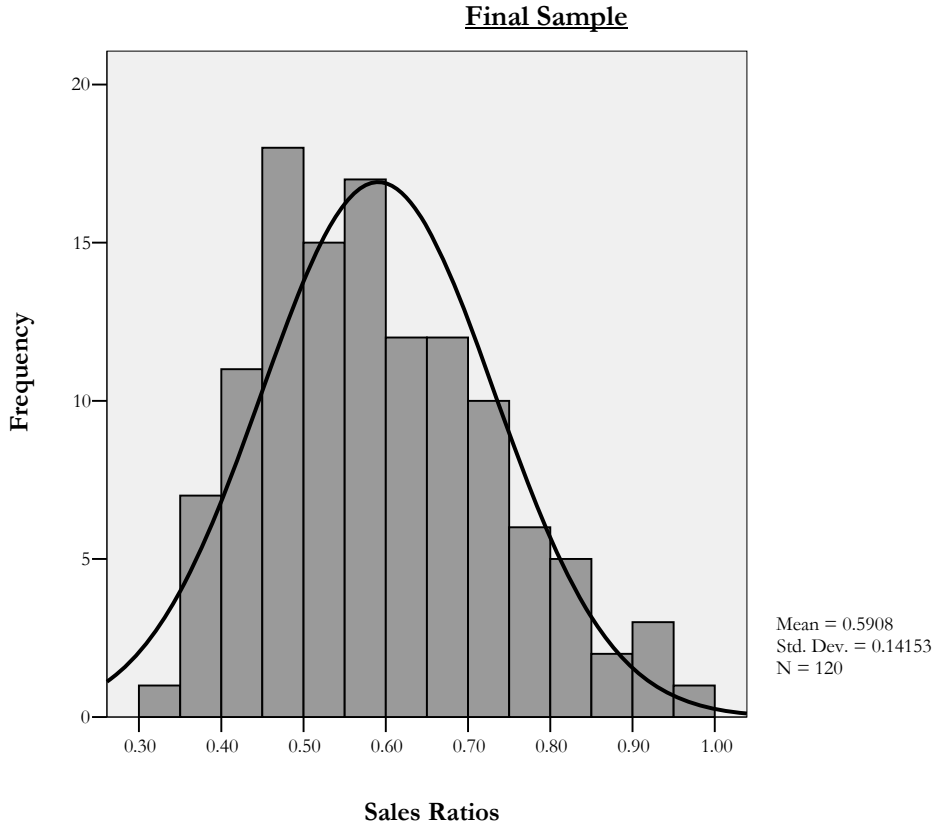
2.2 Sales and Ratio Data: The distribution of sale prices used is reflected in the following histogram.



The next table reports results of the data screening and trimming process. The "screened sales" represent the initial screened sample. The screened sales that were excluded from the final analysis because their ratios were deemed unrepresentative are identified as high or low trims. The "remaining ratios" represent the sample on which all the study's results are based.

| Trimming of Outliers | | | | | | |
|---|---|---|---|---|---|---|
| | | Improved Properties <=$25,000 | Improved Properties >$25,000 & <=$45,000 | Improved Properties >$45,000 | Unimproved Properties | Total |
| **Screened Sales** | | 41 | 46 | 40 | 10 | 137 |
| Excluded | High Trims | 4 | 3 | 6 | 1 | 14 |
| | Low Trims | 2 | 1 | 0 | 0 | 3 |
| **Remaining Ratios** | | **35** | **42** | **34** | **9** | **120** |

The histogram below shows the distribution of the ratios for the sample.




2.3 Population: A copy of the assessment data in electronic form was unavailable, so we used the best available alternative as a pseudo-population (hereinafter, "the population"), i.e. four random samples that were drawn and used by the STC.

## 3. Ratio Study Results

3.1 The Sample: The following table shows that the two highest improved value strata and the unimproved stratum vary from 3.6% to 10.1%. Initially, this exhibits excessive variability from the sample to the population. Upon closer examination, this variation has no material effect on the

overall assessment level and thus we conclude that the un-stratified sample is sufficiently representative of the population.

| Comparing Representivity | | | | | | |
|---|---|---|---|---|---|---|
| | Population Distribution | | | PPRC 2003 Sale Sample | | |
| **Strata** | **N** | **$** | **$ Weight** | **N** | **$** | **$ Weight** |
| Improved Properties <=$25,000 | 37 | 432,316 | 14.5% | 35 | 695,063 | 15.1% |
| Improved Properties >$25,000 & <=$45,000 | 20 | 643,332 | 21.6% | 42 | 1,457,789 | 31.7% |
| Improved Properties >$45,000 | 20 | 1,767,589 | 59.3% | 34 | 2,393,195 | 52.1% |
| Unimproved Properties | 72 | 138,695 | 4.7% | 9 | 49,347 | 1.1% |
| Total | 149 | 2,981,932 | | 120 | 4,595,395 | |

3.2 Representing the Population with the Sample: Since the un-stratified sample is sufficiently representative of the population (Section 3.1), the use of stratification and weighting is not essential. Nevertheless, we used stratification because it produces additional analytical benefits and further optimizes representivity.

3.3 Sales Chasing: There was no indication of sales chasing.

3.4 Study Validity: The sample meets the requirements for producing valid inferences about the county's population of residential properties.

3.5 Assessment Level: Measures of the assessment level are summarized below. For the purposes of this study, the weighted mean from combined stratification is the preferred measure as long as both of the requirements from using the weighted mean are met. In this case, the distributions are not normal (Figure 3) and weighting is compromised by the use of seriously undersized samples. Since both requirements are not met, we focus on the median, though taking notice of the weighted mean, to conclude that the County's assessments for 2003 reflect approximately 57% of market value.

| Assessment Level (Based on Percent of Market Value) | | | | |
|---|---|---|---|---|
| | Stratification and Weighting | Reference | Weighted Mean | Median |
| **Overall Un-weighted** | None | Table 3 | 57.0% | 57.3% |
| **Combined** | By Property Use and Value Range | Table 4 | 57.2% | 57.2% |

3.6 Equity Measures and Evaluation:

i. Uniformity within Strata: Results from Tables 2, 3, 5 & 6 for the strata with sufficient sample size for individual evaluation indicate no problem areas for internal uniformity.

ii. Uniformity between Strata: Another form of inequity exists when different strata are assessed at different levels. The IAAO has established guidelines for identifying such inequity, but compliance can be heavily affected by sample size and uniformity. Therefore, we confine our remarks to identifying where assessment levels differ markedly from the norm. The difference in assessment level (medians) between the lowest and the higher valued improved property strata (49% versus 59% and 60% respectively, Table 3) is substantial.

iii. Vertical Equity: The final form of potential inequity examined is vertical equity. The PRD for the overall sample of 1.037 is slightly regressive according to the IAAO standard (Table 2).

## 4. STC Study

4.1 Comparative Results: The following table contrasts our results with those from the STC study. The STC found the level of assessment adequate, while ours does not. The STC reports substandard measures for horizontal and vertical equity, while our analysis finds an acceptable horizontal measure and only a slightly substandard vertical equity measure. We have already demonstrated that the PPRC study meets the criteria for achieving valid results. The rest of Section 4 examines the validity of the STC's study.

| Comparison of Study Results | | | |
|---|---|---|---|
| **Measure** | **STC Study*** | **PPRC Study*** | **PPRC Study Combined**** |
| Assessment Level - median | 96.7% | 57.3% | 57.2% |
| Assessment Level - weighted mean | 89.0% | 57.0% | 57.2% |
| COD | 28.3% | 20.0% | |
| PRD | 1.09 | 1.04 | |
| Sample Size | 34 | 120 | |
| Relative Precision | 1.00 | 1.88 | |
| * Overall sample (un-stratified and un-weighted) | | | |
| ** Stratification and weighting by Property Use and Value Range | | | |

4.2 Representing the Population with the Sample: The STC does not examine the representivity of its sample, nor does it have the necessary sample size or information to do so. Therefore, in the following table, we provide that missing analysis. In this case, the table shows that the lowest and highest improved value strata in the STC sample vary from 6.9% to 9.6%. Initially, this exhibits excessive variability from the sample to the population. However, upon closer examination, this variation has no material effect and thus we conclude that the STC sample is sufficiently representative of the population.

| Comparing Representivity | | | | | | |
|---|---|---|---|---|---|---|
| | **Population** | | | **STC 2003 Appraisals** | | |
| **Strata** | **N** | **$** | **%** | **N** | **$** | **%** |
| Improved Properties <=$25,000 | 37 | 432,316 | 14.5% | 11 | 108,211 | 21.4% |
| Improved Properties >$25,000 & <=$45,000 | 20 | 643,332 | 21.6% | 4 | 120,211 | 23.8% |
| Improved Properties >$45,000 | 20 | 1,767,589 | 59.3% | 4 | 251,632 | 49.7% |
| Unimproved Properties | 72 | 138,695 | 4.7% | 15 | 25,842 | 5.1% |
| Total | 149 | 2,981,932 | | 34 | 505,895 | |

4.3 Market Value: The final requirement for producing a valid appraisal study is that appraisals must represent market values. As discussed in the introduction for this Section II, and in greater depth in the Procedure Manual (Section III), we use 4 tests to make this determination. The results of each test are reported in the following tables.

| Mann-Whitney Test | | | | |
|---|---|---|---|---|
| For the Entire Sample | | | | |
| Study | Observations | Rank sum | Expected | Ho: Ratios (34 STC Appraisals)=Ratios (120 Sales)<br>z = 5.828<br>Prob > \|z\| = 0.0000 |
| 0 | 34 | 3973 | 2635 | |
| 1 | 120 | 7962 | 9300 | |
| Combined | 154 | 11935 | 11935 | |
| For Single Family Properties Only | | | | |
| Study | Observations | Rank sum | Expected | Ho : Ratios (19 STC Appraisals)=Ratios (108 Sales)<br>z = 5.252<br>Prob > \|z\| = 0.0000 |
| 0 | 19 | 1993 | 1216 | |
| 1 | 108 | 6135 | 6912 | |
| Combined | 127 | 8128 | 8128 | |

| K-Sample Test | | | | |
|---|---|---|---|---|
| For the Entire Sample | | | | |
| Study | Not Greater than the median | Greater than the median | Total | Ho: Ratios (34 STC Appraisals)=Ratios (120 Sales)<br>Pearson chi2(1) = 18.2686 Pr = 0.000<br>Continuity corrected:<br>Pearson chi2(1) = 16.6456 Pr = 0.000 |
| 0 | 6 | 28 | 34 | |
| 1 | 71 | 49 | 120 | |
| Total | 77 | 77 | 154 | |
| For Single Family Properties Only | | | | |
| Study | Not Greater than the median | Greater than the median | Total | Ho: Ratios (19 STC Appraisals)=Ratios (108 Sales)<br>Pearson chi2(1) = 14.2055 Pr = 0.000<br>Continuity corrected:<br>Pearson chi2(1) = 12.3920 Pr = 0.000 |
| 0 | 2 | 17 | 19 | |
| 1 | 62 | 46 | 108 | |
| Total | 64 | 63 | 127 | |

All four tests lead to the conclusion that the STC appraisals do not represent market values (all with 99% statistical confidence). Therefore, the STC study is invalid and its reported results are unreliable.

## 5. Additional Analysis and Findings

5.1 Analysis of Reassessment History: The following table provides a comparison of actual assessment changes (net of new construction) to those that might have been expected for each of the last four reassessments as well as the six-year period leading up to 2003. Only one of the reassessments produced changes in line with the market indicator.

| Actual Value Changes from Reassessment vs. Expected Value Change | | | |
|---|---|---|---|
| Biennial Year | % Net Assessment Change | Missouri OFHEO Index | % Value Change: Actual vs. Expected |
| 1999 | -0.5 | 8.4 | -6% |
| 2001 | 1.0 | 11.4 | 9% |
| 2003 | -2.3 | 11.8 | -19% |
| 2005 | 10.3 | 12.4 | 83% |
| Cumulative 1997 - 2003 | -1.8 | 35.0 | -5% |

## 6. Figures and Tables

**Table 1. STC's Appraisal Ratio Studies**

| | | Group | | | |
|---|---|---|---|---|---|
| | | 1999 | 2001 | 2003 | 2005* |
| Number of Appraisals | | 41 | 39 | 34 | 35 |
| Median | | 1.020 | 1.000 | .967 | .885 |
| 95% Confidence Interval | Lower Bound | .870 | .837 | .774 | .800 |
| for Median | Upper Bound | 1.412 | 1.043 | 1.050 | 1.208 |
| Weighted Mean | | .885 | .772 | .890 | .846 |
| 95% Confidence Interval | Lower Bound | .806 | .677 | .776 | .735 |
| for Weighted Mean | Upper Bound | .964 | .868 | 1.004 | .957 |
| Minimum | | .571 | .042 | .335 | .181 |
| Maximum | | 3.750 | 5.000 | 2.421 | 4.211 |
| Std. Deviation | | .784 | .778 | .406 | .794 |
| Price Related Differential | | 1.551 | 1.397 | 1.088 | 1.325 |
| Coefficient of Dispersion | | .542 | .355 | .283 | .555 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 22.0% | 30.8% | 32.4% | 14.3% |

*The STC has not completed its studies for the 2005 reassessment cycle. These results may not represent final values.

