2003 Commercial Ratio Study
of St. Louis County

PPRC submarkets created by combining CoStar Group Inc. submarkets, as needed
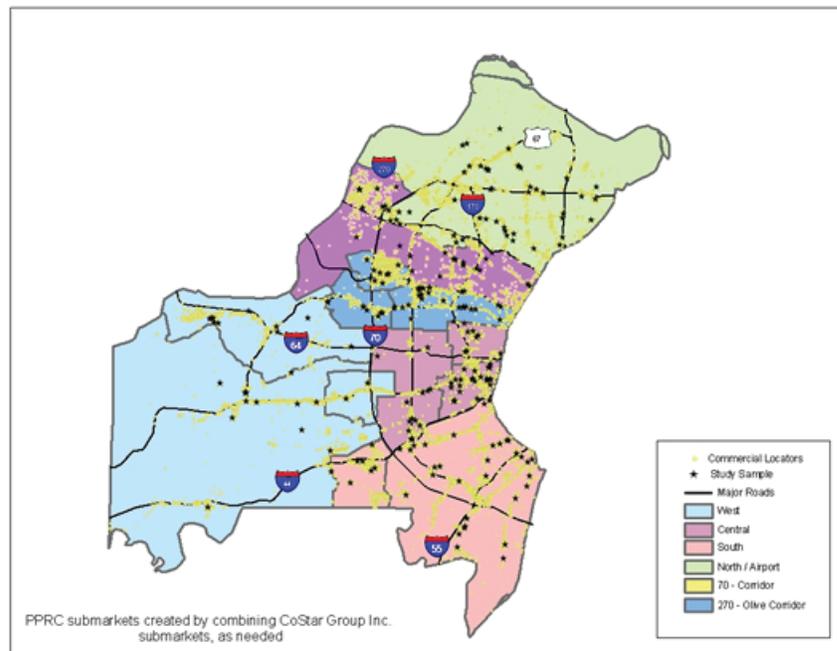
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PUBLIC POLICY RESEARCH CENTER

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REPORT SUMMARY

The Joseph C. Sansone Company (Sansone) contracted with the Curators of the University of Missouri to perform a sales ratio study regarding commercial properties within St. Louis County as of January 1, 2003. This study was performed by the Public Policy Research Center of the University of Missouri – St. Louis, with consultation and oversight from Richard Almy.

The research was conducted to comply with the Standards of the International Association of Assessing Officers as well as with University standards. In order to assure this compliance, certain files are provided as attachments to this report. These include all the files obtained from St. Louis County that were used for this report. We further supply copies of all key files including: the file of all common properties, the final study file fully coded, the initial sales file, the final fully coded sales file, etc. We have also provided logs that describe each of these files. With this data, a knowledgeable party is able to fully examine or replicate our results.

The results show that the relative level of overall assessment is substantially below Missouri's requirement that assessments represent 32% of market value. Instead, our findings conclude that the actual level of assessment in the population is highly likely to fall within a range between 24 and 26%, with 25% (78% of market value) as the best point estimate.

This study was conducted with the benefit of substantial data and other resources that often are not available for such studies. We believe our results to be highly reliable.

Section I. Introduction

This sales ratio study, conducted by the Public Policy Research Center (PPRC), with the consultation and supervision of Richard Almy, complies and conforms to the 1999 *Standard on Ratio Studies* (Standard) issued by the International Association of Assessing Officers (IAAO).

1. **Study Design:** There are many purposes for ratio studies and each may be conducted under various constraints. The specific purpose and constraints of a particular study influence the study design. These purposes and constraints are discussed in this subsection.

    a. **Purpose:** The purpose of this study is to determine the level of assessment of commercial properties in St. Louis County (County) as of January 1, 2003 (study date). The study was commissioned to determine whether appeals based on discrimination are supportable. This specific purpose influences the selection of stratification approaches, appropriate weighting, the proper measure of central tendency and it suggests a high level of statistical rigor – all of which are discussed within this report. For this report's purpose, measurements of horizontal and vertical inequity are less important than measures of central tendency. Nevertheless, such measures of dispersion are calculated and reported, though discussion of those results in the body of this report is minimal.

    b. **Constraints:** Often data, time or budget limitations can constrain the design or methodological rigor of a ratio study. Neither the design, nor the methodology for this study was constrained by data, time or budget limitations.

    c. **Methodological Rigor:** Besides conforming with the Standard, as well as Missouri law and practice, PPRC used a level of methodological rigor and data scrutiny that exceeds the requirements of the Standard and a level that is more rigorous than studies performed by most oversight agencies (Dornfest, 2003).

2. **Experience:** The PPRC has conducted 35 ratio studies in Missouri since 2004. These studies have been conducted for a variety of purposes under a variety of constraints. This experience has provided PPRC with valuable insight into the Missouri assessment process. Furthermore, the variety and quantity of studies PPRC has conducted in St. Louis County have allowed it to become familiar with their data. In addition to the studies the PPRC has conducted, its researchers have reviewed dozens of studies performed by state authorities and other experts around the U.S. The researchers have also thoroughly studied several state ratio study procedure manuals and dozens of professional articles relating to issues involved in conducting these studies.

    The study was supervised by Richard Almy, who as a former IAAO official and as an independent consultant, has conducted numerous ratio studies and contributed to the IAAO Standard. Additionally, he has evaluated a number of ratio study programs for states.

3. **Independent Study:** The PPRC reports to the Provost and Vice Chancellor for Academic Affairs at UMSL and complies with the policies of the Office of Research Administration. Accordingly, research is conducted to meet the highest standards of integrity and professionalism. To demonstrate that this study meets these standards, all files containing the original data and final calculations and coding are available. This allows an independent audit or repeat of the study. The client did not attempt to influence procedures or results.

Section II. Producing Valid Results

The purpose of a ratio study is to produce statistically valid inferences about the entire population of properties based on an examination of a sample of properties. Several requirements must be satisfied in order to make valid inferences. The Standard states: "In general, a ratio study is valid to the extent that the sample is *representative* of the population…To the extent that any ratio study is based on a representative sample, the statistical measures computed from the study are valid." However, "[b]ecause sales do not represent true random samples, extra care must be taken to ensure representativeness (Standard, Section 5.5). In a later section, this study demonstrates how this aspect of representativeness (proportionality) was achieved. The Standard provides further details on the three requirements for achieving a representative sample, which are discussed below (Standard, Section 5.5.1):

1. **<u>Comparable Valuation for Sold and Unsold Parcels</u>**: Comparable valuation requires that sold properties are assessed in similar fashion and at similar rates as unsold properties. This condition is normally satisfied unless the assessor engages in a practice known as sales chasing whereby assessments for sold properties are adjusted using information directly from the market (usually in the form of sales prices), but comparable unsold properties are not. This study analyzes whether sold and unsold properties were comparably valued using methodologies suggested by the Standard. The analysis (in Section V and the Appendix) demonstrates that sold and unsold parcels were comparably valued.

2. **<u>Proportionality</u>[1]:** Proportionality requires that "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. (Standard, Section 5.5.1)." In other words, the distribution of properties in the sample should be similar to the distribution of properties in the population with respect to important attributes such as location and use. This study's sample is drawn from sales reported by the recording of a deed and subsequently entered into the County sale file. As mentioned in the introductory paragraph of this Section, sales are not true random samples. Therefore, this study examines whether the resultant sample is nevertheless sufficiently representative. Where the sample is not sufficiently representative of the population, corrective measures (stratification and weighting) recommended by the IAAO are used (Standard, Section 5.5)

3. **<u>Market Value</u>**: The final requirement asserts that an appropriate indicator of market value must be used. The Standard recognizes sales prices as the most objective surrogate for market values, if the sale sample is properly screened to eliminate sales that do not conform to the definition of a market sale (Standard Section 2.1, 5.5.1 and 6.2). A rigorous process was used to properly screen sales, as described in Section IV of this report.

To summarize, this study was designed to comply with all of the requirements for achieving valid results.

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[1] In the Standard, the use of the terms representative, representativeness and representivity are used for multiple purposes. Sometimes the distinction of their meaning requires reading the Standard in context. To simplify this process, the word "proportionality" is used where the standard uses representative for the same meaning.

Section III. Study Population

This study draws inferences about the County's population based on an examination of a sample. Therefore, it is necessary to know pertinent characteristics of the commercial property population as of the study date. PPRC obtained the 2003 St. Louis County tax roll for real property then used County coding to create a final study population composed of the purely commercial, taxable property in St. Louis County.