**Figure 1. Ratios before Outlier Trimming**

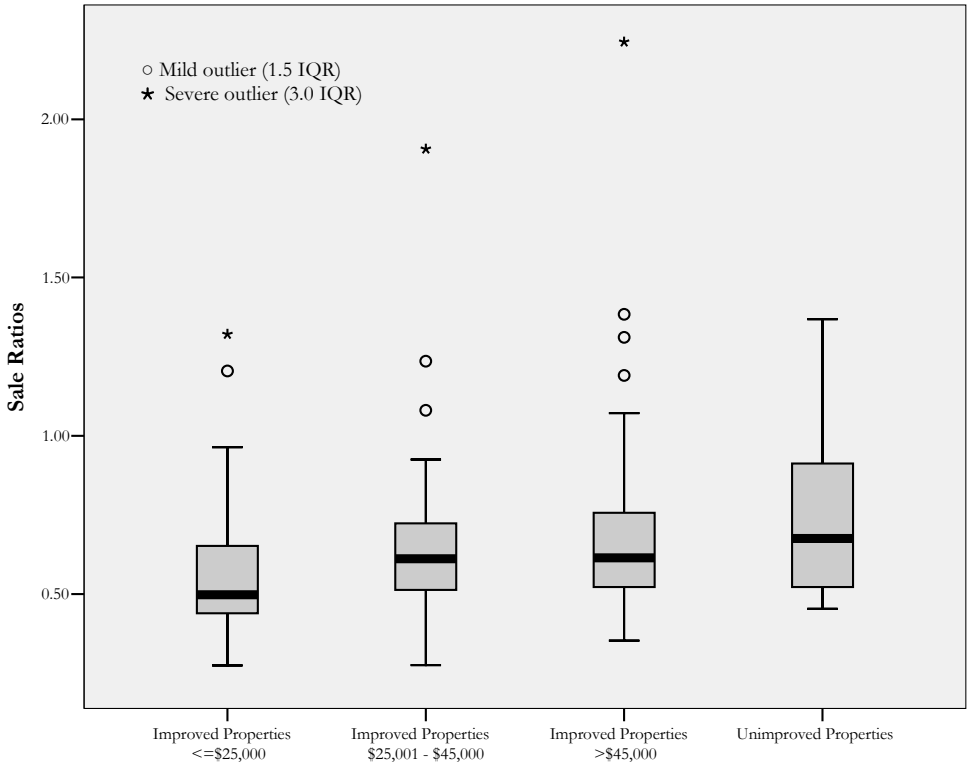
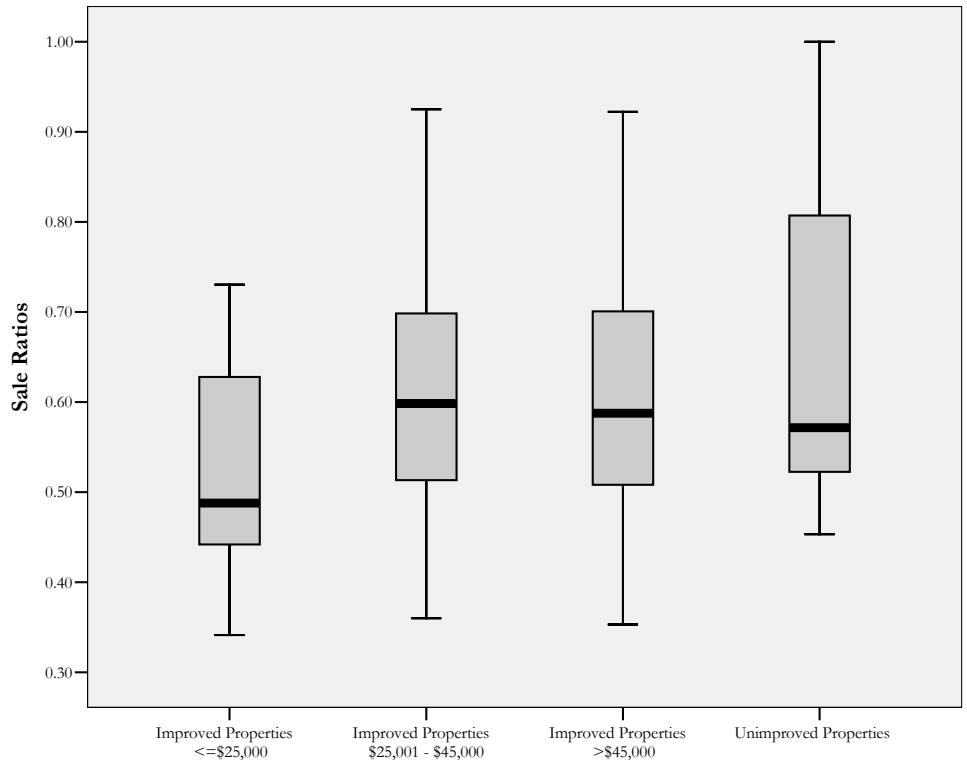
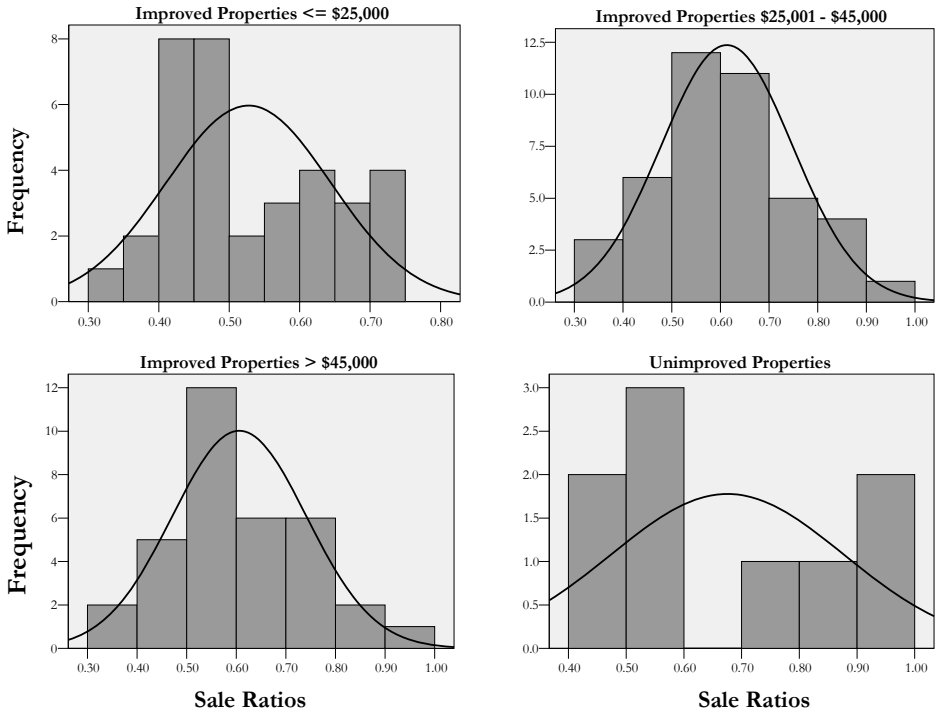



**Figure 2. Ratios after Outlier Trimming**



## Figure 3. Distribution of Final Sale Ratios




## Shapiro-Francia W' Tests for Normality for Various Strata

| Strata | Observations | W' | V' | z | Prob* |
|---|---|---|---|---|---|
| Single Family | 108 | 0.98418 | 1.522 | 0.855 | 0.19614 |
| Multi-family | 3 | . | . | . | . |
| Unimproved Properties | 9 | 0.90761 | 1.457 | 0.614 | 0.26961 |
| Improved Properties | 111 | 0.98297 | 1.676 | 1.051 | 0.14664 |
| Improved Properties<=$25,000 | 35 | 0.94889 | 2.014 | 1.299 | 0.09692 |
| Improved Properties>$25,000 & <=$45,000 | 42 | 0.98940 | 0.480 | -1.430 | 0.92364 |
| Improved Properties>$45,000 | 34 | 0.98617 | 0.533 | -1.195 | 0.88392 |
| Overall Un-weighted | 120 | 0.97700 | 2.414 | 1.786 | 0.03703 |
| *This value represents the indicated probability that the underlying population is normally distributed. A value of less than .05 indicates a distribution that is not normal. | | | | | |

## Table 2. Sales Ratio Analysis: Stratified by Property Use

| | | Strata | | | |
|---|---|---|---|---|---|
| | | Single Family | Unimproved Properties | Multi-family | Overall Un-weighted |
| Number of Sales | | 108 | 9 | 3 | 120 |
| Median | | .575 | .571 | .498 | .573 |
| 95% Confidence Interval for Median | Lower Bound | .538 | .488 | .429 | .538 |
| | Upper Bound | .610 | .912 | .723 | .610 |
| Weighted Mean | | .569 | .662 | .542 | .570 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .539 | .482 | .163 | .540 |
| | Upper Bound | .600 | .843 | .921 | .600 |
| Minimum | | .341 | .453 | .429 | .341 |
| Maximum | | .925 | 1.000 | .723 | 1.000 |
| Std. Deviation | | .135 | .202 | .154 | .142 |
| Price Related Differential | | 1.027 | 1.020 | 1.016 | 1.037 |
| Coefficient of Dispersion | | .191 | .291 | .197 | .200 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 1.9% | 22.2% | .0% | 3.3% |

## Table 3. Sales Ratio Analysis: Stratified by Use and Value

| | | Strata | | | | |
|---|---|---|---|---|---|---|
| | | Improved Properties <=$25,000 | Improved Properties $25,001 - $45,000 | Improved Properties >$45,000 | Unimproved Properties | Overall Un-weighted |
| Number of Sales | | 35 | 42 | 34 | 9 | 120 |
| Median | | .488 | .599 | .588 | .571 | .573 |
| 95% Confidence Interval for Median | Lower Bound | .456 | .549 | .535 | .488 | .538 |
| | Upper Bound | .589 | .675 | .682 | .912 | .610 |
| Weighted Mean | | .505 | .587 | .579 | .662 | .570 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .467 | .546 | .526 | .482 | .540 |
| | Upper Bound | .544 | .629 | .632 | .843 | .600 |
| Minimum | | .341 | .360 | .353 | .453 | .341 |
| Maximum | | .730 | .925 | .922 | 1.000 | 1.000 |
| Std. Deviation | | .117 | .135 | .135 | .202 | .142 |
| Price Related Differential | | 1.043 | 1.044 | 1.047 | 1.020 | 1.037 |
| Coefficient of Dispersion | | .200 | .186 | .180 | .291 | .200 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | .0% | 2.4% | 2.9% | 22.2% | 3.3% |

## Table 4. Combined Results – Post Stratification and Weighting

| | Population Assessor's Value | Median | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Improved Properties<=$25,000 | 432,316 | 0.488 | 885,893 | 17.0% | 0.083 |
| Improved Properties >$25,000 & <=$45,000 | 643,332 | 0.599 | 1,074,010 | 20.6% | 0.124 |
| Improved Properties>$45,000 | 1,767,589 | 0.588 | 3,006,104 | 57.7% | 0.339 |
| Unimproved Properties | 138,695 | 0.571 | 242,898 | 4.7% | 0.027 |
| Total | 2,981,932 | | 5,208,906 | 100.0% | 57.2% |

| | Population Assessor's Value | Weighted Mean | Estimated Actual Value | % of Total Est. Mkt. Value | Subtotal |
|---|---|---|---|---|---|
| **Strata** | | | | | |
| Improved Properties<=$25,000 | 432,316 | 0.505 | 856,071 | 16.4% | 0.083 |
| Improved Properties >$25,000 & <=$45,000 | 643,332 | 0.587 | 1,095,966 | 21.0% | 0.123 |
| Improved Properties>$45,000 | 1,767,589 | 0.579 | 3,052,831 | 58.5% | 0.339 |
| Unimproved Properties | 138,695 | 0.662 | 209,509 | 4.0% | 0.027 |
| Total | 2,981,932 | | 5,214,377 | 100.0% | 57.2% |

## Table 5. Sales Ratio Analysis: Stratified by Location

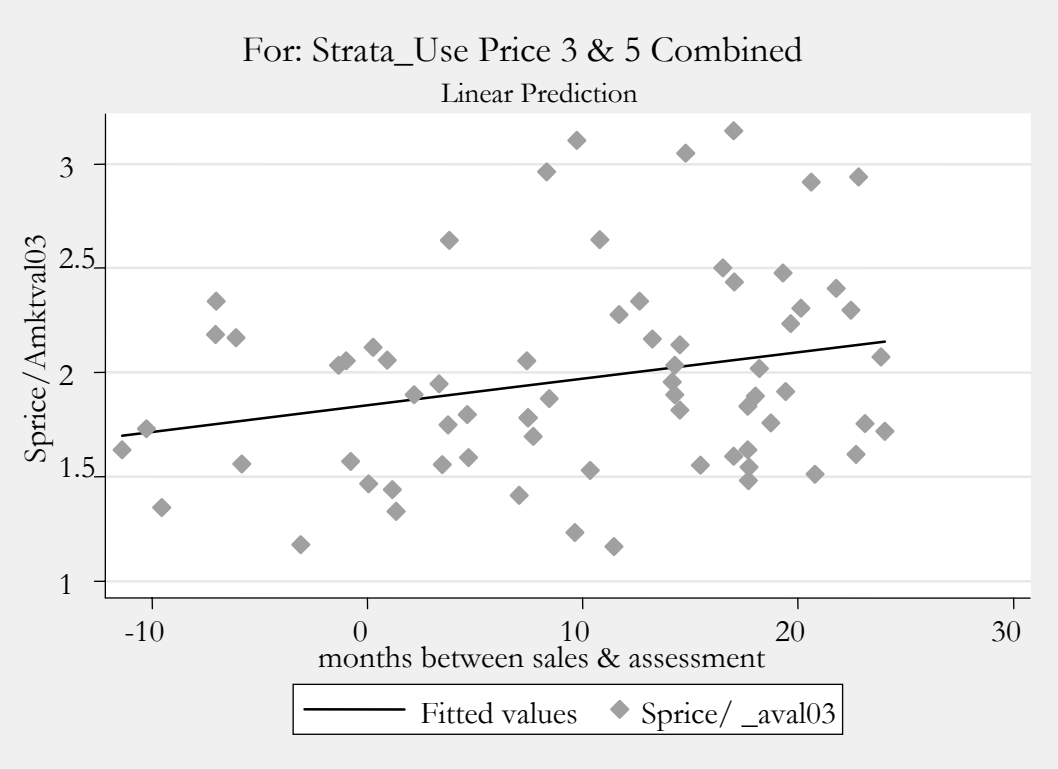
| | | Strata | | |
|---|---|---|---|---|
| | | Potosi Area | All other areas | Overall Un-weighted |
| Number of Sales | | 82 | 38 | 120 |
| Median | | .587 | .525 | .573 |
| 95% Confidence Interval for Median | Lower Bound | .555 | .473 | .538 |
| | Upper Bound | .642 | .610 | .610 |
| Weighted Mean | | .600 | .520 | .570 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .569 | .465 | .540 |
| | Upper Bound | .631 | .575 | .600 |
| Minimum | | .341 | .353 | .341 |
| Maximum | | 1.000 | .912 | 1.000 |
| Std. Deviation | | .141 | .135 | .142 |
| Price Related Differential | | 1.018 | 1.054 | 1.037 |
| Coefficient of Dispersion | | .195 | .209 | .200 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 3.7% | 2.6% | 3.3% |

## Table 6. Sales Ratio Analysis: Stratified by Use and Age

| | | Strata | | | | | |
|---|---|---|---|---|---|---|---|
| | | Unimproved Property | Built before 1951 | Built 1951 through 1965 | Built 1966 through 1982 | Built 1983 through 2002 | Overall Un-weighted |
| Number of Sales | | 9 | 24 | 26 | 27 | 25 | 111 |
| Median | | .571 | .509 | .594 | .588 | .589 | .574 |
| 95% Confidence Interval for Median | Lower Bound | .488 | .456 | .494 | .508 | .503 | .525 |
| | Upper Bound | .912 | .635 | .656 | .701 | .682 | .619 |
| Weighted Mean | | .662 | .514 | .564 | .588 | .572 | .567 |
| 95% Confidence Interval for Weighted Mean | Lower Bound | .482 | .468 | .511 | .539 | .497 | .536 |
| | Upper Bound | .843 | .560 | .618 | .637 | .646 | .599 |
| Minimum | | .453 | .341 | .360 | .389 | .353 | .341 |
| Maximum | | 1.000 | .730 | .875 | .862 | .922 | 1.000 |
| Std. Deviation | | .202 | .120 | .127 | .131 | .148 | .141 |
| Price Related Differential | | 1.020 | 1.036 | 1.041 | 1.024 | 1.043 | 1.037 |
| Coefficient of Dispersion | | .291 | .187 | .172 | .185 | .199 | .201 |
| Coefficient of Concentration | Percent between .9 and 1.1 inclusive | 22.2% | .0% | .0% | .0% | 4.0% | 2.7% |

**Graph 1. Improved Property Price Trend**

A thorough analysis of price-time trends by price strata determined that adjusting reported prices was desirable for the third and fifth improved property strata. The prices for these strata ranged from $50,000 - $420,000. The resultant trend and statistical analysis is shown below.