1. **Data Sources:**: Three files that included information about property class and characteristics, assessments, tax status, new construction information, geo-coding, etc. were used to develop and code a population file:

    a. The "2003 St. Louis County, MO Real Property Assessment Data Tax Year 2003" that included the appraisal and assessment files/tables from the assessor.
    b. The "August 2003 GIS Datasets" from the St. Louis County Department of Planning.
    c. The "November 2004 GIS Datasets" from the St. Louis County Department of Planning.

2. **Establishing the Tax Roll**: Because the County constantly updates its database, files/tables obtained are not synchronized sometimes. The differences found proved immaterial. Therefore, the beginning population was composed of the properties common to the assessor's assessment and appraisal tables and the GIS files for 2003. The common population was then coded and trimmed as indicated in Exhibit 1.

Exhibit 1. 2003 County Real Property Population

	N	Total Assessment	Commercial N	Commercial Assessment
Assessment for Whole Population	386,651	$16,689,754,460	17,340	$6,226,972,640
Assessment after total assessment= zero or less excluded	381,264	$16,689,914,760	17,340	$6,226,972,640
Assessment after non-taxable excluded	370,001	$14,751,079,520	13,910	$4,428,433,980
Assessment after non-commercial excluded	13,116	$4,297,311,250	13,116	$4,297,311,250
Assessment after remaining abatements excluded	13,077	$4,284,765,530	13,077	$4,284,765,530
Final Study Population	13,077	$4,284,765,530	13,077	$4,284,765,530

3. **Stratification**: As mentioned in Section II, determining whether the sample is sufficiently proportional to the population requires that characteristics of the population that affect value be known. In ratio studies, proportionality is examined by comparing the composition of the sale sample to the composition of the population based on one or more of these characteristics. There are other benefits of stratification, particularly the ability to examine properties with similar characteristics such as use or location in greater detail. For the purposes of this report, once the final study population of 13,077 parcels was established, the population was classified into sub-groups (strata) using two approaches, as follows.

    a. **Use**: Properties were coded based on their use, (office, retail, etc.), using County variable coding ("lucode" and "luc"). Coding was verified using information from the County web site.

    b.   **<u>Location</u>:** Additionally, properties were coded based on their location. This was a multi-step process. A variety of approaches to location stratification are used in ratio studies (e.g. taxing districts). For commercial properties, the preferred approach is to use sub-markets when possible. In this study, PPRC obtained the GIS shape files for the 15 sub-markets used by CoStar, a national firm that provides real estate information. After an initial review, it was clear that using all 15 would result in too many strata that represented small portions of the population. Therefore, analysts combined neighboring and similar sub-markets, resulting in a final stratification with 6 sub-markets.

4. **Stratification Results**: The results of stratifying the population were applied to all properties used in the study. Further analysis of stratification is discussed later in the report, and the results of stratification results appear in the Appendix.

Section IV. Study Sample

After establishing the study population, the next step in the ratio study process was creating a sample that could be used to make inferences about the study population. Sales provided by the County were used as the sample, after undergoing a rigorous screening process to ensure that they reflected market value and were appropriate for inclusion. The details of the screening process that are described below are in accordance with Section 6.4 of the Standard.

1. **Data Sources:** Sales information, including the sales price and sales date for property transactions are recorded with the County via certificates of value (which are sworn affidavits), which the Standard identifies as being the best source of sales data (Section 6.2). This information was available to the PPRC in electronic format from the February 2007 Sales File provided by the County. These electronic files also contained information regarding the type of deed, validation information from the county, supplemental property information, notes and other information that were used in the screening process

2. **Preliminary Screening**: The Standard notes the need for screening sales data, but also notes that "Sales are excluded from the ratio study only with good cause…Every arm's length open-market sale that *appears* (emphasis added) to meet the conditions of a market value transaction should be included unless "sufficient and compelling information can be documented to show otherwise" (Standard, Section 6.4). All sales were independently evaluated by appraisers prior to being included in the study. To assist in this process, PPRC analysts undertook a rigorous pre-screening process to identify properties that should not be included, and to identify multiple-parcel sales prior to the validation process.

   a. **Time period**: IAAO recommends analyzing sales over the shortest practical time-period, ideally no longer than a year (Standard, Section 5.4). Sales used for this study were restricted to those that occurred within six months of the assessment date of January 1, 2003 (July 1, 2002 – June 30, 2003).