**Price Trend Regression Statistics**

| Source | SS | df | MS | | |
|---|---|---|---|---|---|
| Model | .783886195 | 1 | .783886915 | Number of obs = 70 | R-squared = 0.0495 |
| Residual | 15.0468676 | 68 | .221277464 | F( 1, 68) = 3.54 | Adj R-squared= 0.0355 |
| Total | 15.8307545 | 69 | .229431224 | Prob > F = 0.0641 | Root MSE = .4704 |

| _aratio | Coef. | Std. Err. | t | P> t | [80% Conf. Interval] | |
|---|---|---|---|---|---|---|
| _adjperiod | .0108761 | .0057785 | 1.88 | 0.064 | .003398 | .0183542 |
| _cons | 1.78576 | .0796358 | 22.42 | 0.000 | 1.682701 | 1.888819 |
| Monthly adjustment rate=.0060905 | | | | Annualized adjustment rate=.0730855 | | |

# SECTION III. PROCEDURE MANUAL

Among Missouri counties, there is little standardization regarding assessment information or systems. Producing a procedure manual or a post-study procedural description that encapsulated every variation needed to capture and verify data prior to the actual conduct of the more standardized ratio study procedures would require hundreds of pages, which we will spare the reader. However, this post-study procedural description should suffice to provide an explanation of the processes used to assure data quality and to identify all major methods.

## *1.* Definition of Purpose and Objectives [Primary Reference: Section 4.1 IAAO 1999]

1.1 Conduct Sales Ratio Studies for the 2003 Reassessment: [Primary Reference: Section 2.3.2.2 IAAO 1999]. The primary task of this study is to conduct sales ratio studies in 27 Missouri counties for residential properties to determine the actual and proper assessment level for the purposes of allocating state school funds. Accordingly, the study follows the recommendations specific to ratio studies conducted for the purpose of indirect equalization.

1.2 Compare Results with STC Ratio Studies: Because the state had already conducted appraisal ratio studies for the same counties, this study was intentionally designed to provide more precision and insight. Some of those differences will be discussed throughout this Section, but some of the most important ones are briefly described, as follows:

i. Sample size: The STC uses small random samples (approx. 35). This study sought larger sample sizes; to increase precision, to allow a more detailed examination of representivity and to permit maximum stratification. Sample sizes are identified within each county report.

ii. Representivity: The STC assumes that because its sample is randomly drawn, it is representative of the population. However, it is well known that small samples often produce sample error. This study was designed to examine the representivity of both the PPRC sample and the STC sample. Results for each examination appear within each county report.

iii. Stratification and Weighting: Stratification is highly desirable, even when not essential. Combined with weighting it provides a means for optimizing representivity. It provides insight into underlying causes of results, e.g. overall low assessments due primarily to seriously low assessments for older properties. Furthermore, some IAAO standards such as equity within a stratum or between strata are relevant only when the results from more homogenous strata are available.

iv. Best methods: To the extent possible (generally only limited by the availability of data), this study was designed to go beyond the minimum requirements of the IAAO standard. For example, the testing for sales chasing used in this study is more precise than outlined in the standard, as is the process for identifying and trimming of outliers.

1.3 Observe/Analyze/Report Any Other Issues that Effect Original Assessments and/or Oversight:: The study's primary objective was to determine levels of assessment (reported as percentages of market value rather than percentages of the statutory fractional assessment, since IAAO standards are expressed in this manner and since it is more intuitive for those less familiar with assessment detail). However, the study does calculate and report most typical ratio study measures. Because equity within a county is less of a concern in this study the examination of related measures is less robust than when the purpose is the overall evaluation of assessment quality. Nevertheless, these measures are often indicative of underlying issues the affect assessment levels, so significant variances

resulted in commentary within each county report. In addition, the conduct of the study allowed the researchers to observe conditions and practices that sometimes merit comment.

## 2. Collection and Preparation of Sales Data [Primary References: Section 4.2 and Section 6.1 IAAO 1999]

2.1 Source of Sales Data: [Primary Reference: Section 6.2 IAAO 1999]

i. Mandatory disclosure: As of 2003, the preferred source for sales information for a sales ratio study, mandatory disclosure, was available only in St. Louis City, St. Louis County and St. Charles County.

ii. MLS data: For all other counties, the sources of the sales information used were the multi-listing services (MLS) affiliated with local boards of realtors (BOR). When sales information from mandatory disclosure is unavailable, MLS information is widely used and/or sought after by assessors, appraisers and others involved in the process of estimating property values. Some, but not many, Missouri assessors have access to MLS information and others have sought it unsuccessfully. Previous research (Gardner 2006) identified MLS information as a key source, when available, in other states without mandatory disclosure (e.g. Texas, Utah, Idaho). The MLS information obtained by the PPRC was not obtained specifically for this project, but for general research purposes regarding property and property tax related policy research. When granted access, it was with the provision that no information would be disclosed, or provided to any other party, that would identify individual transactions and that no sellers, buyers or agents would be contacted based upon their identification within MLS records. BOR's consider MLS information as containing trade secrets and proprietary information. MLS information does not represent all sales. On the other hand, sales where one or more parties are represented by a licensed agent generally represent sales meeting the requirements for a market transaction.

2.2 Period from Which Sales Are Drawn: The period from which sales were drawn varies by county and by property type. In no case does the total period extend beyond four years and only rarely beyond two. Several factors led to the selection of a period for each property group for each county, as follows:

i. Originally, sales information from January 1, 2001 through the present (generally 2005) was requested. However, some multi-listing services changed systems so that the historical sales data was not available as far back.

ii. The range of time for achieving an acceptable sample size for single-family properties rarely exceeded two years and in some cases was as short as one year by design (In one case the final period was nine months due to the need to avoid the effects of an assessment procedure that would skew results). Whenever possible the sales period is balanced with sales before and after the date of analysis, i.e. the assessment date of January 1, 2003.

iii. To acquire the maximum sample in smaller counties for multi-family property, sales from two years before to two years after the analysis date were sought.

iv. To acquire the maximum sample in smaller counties for unimproved properties, sales from two years before to a maximum of three years after the analysis date were sought. While this definition implies a sales period of five years, the actual range for any county was never more than four and most often much less. Since unimproved properties tend to change use or size shortly after being sold, few sales that occurred more than a few months before the analysis date survived the screening process.

2.3 Information Obtained: [Primary Reference: Section 6.1 IAAO 1999] For all sales records, we obtained the following fields of information: sales price, sales date, location (address), property type, parcel identification number, legal description, city, and zip code. In most counties, we were also able to obtain supplemental information such as property size, numbers/types of rooms, special district information (i.e. school districts), year built, and other useful appropriate information.

2.4 Initial Screening of Sales: [Primary Reference: Section 6.4 IAAO 1999] Early in this study, trial ratio studies were conducted that included counties where computerized assessment records were available and in those where assessment information was only available by visiting county offices. It also included in early attempts to acquire supplemental assessor information; such as lists of properties with new construction by year as well as information permitting the definition of the population. From those early efforts, it became clear that procedures were necessary to compensate for unavailable information, and in some cases poor quality information. The IAAO notes that no single sales screening rules or recommendations are universally applicable to ratio studies. Given this, the PPRC created a strict and straightforward procedure used to match sales to assessment information, whereby each sale underwent at least three separate screenings to ensure their validity for use in the study. The specific guidelines are described in the following section.

## 3. Matching and Screening of Assessment and Sales Data [Primary References: Section 4.3 and Section 6.4 IAAO 1999]

3.1 Assessment Information: [Primary Reference: Section 5.1.2 IAAO 1999] Assessment information was obtained in two ways:

i. Individual Matching: For counties where the full assessment roll was not available electronically, researchers obtained assessment information from each assessor office by visiting the county and viewing county records, consulting directly with the assessor, requesting parcel cards from the assessor, following up by sending appropriate information to the assessor for review, and where available, collecting assessment information from online databases operated by the counties.

ii. Full Assessor Rolls: Assessment information that was available for the entire county in electronic format was extracted from the assessor databases by personnel in the assessor's office, or by third-party technical support vendors. Given the various state of county record-keeping databases, the assessor staff in some counties did not have the technical expertise to extract assessment information from their databases without great effort or expense and had to rely upon third-party technical support vendors to do so. When these vendors were actually able to extract the information, these endeavors were time-consuming and expensive in many cases.

iii. Record-Keeping Compliance: Counties varied substantially in their knowledge of record-keeping rules set forth by the Secretary of State, Missouri statutes, and applicable sunshine laws. Ultimately, we found that almost every county worked with the PPRC staff to ensure compliance with these rules; however, the variation in methods and appropriate costs was troublesome (i.e. parcel card requests costs varying from ten cents to two dollars per parcel card).

3.2 Pre-Match Screening: [Primary References: Sections 6.4 and 6.6 IAAO 1999] Prior to any type of sales matching, sales information and assessor information (where applicable) were screened in a number of ways to ensure their validity for inclusion in the ratio study.

i. Indications of New Construction: Properties that indicated new construction were excluded the study. This information was determined either by new construction files in paper or electronic format provided by the assessor, or sales information that indicated new construction, either

from the property year built, legal description, or other supplemental fields. Furthermore, sales and assessment information that indicated the property was built during the time-frame of our study or the year preceding it were also excluded to eliminate the effects of new construction. In many cases, county assessor offices did not maintain current electronic new construction files or had electronic files were purged every year, making the auditing process difficult.

ii. Insufficient information: In some cases, sales had insufficient information to properly match with assessment information. Unless there was a specific matching field such as parcel identification number, legal description, or site address available in a usable format, these properties were excluded from the study.

iii. Sale by Financial/Government/Nonprofit Institution: [Primary References: Sections 6.4.1-6.4.3 IAAO 1999] Sales that involved properties where financial, government, or nonprofit institutions were involved were excluded wherever they were identifiable.

iv. Sales of Exempt Property: [Primary Reference: Section 6.4.5 IAAO 1999] Properties that were classified as tax-exempt or tax-abated were excluded from the study

v. Internal Conflict: In some cases, sales information or assessment information conflicted with itself (i.e. a single family property would be listed as having 3 living units). These properties were excluded from the study.

vi. Assessor Validity Codes: In the cases where the counties coded sales with validity codes, that information was used to further exclude sales from the study.

3.3 Screening and Matching for Studies without Full Assessor Rolls: [Primary References: Sections 6.4 and 6.6 IAAO 1999]

i. Matching and Screening on Site: In order to ensure quality matching between sales and assessor information, field researchers were instructed and trained to follow a specific procedure. First, in order to make a good match in the field, they had to confirm at least two independent pieces of data between the sales and assessor files: parcel identification number and/or county account number, situs address, legal description and owner name. These matches were then recorded as confident matches, as long as there were no conflicts within these identifying fields. Matches where most information matched but researchers were not completely confident were coded as probable matches. Any sales that did not meet these requirements were excluded from the study.

ii. Mixed Use: Assessment records contained assessment values for different property types (residential, commercial, agriculture). Researchers were trained to identify these and exclude any property that contained a commercial or agricultural assessment value, regardless of how small.

iii. Indications of New Construction: Researchers used supplemental information available to the assessor, parcel cards, or any available source to exclude properties affected by new construction.

iv. Field Decision-Making on Matching: In a number of cases, researchers had to make decisions in the field on probable matches. In these situations, researchers followed certain procedures to ensure that only valid matches were included in the study.

- Probable Matches: If any question arose regarding a property where a match was made but the researcher still had questions, the sale was reviewed again using a variety of means, including using supplemental information from both the sales and assessment records,

ordering parcel cards from the assessor, consulting directly with the assessor, or sending supplemental information to the assessor for additional matching. If after this examination the property could not be matched according to our standards, it was excluded from the study.

- Remaining Doubts- Matches where any questions or doubts remaining about after the initial field screening and re-examination mentioned above were excluded from the study. Once every resource was exhausted to remove any remaining doubts about matches, the properties that could not be confirmed were excluded.

v. Level of Effort- Depending upon the availability and condition of data, different levels of effort were spent obtaining and matching sales records. Larger counties generally required less effort to provide a substantial sample size, at least for single-family properties, and most of that effort was used matching property types such as vacant land and multi-family properties to increase their sample size. Smaller counties generally required more effort in matching all property types so that the overall sample size was sufficient for the needs of this study. The overall level of effort in obtaining a sufficient sample size for each county ultimately depended on the quantity and quality of the data from the sales files as well as the quality and accessibility of the assessment information.

3.4 Screening and Matching for Studies with Full Assessor Rolls [Primary References: Section 6.4 and 6.6 1999 IAAO]

i. Electronic Matching: Properties where the electronic assessment rolls were available were matched electronically using parcel identification number. If this matching did not provide a sufficient sample of all property types, situs addresses in both the sales and assessor files were standardized using a computer program named Centrus to bring both up to U.S. Postal Code standards. Properties that were then matched using these standardized addresses as long as the match was 100%.

ii. Supplemental Matching: In some cases, particularly to increase the sample size of certain property types (vacant land and multifamily properties), additional matching was completed by hand as outlined in 3.3 after electronic matching had occurred. Any property that could not be matched electronically or by hand was excluded.

iii. Electronic Screening: Researchers examined the matched electronic file for the same attributes examined by researchers in the field. Properties that indicated mixed value or new construction were excluded from the study.

3.5 Additional Screening: [Primary References: Sections 6.4 and 6.6 IAAO 1999] In addition to the pre-match screening of sales and assessment information and the screening during the matching process, all sales underwent a final review to ensure their validity for use in the study.

i. Assessor New Construction: New Construction fields and records from both sales and assessor files were re-examined to ensure that all of the information suggesting new construction was used to exclude those properties from the study.

ii. Apparent New Construction: Even after using all available information, it was sometimes readily apparent that particularly low or high ratios resulted from unreported new construction information. For the purpose of this study, these too were excluded.

iii. Sale Remnants: [Primary Reference: Gloudemans 2004] Sales with particular low sales prices ($10,000 for single-family properties, $20,000 for multi-family properties, and $1,500 for vacant land) were considered remnants whose market value is extremely difficult to ascertain so these properties were excluded from the study.

iv. Repeat Sales: Properties were sometimes sold more than once in the time-frame of our study. To ensure their validity, we examined a number of issues.

- Normal Sales: Repeat sales that did not change dramatically in a short period of time were considered normal market-value sales and included.

- Flips: In some cases, properties were sold more than once with a major increase in the sale price, indicating a potential property flip where at least one of the sales would not be a good indicator of market value. Researchers were trained to examine these sales and determine which was appropriate for inclusion in the study, depending upon the sale date relative to the assessment date. Any sales that were doubtful were excluded from the study.

- New Construction: In some cases, repeat sales hide new construction. Researchers were trained to examine differences in assessor and sales information, and determine which sale most closely reflected the property and its state at the time of assessment. Properties that were deemed inappropriate according to this test were excluded from the study.

v. Sale/Parcel Mismatch: Properties that passed the initial matching process were also further screened to ensure that a proper match was made in the field of electronically. Properties where the researcher felt a mismatch occurred and had a compelling reason to believe so were excluded from the study.

vi. Miscellaneous: If the researcher had a compelling reason to exclude a property that did not fit the categories listed above, they were screened out and the reason was logged.

vii. High/Low Sale Ratio Examination: We submitted properties with extremely high or extremely low sale ratios to one final review. As a rule, we did not exclude sales on this basis; rather, we used this procedure to indicate properties where a re-examination was appropriate. During this, we reviewed all sale and assessor information to determine whether the property met all of the previous screening criteria and to ensure that a proper match was made. Sales that did meet all criteria or were deemed a mismatch by the researcher were excluded from the study. If all criteria were met, these sales remained.

## 4. Statistical Procedures and Analysis [Primary Reference: Section 4.5 IAAO 1999]

4.1 Nature of the Population: [Primary Reference: Section 5.1.1 IAAO 1999] The IAAO identifies several aspects of the population that are necessary for research design and interpretation of key results, including property types, market conditions, and population composition. The PPRC study used appropriate measures to identify all of these criteria in defining our county populations.

i. Studies with Full Assessor Rolls

- 2003: If the 2003 rolls were available, the researchers trimmed the full county population into purely residential parcels. This population was then used to stratify and provide quantitative information about the county residential population.

- Other: In some cases, the 2003 assessor rolls were unavailable or contained only some of the necessary data for the study. This population was then used to stratify and provide descriptive information from the county residential population.

ii. Studies without Assessor Rolls: Depending on availability, researchers used the past three to four random STC samples as a proxy population. Information and conclusions about property characteristics from the population were drawn from the random samples provided by the STC. This population was then used to stratify and provide descriptive information about the county residential population.

4.2 Stratification: [Primary Reference: Section 4.4 IAAO 1999] The IAAO encourages stratification to increase the representivity of the sample to more closely reflect the population. This study utilized stratification to the fullest extent contingent on available information.

i. Stratification for Equalization of Funding Distributions: [Primary Reference: Section 4.4.2 IAAO 1999] The IAAO strongly recommends the use of stratification for minimizing distortion resulting from variation in assessment levels, in the context of equalizing intergovernmental transfer payments (IAAO, 28). In particular, the IAAO identifies that stratification based on value is especially important for equalization. All 27 county studies are stratified using at least one and as many as six methods of stratification, including value.

ii. Use of Some Small Strata for Increasing Representativeness: Depending upon the availability of data, small strata were used when at least five valid sales were present to increase representivity in this study.

iii. Standard Stratification: Every county was stratified on the basis of property type and value. When additional information was available that could be used for stratification, counties were stratified on the basis of location, age, and whether the sale involved a town or rural lot.

4.3 Adjustments to Sale Prices for Time: [Primary Reference: Section 6.5.4 IAAO 1999, Gloudemans 1999 Chapter 6]. The "sales ratio trend analysis" method (Gloudemans 1999, 265-268) was used to adjust prices for time of sale, where necessary. Several specifics are worth mentioning:

i. Strata Used: Sales were isolated by property use. Vacant (or un-improved) properties were always evaluated separately. Multi-family properties were evaluated separately when sample sizes permitted. When not, these were most always properties with less than five units and they were combined with single family properties. Depending on sample size, single-family properties were broken into two to six strata based on price level. This approach was adopted because price was always a known quantity and because it was logical to assume that high valued properties might appreciate at a different rate than low value properties.

ii. Identifying Multiple Trends and Overly Influential Observations: After preparing the data, a scatter graph with a fitted values line using fractional polynomial regression was printed and examined. This provided two advantages. First, when the possibility exists that a single linear line cannot appropriately represent the data, this is most apparent with this graphing technique. Second, this technique is particularly sensitive to influential outliers, especially at the beginning and end of the period.

iii. Dealing with Outliers: When determining price trends, outliers can produce dramatic results. Using both the standard IQR technique and the information gained from the process described in 4.1.ii, outliers were temporarily removed to examine trends based on the more representative data.

iv. Coding Time of Sale: Rather than code sales based on month, we used actual closing dates.

v. Regression of Sale/Appraisal Ratios on Time: This was performed as described by Gloudemans (1999). An 80% confidence interval was used for two reasons. First, for this specific period, empirical evidence from outside the study indicated there was little likelihood that prices were falling, so the regression is actually one-tailed. In fact, we found only one stratum in any county where prices were falling. Secondly, price trends are often relatively small, say 3%. For those to be found statistically significant at 95%, requires a relatively large or especially uniform sample. It was a judgment call – and rarely mattered.

vi. Multiple Trends: In only one instance, Phelps County, were multiple trend lines necessary.

vii. Combining Strata: When graphs and regressions were performed, each stratum was examined individually. In addition, every logical combination of strata was examined. For example, in a county with five single-family strata, the combination of the two lowest priced strata was considered, but the combination of the lowest with the highest was not.

viii. Documentation: For each county where trends were applied, the resultant trend is presented with a graph and the corresponding regression together with identification of the price range. These are reported at then end of the Section 6 in each county report (Section II).

4.4 Handling Outlier Ratios: Outlier Ratios and Trimming: [Primary References: Section 6.6 and Table 1 IAAO 1999, Idaho Ratio Study Manual 2004-2005, 9-11]

i. Methods Used: As recommended by the IAAO the first method of dealing with outliers was to subject them to greater scrutiny. Those procedures are discussed in 3.5. Nevertheless, outliers remained that required further action. These outliers are depicted on a boxplot in Section 6 within each county study, by strata. All outlier evaluation and trimming was done by strata and no arbitrary trim points were established. Ultimately, the design decision required choosing a method that was consistent or one that was more specific to the data (and what we had learned about the data quality for each county). A balanced approach was chosen. The analyst used four procedures to provide information for the ultimate decision, as follows:

- IQR method: Mild and severe outliers were identified and coded, but neither was automatically excluded.

- Trim limit based on median: The upper and lower trim limit based on the median, plus or minus 40% was identified.

- Trim limit based on %: The general guideline is that small samples should be trimmed no more than 10% and larger samples no more than 5%.

- Sorted list: A list of low ratios and high ratios was printed along with statistics for the stratum (mean, median, range, iqr, standard deviation, etc.).

ii. Trimming: All of the above were considered, with the dominant decision maker being natural breaks that clearly showed a delineation between data that was not typical of values found within the county. The trim limit based on median was violated rarely and only after careful consideration. The trim limit based % was considered, but tempered by our knowledge of data

quality when necessary. Many mild outliers and some severe outliers identified by the IQR method were not trimmed, depending on the distribution of the data.

iii. Judgment Calls: Ultimately, judgment was involved, so final decisions were made with two analysts reviewing the final data before trims were established.

iv. Reporting Outliers: All outlier trimming is reported in Section 2 in each county report.

4.5 Estimating Performance for Unsold Properties, Testing for Sale Chasing, Solving for Sales Chasing: [Primary Reference: Section 10.1 – 10.7 IAAO 1999] IAAO condemns the practice of sales chasing (IAAO, 51) and recommends the split sample technique as a method of detection. A thorough test of sales chasing was conducted and if found, was remedied.

4.6 Measures of Appraisal Level: [Primary References: Section 7.3 and 7.3.6 IAAO 1999] According to the IAAO, for each stratum and aggregation of strata, measures of central tendency should be calculated to estimate appraisal level (Ibid, 41). The measures used in this study were the median ratio and the weighted mean ratio.

4.7 Determining the Overall Ratio for Combined Strata: [Primary Reference: Section 7.3.5 IAAO 1999] IAAO notes that it is inappropriate to weigh measures of central tendency by the number parcels in the stratum when conducting indirect equalization studies (Ibid, 43). In this study the researchers addressed this issue by weighting the strata according to the proportion of market value it represented.

4.8 Measures of Variability: [Primary Reference: Section 7.4 IAAO 1999]

i. Coefficient of Dispersion: [Primary Reference: Section 7.4.1 IAAO 1999] The IAAO recommends the Coefficient of Dispersion test to address uniformity within strata. The PPRC study reports the COD for each strata used per county, and highlights strata with CODs over 20% as problem areas in each county report.

ii. Measures of Reliability: [Primary Reference: Section 7.5 IAAO 1999] This study used confidence intervals and the standard error as appropriate indicators of reliability.

iii. Vertical Inequities: [Primary Reference: Section 7.6 IAAO 1999] Random differences among strata are examined using the price-related differential (PRD). In this study PRD values of .98-1.03 were treated as acceptable.

iv. Determining Whether Ratios Are Normally Distributed: [Primary References: Sections 7.7, 7.8, 7.8.1 IAAO 1999, Stata 2003] Hypothesis testing depends in part on the data being normally distributed. In this study, researchers used the Shapiro-Francia W1 test, (Stata 2003, 171), and the Skewness and Kurtosis test for strata with more than 5,000 observations (Ibid, 78).

## 5. Evaluation and Use of Results [Primary Reference: Section 4.6 IAAO 1999]

5.1 Representativeness of Samples: [Primary Reference: Section 5.5 IAAO 1999] According the IAAO, the statistical validity of a ratio study partially depends on whether it is representative of the population (IAAO, 31) of properties for a given jurisdiction. This study met all requirements for representativeness and thus produced valid results. The essential aspects of a valid ratio study are discussed at length in the introduction to Section II.

i. Achieving Representativeness: [Primary Reference: Section 5.5.1 IAAO 1999] For this study, representativeness was achieved by the use of larger sample sizes, relative to the comparable STC study for a county, based on important factors i.e. appraised value, age of the property, and location. Furthermore, this study accounted for issues related to sales chasing, proportionality, sufficient sample size, and market value identified by the IAAO as essential requirements for representivity.

5.2 Sold and Unsold Properties: [Primary Reference: Section 10 IAAO 1999] An essential requirement of representivity includes the assumption that non-sold properties are appraised in the same manner as sold properties. Our researchers verified this by testing for sales chasing. If sales chasing was detected, appropriate corrective measures were taken to protect the integrity of the study.

i. Preliminary Look:: Researchers began by conducting an informal evaluation of sale ratio differences in a county for the relevant time period. This entailed looking at proportion of sales ratios located within a relatively narrow range of the mean, in the contest of the lowest reasonable standard deviation (Ibid, 52).

ii. Final Look:: When sales chasing was remotely a possibility, researchers started with the split sample technique, which involves performing studies before and after the date of appraisal (Ibid). When final ratio was calculated, every county was examined using a Mann-Whitney test and testing all potential time periods (Ibid.). Additionally, researchers went beyond recommendations in testing portions of relevant time periods. In counties with both 2002 and 2003 assessment data, researchers examined changes for sold/unsold properties in detail (Ibid.) Researchers used corrective measures to eliminate suspect time periods from the study, by using a sample time period that acted to preclude sales chasing (Ibid, 52).

5.3 Proportionality: [Primary Reference: Section 7.3.5 IAAO 1999] The IAAO identifies that proportionality is an essential component of sample being considered representative of the population. The IAAO suggests using appropriate stratification and weighting measures to ensure proportionality.

i. Comparing Sample to Population: According to the IAAO, appropriate conclusions and comparisons between the sample and the population cannot be made unless the sample is representative of the population, which can be achieved through using stratification and weighting methods. As discussed above, the PPRC used stratification and weighting measures that met and in most cases surpassed the minimal IAAO standards regarding stratification and weighting.

ii. Comparing the PPRC Sample to the STC Sample: The use of stratification and weighting on the PPRC sample ensured that it was representative of the population. The STC does not use any stratification or weighting measures with its random sample.

iii. Comparing Sample Sizes: [Primary References: Sections 8.1 – 8.3 IAAO 1999] Statistical accuracy depends in part on sample size, with larger aggregations of data achieving greater precision in testing (Ibid, 48). Measures of reliability are computed when comparing PPRC samples to those of the STC findings. In all cases in this study PPRC relied on larger sample sizes then did the STC for their studies.

5.4 Indicators of Market Value: [Primary References: Section 5.1.2 IAAO 1999] The IAAO identifies several sources of sales data that are appropriate indicators of market value. The PPRC study uses two of these appropriate sources: disclosed sales information in a few jurisdictions where it was available, and multi-listing service sales closed sales in all other counties.

i. Comparing the PPRC Sample to the STC Sample: While the PPRC and STC sample draw their independent sources from appropriate sources indicated by the IAAO, there are still substantial differences in the samples themselves and the results from these samples. To determine which sample was more appropriate with regard to market value, the PPRC study utilized four separate tests. The Mann-Whitney Test and the K-Sample Test were performed twice for each county, once for the overall sample, and once for single-family properties, the dominant property type in each county. The results of these tests are reported in each county summary. For each of these tests we reported the significance level, and drew our conclusions based on a significance level of 95% for at least three of the tests, although most results were significant at the 99% significance level. Generally speaking, the PPRC study found that STC appraisals were not good indicators of market value based on the following tests.