   b. **Population**: The sales file was merged with the purely commercial, taxable study population after trimming for the correct time. Any properties that did not match both files were excluded, to eliminate any non-commercial and non-taxable properties from the sample.

   c. **Multiple-parcel Sale Examination**: During the analysis, PPRC found that county records were incomplete with regards to sales that involved multiple parcels. To remedy this, analysts exhaustively scrutinized each sale to determine whether multiple parcels were involved according to the process described below.

      i. Multiple-parcel Identification: All sales were sorted by sale date, along with sale price, property location, owner information, book and page numbers, instrument type, instrument number, and other necessary information. These sales were then screened individually by researchers and thoroughly examined to determine which properties in question constituted a multiple-parcel sale.

      ii. Multiple-parcel Sale Examination: After identifying a multiple-parcel sale, researchers created a substitute record to reflect the total assessment and sale price, as well as other supplemental information. These substitute records were examined on the same basis as other parcels and sales. E.g. if some of the parcels experienced new construction during the sale year, the sale was coded and excluded from the

study. Furthermore, a list of the parcels involved in the multiple-parcel sale was turned over to the appraisers to assist validation.

      iii. <u>Multi-parcel Sale Scrutiny</u>: All multiple-parcel sales were subject to additional scrutiny by both PPRC and the independent appraisers (Standard, Section 6.4.3).

  d. **<u>Missing Sales Price</u>**: In many cases, County records were incomplete with regard to sale prices of property transactions. All single-parcel sales that were missing sales price or were recorded at a price of zero were excluded from the study (Standard, Section 6.1).

  e. **<u>Duplicate/Redundant Records</u>**: County sales files often include redundant records. In these cases, PPRC analysts carefully scrutinized each record and determined which was the suitable record for inclusion.

  f. **<u>2002 Assessment Changes</u>**: When assessments for 2003 reflected changes from 2002 for reasons other than reassessment, such as due to new construction, then sales occurring in 2002 were coded and excluded from further consideration. (Standard, Section 4.3)

  g. **<u>2003 Assessment Change</u>**: Since assessments between 2003 and 2004 cannot change due to revaluation, any sales that occurred during 2003 where an assessment did change were coded and excluded from consideration (Standard, Section 4.3).

  h. **<u>County Validation</u>:** PPRC also used county validation codes to assist screening sales. The county conducts a separate validation process for all sales reported to the county for inclusion to assist in the assessment process. All single-parcel sales that were not coded a "V" or an "X" were excluded from the study. All multi-parcel sales that were coded "2" through "8" were also excluded. These codes reflect specific reasons identified by the County as not being reflective of market value and are thus properly excluded.

  i. **<u>Multiple Sales of the Same Property</u>:** In some cases, properties were sold more than once during the study period. These can indicate the possibility of flipping or other forms of non-market value transactions. In those instances, only the most recent sale was considered for use. When the data suggested that neither sale might represent market value, both were excluded.

  j. **<u>Deed Information</u>**: PPRC eliminated those sales from the sample that the County had not judged valid when the sale was recorded using an inferior deed (Standard, Section 6.4.1.8).

3. **<u>Appraiser Validation</u>**: The Standard recommends efforts to confirm sales by contacting parties knowledgeable of the transaction (Standard, Section 6.3). Almy and PPRC requested that the client hire a suitable independent appraiser to validate the pre-screened sales for inclusion in the study. The process is described below. As mentioned earlier, the Standard stresses that sales should only be excluded for good reason. The independent appraisers followed IAAO guidelines to make the final decision whether a sale submitted for validation should be excluded from the study

  a. **<u>Validation Questionnaire</u>**: (Standard, Section 6.3.2) Almy and PPRC created a validation questionnaire using the IAAO Standard Sample Questionnaire and the County Certificate of Value as references. This questionnaire was used by the appraiser to determine whether the property sold at market value when an appropriate party was reached. This constituted one piece of information used by the appraiser to make an informed decision regarding the validity of the sale. If the sale was rejected, a specific reason was required.

b. **Supplemental Information**: Certificates of values, copies of the county's electronic records, as well as other public and commercial records were used to assist in the validation process. Where available, printouts from the County's validation work files were also used. The appraisers also used information available to them as a result of their practice.

c. **Additional Scrutiny**- PPRC reviewed all preliminary conclusions by the appraisers and identified sales where there was insufficient or incomplete documentation. These were returned to the appraiser for further documentation and/or scrutiny. PPRC also identified ratio and value outliers for additional appraisal scrutiny.