- Mann-Whitney Test: [Primary Reference: Section 9.6 IAAO 1999, Stata 2003 60-68] The IAAO indicates that a Mann-Whitney Test is appropriate when comparing appraisals and sales to determine which reflect market value. The Mann-Whitney tests used in this study examine the medians for the PPRC and STC sample and tests whether both samples could statistically be drawn from the same population. The IAAO notes that statistically significant results often would lead to the conclusion that both samples were not drawn from the same population and that the appraisals did not reflect market value.

- Kruskal-Wallis K-Sample Test: [Primary Reference: Stata 2003 234-235] The K-Sample Test is also used to supplement the results of the Mann-Whitney Test. The K-Sample tests in this study examine whether the distribution of certain samples (in this case the PPRC and STC samples) can come from the same population. A statistically significant result would reject the null hypothesis that both samples come from the same populations. In almost every case, the results from the K-Sample Test echoed the results from the Mann-Whitney test.

ii. High Value Properties [Primary References: Section 5.5.2 IAAO 1999, IAAO 2006] High value properties bear inclusion in the sample, depending on the intended use of the ratio study. When intended for indirect equalization, such as when determining the distribution of intergovernmental transfer payments between the state and several counties, inclusion of the high value property is required to achieve representivity (Ibid, 32) . For monitoring appraisal performance, on the other hand, high value properties may be excluded from the study sample (Ibid.). The 2006 draft of the IAAO Standard suggests that when high value properties significantly influence results within a stratum to move or eliminate the sale in question. We examined for high value properties and followed the procedures outlined in the 2006 Standard draft.

5.5 Reassessment Evaluation: In addition to analysis of assessment rates for each of the counties in our study, we also examined reassessment trends in each respective county.

i. Overall Reassessment Rate Changes: For all counties, we had copies of biennial reassessment changes for the time period of 1997 through 2005 provided by the STC. We used this information to determine whether or not a serious reassessment occurred between assessment cycles. Rate changes of two percent or less were considered troublesome and noted in each respective county report.

ii. Value Capture: In addition to reporting on reassessment rate changes, the PPRC conducted further analysis on whether the reassessments captured market value. To do so, we used market data from the Office of Federal Housing Enterprise Oversight provided by the STC to compare the reassessment rate to the OFHEO index. Depending upon the availability of data, between

one to two indicators of market value are used and compared against the reassessment rate changes.

iii. Real Reassessment Rate Changes: For some counties, information about previous assessment rates was available for PPRC analysis. In these counties, the PPRC conducted a real reassessment evaluation to determine whether or not a serious reassessment took place in 2003. The results of those real reassessments are reported in each respective county report.

5.6 Ratio Study Standards: [Primary Reference: Section 14 IAAO 1999] The IAAO suggests standards for ratio studies where market value is mandated by law as the basis for assessment (Ibid, 55). Those standards are delineated below:

i. Level of Appraisal: [Primary References: Section 14.1 and 14.1.2 IAAO 1999] Indirect equalization was a primary focus of this research. Consequently, 0.95-1.05 was the standard applied to evaluate the overall level of appraisal against the statutorily required level of assessment.

ii. Uniformity among Strata: [Primary References: Sections 14.2.1 – 14.2.6 IAAO 1999] The IAAO remarks that uniformity in appraisal performance between strata is important for study validity (Ibid, 57). In this study researchers ensured each stratum was within 5% of the appraisal level for the county (Ibid.).

iii. Vertical Equity: [Primary Reference: Section 14.2.7 IAAO 1999] The IAAO recommends that PRDs should range from 0.98 to 1.03 (Ibid.). In this study, researchers used that standard in evaluating study PRD values.

5.7 Presentation of Findings: [Primary Reference: Section 12 IAAO 1999] The findings of this study are documented in a text, which features exhibits designed to support the interpretation of the results.

5.8 Documentation:[Primary Reference: Section 12 IAAO 1999] The final documentation of our report includes: A final report, which contains the overall conclusions of the study; a procedure manual; and jurisdiction-level reports for each of the twenty-seven counties examined in this research. Furthermore, the PPRC maintains all paper and electronic files and logs of its work for auditing purposes.

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## Appendix Table A: Residential Values by County

| | | Total Residential Assessment 2003 | | | % of Missouri Total |
|---|---|---|---|---|---|
| | **MISSOURI TOTAL** | **36,168,817,425** | | | **100.00%** |
| | **TOTAL OF 88 NOT STUDIED** | | | | |
| | **TOTAL OF 27 STUDIED** | **25,930,145,931** | | | **71.69%** |
| **Rank** | **County Names** | **Residential Rural Lot** | **Residential Town Lot** | **TOTAL** | **Percentage** |
| 1 | ST. LOUIS | 2746261060 | 7601083330 | 10347344390 | 28.61% |
| 2 | JACKSON | 198920043 | 3991507652 | 4190427695 | 11.59% |
| 3 | ST. CHARLES | 923363260 | 2161065790 | 3084429050 | 8.53% |
| 4 | CLAY | 169942160 | 1411264242 | 1581206402 | 4.37% |
| 5 | GREENE | 639806190 | 936384820 | 1576191010 | 4.36% |
| 6 | ST. LOUIS CITY | 0 | 1167665420 | 1167665420 | 3.23% |
| 7 | JEFFERSON | 844510500 | 255054700 | 1099565200 | 3.04% |
| 8 | BOONE | 268339157 | 616667064 | 885006221 | 2.45% |
| 9 | PLATTE | 189584504 | 509327246 | 698911750 | 1.93% |
| 10 | CAMDEN | 495515190 | 176840450 | 672355640 | 1.86% |
| 11 | FRANKLIN | 403860904 | 237683689 | 641544593 | 1.77% |
| 12 | CASS | 214432172 | 406479965 | 620912137 | 1.72% |
| 13 | JASPER | 135258450 | 374257770 | 509516220 | 1.41% |
| 14 | COLE | 205239230 | 302215180 | 507454410 | 1.40% |
| 15 | CAPE GIRARDEAU | 101656690 | 279444310 | 381101000 | 1.05% |
| 16 | BUCHANAN | 62353680 | 312085930 | 374439610 | 1.04% |
| 17 | CHRISTIAN | 172657340 | 178129710 | 350787050 | 0.97% |
| 18 | TANEY | 152359550 | 96199630 | 248559180 | 0.69% |
| 19 | NEWTON | 100593970 | 143616630 | 244210600 | 0.68% |
| 20 | ST. FRANCOIS | 88544310 | 148999940 | 237544250 | 0.66% |
| 21 | STONE | 174525020 | 41621700 | 216146720 | 0.60% |
| 22 | LINCOLN | 147051660 | 60396010 | 207447670 | 0.57% |
| 23 | JOHNSON | 106064202 | 94876668 | 200940870 | 0.56% |
| 24 | WARREN | 121949500 | 77097840 | 199047340 | 0.55% |

| Rank | County Names | Residential Rural Lot | Residential Town Lot | TOTAL | Percentage |
|---|---|---|---|---|---|
| 25 | MORGAN | 168014810 | 21557750 | 189572560 | 0.52% |
| 26 | PETTIS | 91615084 | 90774160 | 182389244 | 0.50% |
| 27 | CALLAWAY | 115417990 | 58898440 | 174316430 | 0.48% |
| 28 | PHELPS | 79196760 | 85739090 | 164935850 | 0.46% |
| 29 | LAFAYETTE | 67839797 | 83645637 | 151485434 | 0.42% |
| 30 | BUTLER | 99905861 | 44347280 | 144253141 | 0.40% |
| 31 | BARRY | 100991426 | 42296621 | 143288047 | 0.40% |
| 32 | SCOTT | 40821670 | 101229880 | 142051550 | 0.39% |
| 33 | HOWELL | 75446750 | 60894690 | 136341440 | 0.38% |
| 34 | LACLEDE | 77494920 | 57791830 | 135286750 | 0.37% |
| 35 | MILLER | 76499690 | 58249640 | 134749330 | 0.37% |
| 36 | LAWRENCE | 65880150 | 66774950 | 132655100 | 0.37% |
| 37 | MARION | 33529220 | 88383190 | 121912410 | 0.34% |
| 38 | RAY | 61342460 | 59737440 | 121079900 | 0.33% |
| 39 | WEBSTER | 76460780 | 40349490 | 116810270 | 0.32% |
| 40 | CLINTON | 55522820 | 58198020 | 113720840 | 0.31% |
| 41 | PULASKI | 68138850 | 42744910 | 110883760 | 0.31% |
| 42 | HENRY | 42609730 | 65168660 | 107778390 | 0.30% |
| 43 | STODDARD | 55854017 | 49427703 | 105281720 | 0.29% |
| 44 | AUDRAIN | 38939974 | 65179866 | 104119840 | 0.29% |
| 45 | POLK | 56995560 | 44967950 | 101963510 | 0.28% |
| 46 | STE. GENEVIEVE | 72865820 | 25882520 | 98748340 | 0.27% |
| 47 | ADAIR | 29653600 | 65679350 | 95332950 | 0.26% |
| 48 | PERRY | 49911475 | 43114735 | 93026210 | 0.26% |
| 49 | CRAWFORD | 65874510 | 26934840 | 92809350 | 0.26% |
| 50 | ANDREW | 48542570 | 40598230 | 89140800 | 0.25% |
| 51 | DUNKLIN | 25874770 | 61647930 | 87522700 | 0.24% |
| 52 | BENTON | 69105110 | 15769820 | 84874930 | 0.23% |
| 53 | NODAWAY | 24173850 | 55893150 | 80067000 | 0.22% |
| 54 | SALINE | 19281700 | 57391410 | 76673110 | 0.21% |
| 55 | GASCONADE | 44943380 | 27865860 | 72809240 | 0.20% |
| 56 | VERNON | 39346930 | 32915220 | 72262150 | 0.20% |

| Rank | County Names | Residential Rural Lot | Residential Town Lot | TOTAL | Percentage |
|---|---|---|---|---|---|
| 57 | RANDOLPH | 27780070 | 44360060 | 72140130 | 0.20% |
| 58 | MCDONALD | 48655990 | 15416820 | 64072810 | 0.18% |
| 59 | OSAGE | 53260160 | 8929970 | 62190130 | 0.17% |
| 60 | COOPER | 25981940 | 35236500 | 61218440 | 0.17% |
| 61 | BATES | 32119310 | 29053030 | 61172340 | 0.17% |
| 62 | WASHINGTON | 52724380 | 8035320 | 60759700 | 0.17% |
| 63 | MONITEAU | 28139510 | 31177050 | 59316560 | 0.16% |
| 64 | TEXAS | 40280280 | 18524700 | 58804980 | 0.16% |
| 65 | CEDAR | 36918440 | 21127360 | 58045800 | 0.16% |
| 66 | PIKE | 31199770 | 25188510 | 56388280 | 0.16% |
| 67 | NEW MADRID | 14587630 | 39253040 | 53840670 | 0.15% |
| 68 | DENT | 36435390 | 16163900 | 52599290 | 0.15% |
| 69 | LIVINGSTON | 16561860 | 35817720 | 52379580 | 0.14% |
| 70 | DALLAS | 40871600 | 11191270 | 52062870 | 0.14% |
| 71 | MONTGOMERY | 29928360 | 21707460 | 51635820 | 0.14% |
| 72 | MACON | 22263820 | 28987160 | 51250980 | 0.14% |
| 73 | WRIGHT | 30260900 | 19585430 | 49846330 | 0.14% |
| 74 | MADISON | 28448180 | 16504970 | 44953150 | 0.12% |
| 75 | BARTON | 21275200 | 23404590 | 44679790 | 0.12% |
| 76 | RALLS | 35599840 | 8449040 | 44048880 | 0.12% |
| 77 | PEMISCOT | 13321390 | 29598710 | 42920100 | 0.12% |
| 78 | BOLLINGER | 36501780 | 6245610 | 42747390 | 0.12% |
| 79 | DOUGLAS | 31457380 | 10201120 | 41658500 | 0.12% |
| 80 | HICKORY | 36143260 | 3982670 | 40125930 | 0.11% |
| 81 | LINN | 13735970 | 25496000 | 39231970 | 0.11% |
| 82 | WAYNE | 31499305 | 6682600 | 38181905 | 0.11% |
| 83 | HOWARD | 19121040 | 15496350 | 34617390 | 0.10% |
| 84 | MISSISSIPPI | 11825050 | 22764560 | 34589610 | 0.10% |
| 85 | MARIES | 26389250 | 7926900 | 34316150 | 0.09% |
| 86 | RIPLEY | 27422750 | 6726210 | 34148960 | 0.09% |
| 87 | DEKALB | 17527830 | 15741240 | 33269070 | 0.09% |
| 88 | GRUNDY | 10889290 | 22194150 | 33083440 | 0.09% |

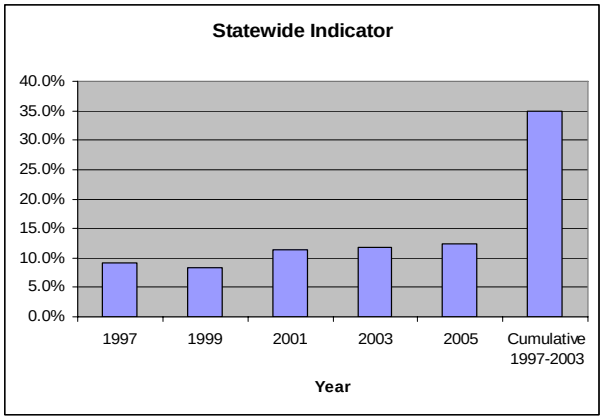
| Rank | County Names | Residential Rural Lot | Residential Town Lot | TOTAL | Percentage |
|---|---|---|---|---|---|
| 89 | OZARK | 28291250 | 4749380 | 33040630 | 0.09% |
| 90 | ST. CLAIR | 23887200 | 8114800 | 32002000 | 0.09% |
| 91 | CALDWELL | 18705500 | 13222700 | 31928200 | 0.09% |
| 92 | CARROLL | 12563800 | 19045550 | 31609350 | 0.09% |
| 93 | MONROE | 18301960 | 12927610 | 31229570 | 0.09% |
| 94 | IRON | 18368940 | 12634460 | 31003400 | 0.09% |
| 95 | DAVIESS | 18620960 | 9166610 | 27787570 | 0.08% |
| 96 | OREGON | 19344457 | 7835143 | 27179600 | 0.08% |
| 97 | DADE | 18489850 | 8506590 | 26996440 | 0.07% |
| 98 | LEWIS | 14208855 | 11677560 | 25886415 | 0.07% |
| 99 | CHARITON | 14463860 | 10055300 | 24519160 | 0.07% |
| 100 | HARRISON | 8496270 | 14905120 | 23401390 | 0.06% |
| 101 | CLARK | 13903620 | 8265320 | 22168940 | 0.06% |
| 102 | REYNOLDS | 15779117 | 5304448 | 21083565 | 0.06% |
| 103 | SHELBY | 10256310 | 10791500 | 21047810 | 0.06% |
| 104 | ATCHISON | 6604670 | 13921550 | 20526220 | 0.06% |
| 105 | SHANNON | 14624370 | 5623460 | 20247830 | 0.06% |
| 106 | HOLT | 7266840 | 11853900 | 19120740 | 0.05% |
| 107 | GENTRY | 5757620 | 12432560 | 18190180 | 0.05% |
| 108 | PUTNAM | 12994510 | 4915620 | 17910130 | 0.05% |
| 109 | SULLIVAN | 8993090 | 6928570 | 15921660 | 0.04% |
| 110 | CARTER | 12567100 | 3261124 | 15828224 | 0.04% |
| 111 | KNOX | 6746948 | 5622954 | 12369902 | 0.03% |
| 112 | SCOTLAND | 6598020 | 5581770 | 12179790 | 0.03% |
| 113 | SCHUYLER | 5557450 | 5356700 | 10914150 | 0.03% |
| 114 | MERCER | 5776700 | 3044920 | 8821620 | 0.02% |
| 115 | WORTH | 2280250 | 2429020 | 4709270 | 0.01% |

*Source: Residential Rural, Residential Town Lot - State Tax Commission (STC)*
*Total and Percentage - Calculated by PPRC*

**Appendix Table B: Change in Assessed value Net of New Construction by county & year**

| N | Name | change1999 | change 2001 | change 2003 | change 2005 | 97-03 cum chg |
|---|---|---|---|---|---|---|
| 1 | **ADAIR** | -0.47% | 7.63% | 0.00% | -0.13% | 7.1% |
| 2 | **ANDREW** | 0.92% | 19.13% | 12.61% | 1.32% | 35.4% |
| 3 | **ATCHISON** | -0.51% | 10.95% | -0.46% | -0.70% | 9.9% |
| 4 | **AUDRAIN** | 3.56% | 6.88% | 1.79% | 1.54% | 12.7% |
| 5 | **BARRY** | 10.69% | 0.72% | 0.76% | 8.40% | 12.3% |
| 6 | **BARTON** | 3.72% | -0.49% | 9.21% | 4.92% | 12.7% |
| 7 | **BATES** | 0.86% | 4.96% | 6.61% | 2.68% | 12.9% |
| 8 | **BENTON** | 0.01% | 0.00% | 0.09% | 7.42% | 0.1% |
| 9 | **BOLLINGER** | 0.17% | 0.79% | 10.60% | -0.23% | 11.7% |
| 10 | **BOONE** | 0.26% | 7.77% | 0.41% | 14.81% | 8.5% |
| 11 | **BUCHANAN** | 5.08% | 8.96% | -0.01% | 17.97% | 14.5% |
| 12 | **BUTLER** | 0.91% | 5.32% | 3.15% | 14.66% | 9.6% |
| 13 | **CALDWELL** | 5.85% | 8.50% | -0.03% | 11.77% | 14.8% |
| 14 | **CALLAWAY** | 0.36% | 1.51% | 0.01% | 0.81% | 1.9% |
| 15 | **CAMDEN** | 6.53% | 7.92% | 4.44% | 7.02% | 20.1% |
| 16 | **CAPE GIRARDEAU** | 0.88% | 7.33% | 2.54% | 5.29% | 11.0% |
| 17 | **CARROLL** | 31.73% | -0.36% | -0.27% | -0.12% | 30.9% |
| 18 | **CARTER** | 5.95% | 2.25% | 1.01% | 11.52% | 9.4% |
| 19 | **CASS** | 4.73% | 11.60% | 6.01% | 6.25% | 23.9% |
| 20 | **CEDAR** | 2.99% | 2.98% | 5.60% | -1.01% | 12.0% |
| 21 | **CHARITON** | 4.27% | -0.39% | 2.76% | 3.61% | 6.7% |
| 22 | **CHRISTIAN** | 4.99% | 14.45% | 3.35% | 11.66% | 24.2% |
| 23 | **CLARK** | -0.83% | 0.54% | -0.39% | -0.18% | -0.7% |

** Note: The numbers highlighted indicate change in assessed value below 50% of OFHEO*




*Source: Office of Federal Housing Enterprice Oversight, U.S. Department of Housing and Urban Development. http://www.ofheo.gov (Percentage calculated by PPRC based on 4th quarter to 4th quarter)*

| N | Name | change1999 | change 2001 | change 2003 | change 2005 | 97-03 cum chg |
|---|---|---|---|---|---|---|
| 24 | **CLAY** | 14.46% | 6.09% | 9.79% | 6.68% | 33.3% |
| 25 | **CLINTON** | 10.15% | 0.24% | 8.15% | 4.95% | 19.4% |
| 26 | **COLE** | 7.95% | -0.28% | 10.78% | 7.11% | 19.3% |
| 27 | **COOPER** | 9.31% | 2.12% | 6.65% | 8.21% | 19.0% |
| 28 | **CRAWFORD** | -0.60% | 11.31% | 0.01% | 17.53% | 10.7% |
| 29 | **DADE** | 0.84% | 1.89% | 7.82% | -1.09% | 10.8% |
| 30 | **DALLAS** | 10.08% | 1.13% | 1.87% | 2.19% | 13.4% |
| 31 | **DAVIESS** | 8.21% | -0.46% | 1.41% | 34.46% | 9.2% |
| 32 | **DEKALB** | 22.47% | 0.04% | -0.43% | 11.54% | 22.0% |
| 33 | **DENT** | -0.23% | -1.84% | -0.64% | 25.50% | -2.7% |
| 34 | **DOUGLAS** | -0.68% | -0.60% | -0.44% | 5.25% | -1.7% |
| 35 | **DUNKLIN** | -3.22% | 3.84% | 0.54% | 9.90% | 1.0% |
| 36 | **FRANKLIN** | 5.92% | 5.32% | 4.67% | 12.25% | 16.8% |
| 37 | **GASCONADE** | 8.65% | 8.67% | 5.64% | 10.58% | 24.7% |
| 38 | **GENTRY** | -0.07% | -1.55% | 2.82% | 22.51% | 1.2% |
| 39 | **GREENE** | 0.53% | 7.79% | 0.72% | 10.21% | 9.1% |
| 40 | **GRUNDY** | -0.89% | 0.27% | 23.79% | -0.87% | 23.0% |
| 41 | **HARRISON** | 6.71% | -0.06% | 11.27% | -0.24% | 18.7% |
| 42 | **HENRY** | 0.03% | 3.42% | 10.85% | 4.53% | 14.7% |
| 43 | **HICKORY** | 3.22% | 0.19% | 6.39% | 2.04% | 10.0% |
| 44 | **HOLT** | 28.52% | 0.88% | 1.59% | 12.42% | 31.7% |
| 45 | **HOWARD** | 1.99% | 4.49% | 5.01% | 4.35% | 11.9% |
| 46 | **HOWELL** | 0.32% | 8.43% | -0.19% | 7.85% | 8.6% |
| 47 | **IRON** | -0.19% | 4.45% | -1.05% | 16.44% | 3.2% |
| 48 | **JACKSON** | 10.37% | 5.79% | 13.40% | 13.80% | 32.4% |
| 49 | **JASPER** | 0.21% | 40.29% | -1.16% | 1.02% | 39.0% |

| N | Name | change1999 | change 2001 | change 2003 | change 2005 | 97-03 cum chg |
|---|---|---|---|---|---|---|
| 50 | **JEFFERSON** | 3.29% | 6.73% | 0.96% | 9.34% | 11.3% |
| 51 | **JOHNSON** | 0.88% | 5.24% | 1.06% | 5.03% | 7.3% |
| 52 | **KNOX** | -1.51% | -2.93% | -2.17% | -0.53% | -6.5% |
| 53 | **LACLEDE** | 4.51% | 4.26% | -0.12% | 2.18% | 8.8% |
| 54 | **LAFAYETTE** | 0.74% | 26.89% | 0.71% | 4.18% | 28.7% |
| 55 | **LAWRENCE** | 0.23% | -0.22% | 0.01% | 11.64% | 0.0% |
| 56 | **LEWIS** | 1.34% | -1.32% | -0.25% | -0.20% | -0.2% |
| 57 | **LINCOLN** | 8.07% | 2.90% | 4.45% | 7.10% | 16.1% |
| 58 | **LINN** | 0.26% | 14.21% | 0.21% | 2.26% | 14.7% |
| 59 | **LIVINGSTON** | -0.48% | 13.50% | -0.91% | 9.93% | 11.9% |
| 60 | **MCDONALD** | -0.12% | -0.35% | 7.69% | 7.05% | 7.2% |
| 61 | **MACON** | 12.79% | 7.00% | 0.23% | 1.41% | 21.0% |
| 62 | **MADISON** | 0.17% | 0.75% | 33.80% | 7.18% | 35.0% |
| 63 | **MARIES** | 0.73% | 0.83% | 0.83% | 13.21% | 2.4% |
| 64 | **MARION** | 6.48% | -0.37% | 13.40% | 2.65% | 20.3% |
| 65 | **MERCER** | -0.30% | -4.40% | 2.40% | 1.87% | -2.4% |
| 66 | **MILLER** | 6.46% | 1.21% | 0.09% | 8.99% | 7.8% |
| 67 | **MISSISSIPPI** | 8.12% | 3.71% | -0.01% | 12.25% | 12.1% |
| 68 | **MONITEAU** | 8.02% | 1.92% | 4.61% | 7.56% | 15.2% |
| 69 | **MONROE** | 3.88% | 2.35% | 0.58% | 4.49% | 6.9% |
| 70 | **MONTGOMERY** | 0.09% | 9.37% | -0.30% | 11.99% | 9.1% |
| 71 | **MORGAN** | 0.70% | 17.48% | 0.50% | 25.64% | 18.9% |
| 72 | **NEW MADRID** | 3.51% | 4.18% | 1.95% | 4.50% | 9.9% |
| 73 | **NEWTON** | 2.33% | 6.89% | 3.70% | 2.35% | 13.4% |
| 74 | **NODAWAY** | 18.30% | 3.40% | 0.08% | 0.47% | 22.4% |
| 75 | **OREGON** | 0.94% | 0.97% | 0.76% | 0.75% | 2.7% |

| N | Name | change1999 | change 2001 | change 2003 | change 2005 | 97-03 cum chg |
|---|---|---|---|---|---|---|
| 76 | **OSAGE** | 0.00% | 0.00% | 7.00% | 12.45% | 7.0% |
| 77 | **OZARK** | 2.44% | -2.79% | -0.40% | 0.16% | -0.8% |
| 78 | **PEMISCOT** | 16.19% | 2.78% | 2.04% | 4.26% | 21.9% |
| 79 | **PERRY** | 6.13% | 3.33% | 4.17% | 9.36% | 14.2% |
| 80 | **PETTIS** | 0.19% | 13.53% | 3.92% | 1.68% | 18.2% |
| 81 | **PHELPS** | 0.88% | 8.32% | 0.39% | 1.54% | 9.7% |
| 82 | **PIKE** | 8.77% | -0.46% | 0.10% | 3.57% | 8.4% |
| 83 | **PLATTE** | 1.23% | 4.77% | 6.62% | 4.87% | 13.1% |
| 84 | **POLK** | 1.00% | 5.53% | 0.63% | 1.12% | 7.3% |
| 85 | **PULASKI** | 0.54% | 9.86% | -0.56% | 14.06% | 9.8% |
| 86 | **PUTNAM** | 2.57% | 3.10% | 7.54% | 21.97% | 13.7% |
| 87 | **RALLS** | -0.01% | 9.58% | 0.20% | 6.08% | 9.8% |
| 88 | **RANDOLPH** | 0.73% | 5.41% | 4.87% | 11.65% | 11.4% |
| 89 | **RAY** | -0.03% | 20.20% | 3.02% | 3.70% | 23.8% |
| 90 | **REYNOLDS** | -1.56% | -1.04% | -0.81% | -1.27% | -3.4% |
| 91 | **RIPLEY** | 0.09% | 8.90% | -0.90% | 5.46% | 8.0% |
| 92 | **ST. CHARLES** | 10.40% | 11.54% | 14.93% | 13.50% | 41.5% |
| 93 | **ST. CLAIR** | -1.21% | 3.25% | -0.51% | 0.65% | 1.5% |
| 94 | **ST. FRANCOIS** | 2.41% | 19.36% | -0.16% | 3.46% | 22.0% |
| 95 | **STE. GENEVIEVE** | 7.84% | 5.57% | 4.02% | 10.19% | 18.4% |
| 96 | **ST. LOUIS** | 4.95% | 14.46% | 6.48% | 13.17% | 27.9% |
| 97 | **SALINE** | -0.13% | 2.32% | 15.03% | 3.11% | 17.5% |
| 98 | **SCHUYLER** | -0.07% | -0.61% | -0.27% | 0.00% | -0.9% |
| 99 | **SCOTLAND** | -0.01% | -0.16% | -0.33% | -0.01% | -0.5% |
| 100 | **SCOTT** | 0.17% | 7.64% | 1.02% | 4.00% | 8.9% |

| N | Name | change1999 | change 2001 | change 2003 | change 2005 | 97-03 cum chg |
|---|---|---|---|---|---|---|
| 101 | **SHANNON** | 0.24% | 6.06% | -0.11% | -0.13% | 6.2% |
| 102 | **SHELBY** | -0.62% | 6.20% | 1.73% | 3.20% | 7.4% |
| 103 | **STODDARD** | 5.47% | 6.85% | 0.74% | 4.95% | 13.5% |
| 104 | **STONE** | 1.53% | 1.25% | 1.26% | 8.20% | 4.1% |
| 105 | **SULLIVAN** | -0.22% | 1.54% | -1.47% | 2.36% | -0.2% |
| 106 | **TANEY** | 0.63% | 2.51% | 2.46% | 2.96% | 5.7% |
| 107 | **TEXAS** | -1.90% | -0.28% | -0.30% | 8.63% | -2.5% |
| 108 | **VERNON** | 6.19% | 4.52% | 3.94% | 6.23% | 15.4% |
| 109 | **WARREN** | 3.29% | 5.33% | 5.06% | 11.93% | 14.3% |
| 110 | **WASHINGTON** | -0.47% | 1.02% | -2.29% | 10.32% | -1.8% |
| 111 | **WAYNE** | 4.24% | 4.74% | -0.20% | -0.55% | 9.0% |
| 112 | **WEBSTER** | 0.25% | 0.30% | 0.54% | 2.84% | 1.1% |
| 113 | **WORTH** | -1.54% | -0.75% | -0.34% | 0.12% | -2.6% |
| 114 | **WRIGHT** | 1.40% | -0.92% | -0.92% | 12.66% | -0.5% |
| 115 | **ST. LOUIS CITY** | 3.42% | 6.74% | 13.81% | 32.95% | 25.6% |

*Source: 1999 - 2003 State Tax Commission (STC)*
*2005 - PPRC Calculation based on STC formula .*
*Cumulative 1997 - 2003: Calculated by PPRC*

## Appendix Table C: STC Ratio Study Data (2003) with PPRC Indicators (Residential and Commercial)

| RESIDENTIAL ALTERNATIVE RATIO ANALYSIS - 2004 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| RATIO - SCHOOL FUNDING PURPOSES | | | | | | | | | |
| | | | STATISTICAL INFERENCES | | | | | PPRC Analysis | |
| | PRELIMINARY RATIO | | | | | | | | |
| COUNTY | MEDIAN | COD | Median RATIO | C O D | RATIO TO BE USED | COD<=25 | MID-POINT | Final | Used |
| ADAIR | 20.14 | 40.21 | 20.14 | 40.21 | 20.14 | | | | |
| ANDREW | 19.31 | 34.78 | 19.31 | 34.78 | 19.31 | | | | |
| ATCHISON | 18.79 | 30.44 | 18.79 | 30.44 | 18.79 | | | | |
| AUDRAIN | 19.01 | 15.47 | 19.01 | 15.47 | 19.01 | | | | |
| BARRY | 17.85 | 15.06 | 18.24 | 12.57 | 18.24 | | | Increase | Final Ratio |
| BARTON | 18.86 | 20.63 | 18.86 | 20.63 | 18.86 | | | | |
| BATES | 18.31 | 27.03 | 18.31 | 27.03 | 18.31 | | | | |
| BENTON | 23.33 | 58.83 | 22.79 | 55.89 | 22.79 | | | Decrease | Final Ratio |
| BOLLINGER | 20.55 | 49.31 | 20.55 | 49.31 | 20.55 | | | | |
| BOONE | 18.76 | 11.02 | 18.76 | 11.02 | 18.76 | | | | |
| BUCHANAN | 15.16 | 26.90 | 17.11 | 22.52 | 18.10 | 1 | | Increase | COD |
| BUTLER | 18.32 | 11.36 | 18.32 | 11.36 | 18.32 | | | | |
| CALDWELL | 20.00 | 30.46 | 20.00 | 27.02 | 20.00 | | | | |
| CALLAWAY | 17.90 | 37.57 | 18.06 | 35.88 | 18.06 | | | Increase | Final Ratio |
| CAMDEN | 18.70 | 25.01 | 18.70 | 25.01 | 18.70 | | | | |
| CAPE GIRARDEAU | 19.10 | 23.13 | 19.10 | 23.13 | 19.10 | | | | |
| CARROLL | 19.00 | 28.83 | 19.00 | 28.83 | 19.00 | | | | |
| CARTER | 17.60 | 29.39 | 19.00 | 24.25 | 19.00 | | | Increase | Final Ratio |
| CASS | 19.53 | 20.31 | 19.53 | 20.31 | 19.53 | | | | |
| CEDAR | 18.55 | 16.22 | 18.55 | 16.22 | 18.55 | | | | |

| COUNTY | MEDIAN | COD | Median RATIO | C O D | RATIO TO BE USED | COD<=25 | MID-POINT | Final | Used |
|---|---|---|---|---|---|---|---|---|---|
| CHARITON | 18.47 | 23.78 | 19.00 | 22.88 | 19.00 | | | Increase | Final Ratio |
| CHRISTIAN | 18.73 | 16.97 | 18.59 | 15.28 | 18.59 | | | Decrease | Final Ratio |
| CLARK | 18.54 | 87.71 | 18.54 | 87.71 | 18.54 | | | | |
| CLAY | 18.86 | 13.36 | 18.86 | 13.36 | 18.86 | | | | |
| CLINTON | 19.84 | 139.73 | 19.84 | 139.73 | 19.84 | | | | |
| COLE | 19.77 | 17.24 | 19.77 | 17.24 | 19.77 | | | | |
| COOPER | 19.44 | 11.81 | 19.44 | 11.81 | 19.44 | | | | |
| CRAWFORD | 18.60 | 30.11 | 18.60 | 30.11 | 18.60 | | | | |
| DADE | 16.98 | 24.16 | 16.98 | 24.16 | 18.10 | 1 | | | COD |
| DALLAS | 19.51 | 18.82 | 19.51 | 18.82 | 19.51 | | | | |
| DAVIESS | 18.28 | 21.98 | 18.28 | 21.98 | 18.28 | | | | |
| DEKALB | 18.56 | 42.75 | 18.56 | 42.75 | 18.56 | | | | |
| DENT | 19.24 | 18.56 | 19.24 | 18.56 | 19.24 | | | | |
| DOUGLAS | 18.21 | 13.74 | 18.21 | 13.09 | 18.21 | | | | |
| DUNKLIN | 18.58 | 7.23 | 18.58 | 7.23 | 18.58 | | | | |
| FRANKLIN | 19.70 | 12.03 | 19.70 | 12.03 | 19.70 | | | | |
| GASCONADE | 19.72 | 25.17 | 19.72 | 25.17 | 19.72 | | | | |
| GENTRY | 18.29 | 29.44 | 18.29 | 29.44 | 18.29 | | | | |
| GREENE | 18.59 | 11.46 | 18.59 | 11.46 | 18.59 | | | | |
| GRUNDY | 18.86 | 50.17 | 18.85 | 25.72 | 18.85 | | | | |
| HARRISON | 22.00 | 42.43 | 22.00 | 42.43 | 22.00 | | | | |
| HENRY | 19.33 | 13.30 | 19.33 | 13.30 | 19.33 | | | | |
| HICKORY | 18.06 | 18.22 | 18.06 | 18.22 | 18.10 | 1 | | Increase | COD |
| HOLT | 19.29 | 42.39 | 19.29 | 42.39 | 19.29 | | | | |
| HOWARD | 19.20 | 22.77 | 19.20 | 22.77 | 19.20 | | | | |
| HOWELL | 18.46 | 14.14 | 18.55 | 12.77 | 18.55 | | | Increase | Final Ratio |
| IRON | 19.00 | 43.45 | 19.00 | 43.45 | 19.00 | | | | |
| JACKSON | 18.38 | 17.44 | 18.38 | 17.44 | 18.38 | | | | |

| COUNTY | MEDIAN | COD | Median RATIO | C O D | RATIO TO BE USED | COD<=25 | MID-POINT | Final | Used |
|---|---|---|---|---|---|---|---|---|---|
| JASPER | 20.24 | 28.99 | 20.24 | 28.99 | 20.24 | | | | |
| JEFFERSON | 15.97 | 44.58 | 17.33 | 36.63 | 17.46 | | 1 | Increase | Midpoint |
| JOHNSON | 18.39 | 25.17 | 18.39 | 25.17 | 18.39 | | | | |
| KNOX | 20.93 | 81.69 | 20.93 | 81.69 | 20.93 | | | | |
| LACLEDE | 18.77 | 17.26 | 18.77 | 17.26 | 18.77 | | | | |
| LAFAYETTE | 19.33 | 63.83 | 19.33 | 63.83 | 19.33 | | | | |
| LAWRENCE | 18.11 | 14.42 | 18.11 | 14.42 | 18.11 | | | | |
| LEWIS | 19.38 | 40.01 | 19.38 | 40.01 | 19.38 | | | | |
| LINCOLN | 18.64 | 11.66 | 18.64 | 11.66 | 18.64 | | | | |
| LINN | 20.37 | 24.42 | 20.37 | 24.42 | 20.37 | | | | |
| LIVINGSTON | 18.95 | 13.14 | 18.95 | 13.14 | 18.95 | | | | |
| MCDONALD | 19.19 | 20.22 | 19.19 | 20.22 | 19.19 | | | | |
| MACON | 17.89 | 24.44 | 18.72 | 23.24 | 18.72 | | | Increase | Final Ratio |
| MADISON | 18.40 | 24.22 | 18.40 | 23.33 | 18.40 | | | | |
| MARIES | 19.02 | 25.88 | 19.02 | 25.88 | 19.02 | | | | |
| MARION | 18.72 | 13.77 | 18.87 | 14.19 | 18.87 | | | Increase | Final Ratio |
| MERCER | 19.54 | 31.68 | 19.54 | 31.68 | 19.54 | | | | |
| MILLER | 18.22 | 46.51 | 18.22 | 46.51 | 18.22 | | | | |
| MISSISSIPPI | 18.29 | 44.65 | 18.29 | 44.65 | 18.29 | | | | |
| MONITEAU | 18.06 | 17.76 | 18.06 | 17.76 | 18.10 | 1 | | Increase | COD |
| MONROE | 19.21 | 14.35 | 19.21 | 14.35 | 19.21 | | | | |
| MONTGOMERY | 18.87 | 9.12 | 18.87 | 9.12 | 18.87 | | | | |
| MORGAN | 18.36 | 30.26 | 18.36 | 30.26 | 18.36 | | | | |
| NEW MADRID | 18.15 | 8.51 | 19.29 | 7.56 | 19.29 | | | Increase | Final Ratio |
| NEWTON | 18.28 | 21.03 | 18.52 | 19.01 | 18.52 | | | Increase | Final Ratio |
| NODAWAY | 14.86 | 33.72 | 15.57 | 29.83 | 16.43 | | 1 | Increase | Midpoint |
| OREGON | 17.97 | 34.04 | 18.60 | 27.01 | 18.60 | | | Increase | Final Ratio |
| OSAGE | 18.13 | 30.26 | 18.13 | 30.26 | 18.13 | | | | |
| OZARK | 18.40 | 18.19 | 18.40 | 18.19 | 18.40 | | | | |

| COUNTY | MEDIAN | COD | Median RATIO | C O D | RATIO TO BE USED | COD<=25 | MID-POINT | Final | Used |
|---|---|---|---|---|---|---|---|---|---|
| PEMISCOT | 18.13 | 13.47 | 18.13 | 13.47 | 18.13 | | | | |
| PERRY | 19.56 | 40.28 | 19.56 | 40.28 | 19.56 | | | | |
| PETTIS | 19.85 | 32.35 | 19.85 | 30.43 | 19.85 | | | | |
| PHELPS | 17.68 | 26.78 | 17.84 | 24.32 | 18.10 | 1 | | Increase | COD |
| PIKE | 16.58 | 20.69 | 18.59 | 12.46 | 18.59 | | | Increase | Final Ratio |
| PLATTE | 18.42 | 15.02 | 18.42 | 15.02 | 18.42 | | | | |
| POLK | 18.06 | 19.86 | 18.06 | 19.86 | 18.10 | 1 | | | COD |
| PULASKI | 16.06 | 29.48 | 16.84 | 27.76 | 16.84 | | | Increase | Final Ratio |
| PUTNAM | 19.10 | 16.15 | 19.10 | 16.15 | 19.10 | | | | |
| RALLS | 18.39 | 61.15 | 18.39 | 61.15 | 18.39 | | | | |
| RANDOLPH | 16.97 | 22.99 | 16.97 | 23.31 | 18.10 | 1 | | | COD |
| RAY | 21.26 | 26.08 | 21.26 | 26.08 | 21.26 | | | | |
| REYNOLDS | 20.32 | 46.49 | 20.32 | 46.49 | 20.32 | | | | |
| RIPLEY | 19.38 | 13.13 | 19.38 | 13.13 | 19.38 | | | | |
| ST. CHARLES | 18.00 | 8.68 | 18.01 | 6.41 | 18.10 | 1 | | Increase | COD |
| ST. CLAIR | 20.00 | 15.63 | 20.00 | 15.63 | 20.00 | | | | |
| ST. FRANCOIS | 19.37 | 35.49 | 19.37 | 35.49 | 19.37 | | | | |
| STE. GENEVIEVE | 21.21 | 30.60 | 21.21 | 29.23 | 21.21 | | | | |
| ST. LOUIS | 17.09 | 10.27 | 17.18 | 10.50 | 17.89 | 1 | | Increase | COD |
| SALINE | 18.30 | 20.75 | 18.30 | 20.63 | 18.30 | | | | |
| SCHUYLER | 19.50 | 37.35 | 19.50 | 37.35 | 19.50 | | | | |
| SCOTLAND | 18.29 | 64.73 | 18.29 | 64.73 | 18.29 | | | | |
| SCOTT | 18.71 | 7.10 | 18.71 | 7.10 | 18.71 | | | | |
| SHANNON | 17.57 | 19.65 | 18.23 | 16.88 | 18.23 | | | Increase | Final Ratio |
| SHELBY | 19.35 | 32.02 | 19.35 | 32.02 | 19.35 | | | | |
| STODDARD | 18.62 | 8.43 | 18.62 | 8.43 | 18.62 | | | | |
| STONE | 18.51 | 16.21 | 18.51 | 16.21 | 18.51 | | | | |
| SULLIVAN | 18.18 | 15.60 | 18.18 | 15.60 | 18.18 | | | | |

| COUNTY | MEDIAN | COD | **Median RATIO** | **C O D** | **RATIO TO BE USED** | **COD<=25** | **MID-POINT** | **Final** | **Used** |
|---|---|---|---|---|---|---|---|---|---|
| TANEY | 19.00 | 29.53 | 19.00 | 29.53 | 19.00 | | | | |
| TEXAS | 15.70 | 31.63 | 17.50 | 27.42 | 17.50 | | | Increase | Final Ratio |
| VERNON | 17.12 | 21.10 | 18.66 | 17.36 | 18.66 | | | Increase | Final Ratio |
| WARREN | 18.48 | 14.55 | 18.48 | 14.55 | 18.48 | | | | |
| WASHINGTON | 18.06 | 32.05 | 18.33 | 28.32 | 18.33 | | | Increase | Final Ratio |
| WAYNE | 19.00 | 19.01 | 19.00 | 19.01 | 19.00 | | | | |
| WEBSTER | 18.39 | 10.67 | 18.39 | 10.67 | 18.39 | | | | |
| WORTH | 19.28 | 25.66 | 19.28 | 25.66 | 19.28 | | | | |
| WRIGHT | 18.05 | 19.83 | 18.29 | 18.25 | 18.29 | | | Increase | Final Ratio |
| ST. LOUIS CITY | 17.17 | 17.64 | 17.17 | 17.64 | 18.10 | 1 | | | COD |
| | | | | | | - 10 | - 2 | | |

**COMMERCIAL ALTERNATIVE**
**RATIO ANALYSIS - 2004**

**STATISTICAL INFERENCES**

| PRELIMINARY RATIO | | | | | | | | PPRC Analysis | |
|---|---|---|---|---|---|---|---|---|---|
| COUNTY | MEDIAN | COD | **MEDIAN RATIO** | **C O D** | **RATIO TO BE USED** | **COD<=25** | **MID-POINT** | **Final** | **Used** |
| ADAIR | 36.24 | 19.85 | 36.24 | 19.85 | 36.24 | | | | |
| ANDREW | 27.81 | 40.38 | 30.41 | 36.77 | 30.41 | | | Increase | Final Ratio |
| ATCHISON | 31.96 | 55.59 | 31.96 | 55.59 | 31.96 | | | | |
| AUDRAIN | 30.60 | 34.92 | 30.60 | 33.45 | 30.60 | | | | |
| BARRY | 33.37 | 47.49 | 33.37 | 47.49 | 33.37 | | | | |
| BARTON | 32.00 | 52.84 | 32.00 | 52.84 | 32.00 | | | | |
| BATES | 32.32 | 32.81 | 32.32 | 32.81 | 32.32 | | | | |
| BENTON | 32.21 | 45.44 | 32.21 | 45.44 | 32.21 | | | | |
| BOLLINGER | 34.60 | 57.99 | 34.60 | 57.99 | 34.60 | | | | |
| BOONE | 30.71 | 71.40 | 30.71 | 71.40 | 30.71 | | | | |
| BUCHANAN | 31.83 | 62.30 | 31.83 | 62.30 | 31.83 | | | | |
| BUTLER | 31.70 | 22.26 | 31.70 | 22.26 | 31.70 | | | | |
| CALDWELL | 30.84 | 32.13 | 30.84 | 32.13 | 30.84 | | | | |
| CALLAWAY | 32.00 | 25.70 | 32.00 | 25.70 | 32.00 | | | | |
| CAMDEN | 29.51 | 39.52 | 29.51 | 39.84 | 30.40 | | 1 | | COD |
| CAPE GIRARDEAU | 31.66 | 13.92 | 31.66 | 13.92 | 31.66 | | | | |
| CARROLL | 30.99 | 52.85 | 30.99 | 51.53 | 30.99 | | | | |
| CARTER | 23.57 | 53.74 | 25.52 | 43.89 | 27.28 | | 1 | Increase | Midpoint |
| CASS | 33.24 | 127.16 | 33.24 | 127.16 | 33.24 | | | | |
| CEDAR | 32.67 | 43.01 | 32.67 | 43.01 | 32.67 | | | | |
| CHARITON | 22.07 | 64.59 | 29.29 | 48.66 | 29.29 | | | Increase | Final Ratio |

| COUNTY | MEDIAN | COD | **MEDIAN RATIO** | **C O D** | **RATIO TO BE USED** | **COD<=25** | **MID-POINT** | **Final** | **Used** |
|---|---|---|---|---|---|---|---|---|---|
| CHRISTIAN | 27.65 | 88.58 | 27.65 | 39.74 | 28.00 | | 1 | | Midpoint |
| CLARK | 32.02 | 20.89 | 32.02 | 20.89 | 32.02 | | | | |
| CLAY | 30.75 | 28.46 | 30.75 | 28.46 | 30.75 | | | | |
| CLINTON | 32.14 | 70.15 | 32.14 | 70.15 | 32.14 | | | | |
| COLE | 34.91 | 40.95 | 32.13 | 24.11 | 32.13 | | | Decrease | Final Ratio |
| COOPER | 27.77 | 49.52 | 29.16 | 40.95 | 29.16 | | | Increase | Final Ratio |
| CRAWFORD | 35.93 | 32.12 | 35.93 | 32.12 | 35.93 | | | | |
| DADE | 32.09 | 109.94 | 32.09 | 109.94 | 32.09 | | | | |
| DALLAS | 35.49 | 48.64 | 35.49 | 48.64 | 35.49 | | | | |
| DAVIESS | 24.90 | 64.28 | 30.44 | 48.97 | 30.44 | | | Increase | Final Ratio |
| DEKALB | 24.95 | 51.32 | 28.68 | 40.38 | 28.68 | | | Increase | Final Ratio |
| DENT | 32.92 | 19.14 | 32.92 | 19.14 | 32.92 | | | | |
| DOUGLAS | 35.93 | 21.53 | 35.93 | 21.53 | 35.93 | | | | |
| DUNKLIN | 30.32 | 16.44 | 30.32 | 16.44 | 30.40 | 1 | | | Midpoint |
| FRANKLIN | 30.67 | 35.52 | 30.67 | 35.52 | 30.67 | | | | |
| GASCONADE | 30.37 | 33.55 | 30.37 | 33.55 | 30.40 | | 1 | | Midpoint |
| GENTRY | 30.42 | 49.52 | 30.81 | 47.85 | 30.81 | | | Increase | Final Ratio |
| GREENE | 32.07 | 16.45 | 32.07 | 16.45 | 32.07 | | | | |
| GRUNDY | 32.58 | 56.46 | 32.14 | 58.19 | 32.14 | | | Decrease | Final Ratio |
| HARRISON | 27.02 | 56.64 | 28.67 | 52.87 | 28.67 | | | Increase | Final Ratio |
| HENRY | 32.38 | 24.32 | 32.38 | 24.32 | 32.38 | | | | |
| HICKORY | 29.70 | 38.13 | 29.70 | 38.03 | 29.70 | | | | |
| HOLT | 30.68 | 60.78 | 30.68 | 60.78 | 30.68 | | | | |
| HOWARD | 27.73 | 39.25 | 28.01 | 36.37 | 28.01 | | | Increase | Final Ratio |
| HOWELL | 29.70 | 29.43 | 30.21 | 25.11 | 30.21 | | | Increase | Final Ratio |
| IRON | 26.71 | 36.42 | 31.79 | 30.03 | 31.79 | | | Increase | Final Ratio |
| JACKSON | 30.73 | 44.72 | 30.73 | 44.72 | 30.73 | | | | |
| JASPER | 26.72 | 65.63 | 29.98 | 46.62 | 29.98 | | | Increase | Final Ratio |
| JEFFERSON | 33.78 | 27.29 | 33.78 | 22.27 | 33.78 | | | | |

| COUNTY | MEDIAN | COD | MEDIAN RATIO | C O D | RATIO TO BE USED | COD<=25 | MID-POINT | Initial | Final | Used |
|---|---|---|---|---|---|---|---|---|---|---|
| JOHNSON | 30.56 | 18.58 | 32.16 | 17.52 | 32.16 | | | | Increase | Final Ratio |
| KNOX | 32.00 | 30.40 | 32.00 | 30.40 | 32.00 | | | | | |
| LACLEDE | 33.13 | 32.04 | 33.13 | 32.04 | 33.13 | | | | | |
| LAFAYETTE | 29.55 | 45.86 | 29.55 | 45.86 | 29.55 | | | | | |
| LAWRENCE | 32.40 | 47.04 | 32.40 | 47.04 | 32.40 | | | | | |
| LEWIS | 32.00 | 41.84 | 32.00 | 41.84 | 32.00 | | | | | |
| LINCOLN | 31.36 | 47.67 | 31.36 | 47.67 | 31.36 | | | | | |
| LINN | 32.00 | 32.89 | 32.00 | 32.89 | 32.00 | | | | | |
| LIVINGSTON | 33.05 | 35.13 | 33.05 | 35.13 | 33.05 | | | | | |
| MCDONALD | 30.64 | 90.14 | 29.20 | 62.52 | 30.40 | | 1 | | Decrease | Midpoint |
| MACON | 27.78 | 36.40 | 28.77 | 35.73 | 28.77 | | | | Increase | Final Ratio |
| MADISON | 33.07 | 43.55 | 33.07 | 43.55 | 33.07 | | | | | |
| MARIES | 29.44 | 28.53 | 32.01 | 26.50 | 32.01 | | | | Increase | Final Ratio |
| MARION | 32.51 | 23.99 | 32.51 | 23.99 | 32.51 | | | | | |
| MERCER | 32.15 | 43.54 | 32.15 | 43.54 | 32.15 | | | | | |
| MILLER | 31.95 | 58.93 | 31.95 | 58.93 | 31.95 | | | | | |
| MISSISSIPPI | 31.40 | 51.23 | 31.40 | 51.23 | 31.40 | | | | | |
| MONITEAU | 30.16 | 30.16 | 30.16 | 30.16 | 30.16 | | | | | |
| MONROE | 31.23 | 25.59 | 31.23 | 25.59 | 31.23 | | | | | |
| MONTGOMERY | 31.93 | 44.75 | 31.93 | 35.25 | 31.93 | | | | | |
| MORGAN | 30.10 | 49.35 | 31.24 | 45.82 | 31.24 | | | | Increase | Final Ratio |
| NEW MADRID | 32.41 | 23.86 | 32.41 | 23.86 | 32.41 | | | | | |
| NEWTON | 29.62 | 50.36 | 32.47 | 38.53 | 32.47 | | | | Increase | Final Ratio |
| NODAWAY | 27.35 | 60.54 | 31.63 | 48.18 | 31.63 | | | | Increase | Final Ratio |
| OREGON | 30.65 | 23.57 | 30.65 | 22.87 | 30.65 | | | | | |
| OSAGE | 33.26 | 57.34 | 33.26 | 56.70 | 33.26 | | | | | |
| OZARK | 31.96 | 34.84 | 31.96 | 34.84 | 31.96 | | | | | |
| PEMISCOT | 32.00 | 30.29 | 32.00 | 30.29 | 32.00 | | | | | |
| PERRY | 33.00 | 36.01 | 33.00 | 36.01 | 33.00 | | | | | |

| COUNTY | MEDIAN | COD | **MEDIAN RATIO** | **C O D** | **RATIO TO BE USED** | **COD<=25** | **MID-POINT** | **Initial** | **Final** | **Used** |
|---|---|---|---|---|---|---|---|---|---|---|
| PETTIS | 26.48 | 31.83 | 26.70 | 32.65 | 27.84 | | 1 | | Increase | Midpoint |
| PHELPS | 33.80 | 63.23 | 33.80 | 63.23 | 33.80 | | | | | |
| PIKE | 32.00 | 43.86 | 32.00 | 43.86 | 32.00 | | | | | |
| PLATTE | 32.25 | 88.23 | 32.25 | 88.23 | 32.25 | | | | | |
| POLK | 32.06 | 54.23 | 32.06 | 54.23 | 32.06 | | | | | |
| PULASKI | 29.84 | 74.52 | 32.07 | 55.20 | 32.07 | | | | Increase | Final Ratio |
| PUTNAM | 33.68 | 24.87 | 33.68 | 24.87 | 33.68 | | | | | |
| RALLS | | | 31.78 | 28.25 | 31.78 | | | | | |
| RANDOLPH | 33.29 | 72.42 | 33.29 | 72.42 | 33.29 | | | | | |
| RAY | 31.61 | 25.38 | 31.61 | 25.38 | 31.61 | | | | | |
| REYNOLDS | 32.28 | 160.31 | 32.28 | 160.31 | 32.28 | | | | | |
| RIPLEY | 31.41 | 26.20 | 31.41 | 26.20 | 31.41 | | | | | |
| ST. CHARLES | 29.26 | 76.81 | 30.17 | 83.82 | 30.17 | | | | Increase | Final Ratio |
| ST. CLAIR | 32.01 | 25.04 | 32.01 | 25.04 | 32.01 | | | | | |
| ST. FRANCOIS | 31.95 | 21.60 | 31.95 | 21.60 | 31.95 | | | | | |
| STE. GENEVIEVE | 31.83 | 45.92 | 31.83 | 45.92 | 31.83 | | | | | |
| ST. LOUIS | 32.59 | 31.36 | 32.59 | 29.18 | 32.59 | | | | | |
| SALINE | 32.22 | 29.63 | 32.29 | 27.38 | 32.29 | | | | | |
| SCHUYLER | 36.89 | 32.94 | 36.89 | 32.94 | 36.89 | | | | | |
| SCOTLAND | 31.99 | 35.92 | 31.99 | 35.92 | 31.99 | | | | | |
| SCOTT | 30.26 | 17.46 | 30.26 | 17.46 | 30.40 | 1 | | | | COD |
| SHANNON | 33.47 | 47.56 | 33.47 | 47.56 | 33.47 | | | | | |
| SHELBY | 33.24 | 24.95 | 33.24 | 24.95 | 33.24 | | | | | |
| STODDARD | 31.41 | 13.27 | 31.41 | 13.27 | 31.41 | | | | | |
| STONE | 22.41 | 56.71 | 23.37 | 56.18 | 23.37 | | | | Increase | Final Ratio |
| SULLIVAN | 32.59 | 23.96 | 32.59 | 23.96 | 32.59 | | | | | |
| TANEY | 33.81 | 140.95 | 34.00 | 127.88 | 34.00 | | | | Increase | Final Ratio |
| TEXAS | 30.48 | 27.41 | 30.48 | 25.39 | 30.48 | | | | | |

| COUNTY | MEDIAN | COD | **MEDIAN RATIO** | **C O D** | **RATIO TO BE USED** | **COD<=25** | **MID-POINT** | **Initial** | **Final** | **Used** |
|---|---|---|---|---|---|---|---|---|---|---|
| VERNON | 32.50 | 25.48 | 32.50 | 25.48 | 32.50 | | | | | |
| WARREN | 34.19 | 55.28 | 33.73 | 51.99 | 33.73 | | | | Decrease | Final Ratio |
| WASHINGTON | 27.83 | 33.74 | 28.79 | 32.57 | 29.97 | | 1 | | Increase | Midpoint |
| WAYNE | 28.48 | 37.27 | 31.37 | 33.40 | 31.37 | | | | Increase | Final Ratio |
| WEBSTER | 32.59 | 21.42 | 32.59 | 21.42 | 32.59 | | | | | |
| WORTH | 35.27 | 27.50 | 35.27 | 27.50 | 35.27 | | | | | |
| WRIGHT | 32.02 | 28.56 | 32.02 | 28.56 | 32.02 | | | | | |
| ST. LOUIS CITY | 29.90 | 56.31 | 29.90 | 56.31 | 30.40 | | 1 | | | Midpoint |
| | | | | | | - 2 | - 8 | | | |

*Source: STC Ratio Study Data for 2003*
*PPRC analysis based on STC data.*

*Note: 10 of the 115 counties got COD bonus and 2 got midpoint bonus for residential assessment.
2 of the 115 counties got COD bonus and 8 got midpoint bonus for commercial assessment.
I = Increased ratio from initial median to final median, D= Decreased ratio from Initial median to final median.