4. **Results from the Validation Process**: The results of the validation process are summarized below:

Exhibit 2. 2003 Sales Screening Results

Sales Screening	Number
Previously Screened Sales*	628
Multi-parcel Locators Consolidated into 1 record per sale	41
Multi-parcel Sale Record Missing for at least 1 parcel in Sale	14
No Sale Price	14
Superseded/Redundant Sale Record	49
New Construction During Sale Year	31
Assessment Change During Even Sales Year	56
County Validity Code Invalid	123
Multiple Sale of Same property, Earlier Sale Excluded	5
Conflicting Multiple Records for Same Sale, Both Excluded	4
Unverified by County and not Warranty Deed	4
Conflicting Assessment and Property Information	1
Appraiser Verification	
Sale Unverified by Appraiser	4
Transaction between Related Parties	4
Sale Under Duress	4
Partial Interest Sale	2
Sale Involved Gov't, Religious, Educational, or Charitable Entity	3
Price Affected by Other Abnormalities (Reason Reported on Questionnaire)[2]	24
Final Un-trimmed Sample	235

*Initial number of records in February 2007 County sale file represented in the study population.

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[2] Often these were the result of sales invalidated for multiple reasons. These reasons are on the sales validation records that are a supplement to this report.

Section V. Final Ratio Study Preparation

After the validation process was completed, the sales sample underwent additional analysis prior to the actual ratio study analysis to ensure that it met the requirements set forth by the Standard.

1. **Price Time Trending:** Section 6.5.4 of the IAAO notes that identifying and adjusting for price trends over time is important to reflect actual changes in the market. This sales ratio study uses sales that straddle the assessment date and that occur over a reasonably short time-period (6 months before to 6 months after). When this is the circumstance, time trending of sales prices is not essential unless there is a demonstrable change in price trends during the period because the measures of central tendency will not be affected in a material way. PPRC found no such trend changes. Nevertheless, there remains some value in price time trending, particularly when properties with different trends are intermingled in the same stratum. Additionally, measures of uniformity are affected. Finally, when prices are not time trended during a period of rapidly escalating values, a false indicator of sales chasing can result. For all these reasons, the PPRC did analyze price time trends and apply adjustments as needed.

    a. **Methodology:** To evaluate price time trends a set of strata must be selected for evaluation. There is no one right way to do this. Because price time trending involves some judgment, the experience of PPRC is that the selection should be guided by appropriate logic that can be measured against outside indicators of value change if practical. Clearly, unimproved properties needed to be separate. We further divided improved properties with prices above $1,965,000. This value was the break point for "value outliers". More importantly, properties of approximately $2 million have access to different borrowing markets such that value trends can be affected. Exhibit 3 shows what was occurring during the sale period regarding a variety of base borrowing indexes that may have contributed to value change trends.

Exhibit 3. Basis for Commercial Borrowing

	Prime Rate	3 Year TCM Index	10 Year TCM Index
June 2002	4.75	3.49	4.93
July 2002	4.75	3.01	4.65
December 2002	4.25	2.23	4.03
January 2003	4.25	2.18	4.05
June 2003	4.25	1.51	3.33
July 2003	4.00	1.93	3.98

    b. **Results**: For each of these three groupings of properties an analysis appears in the Appendix. For each of these groupings, a variety of graphing techniques and regression analyses were used to determine whether price changes could be properly represented by a single linear trend or whether the pattern was non-linear or multi-linear. PPRC found a statistically significant trend for each group, but not un-improved properties. These graphic and regression results appear in the Appendix.

2. **Ratio Outliers:** The next step in final preparation is to identify and treat ratio outliers. The preferred method of dealing with extreme high or low ratios (outliers) is to subject them to additional scrutiny, a process identified and completed in Section IV during the validation process. However, if outliers still persist in the study, they can have a significant effect on statistical measures, particularly the mean and weighted mean. The Standard notes that "if outliers can be identified, trimming procedures are acceptable methods for creating a more representative sample" (Section 6.6). Therefore, PPRC used a rigorous process to identify and trim ratio outliers using the methods identified by the Standard.

    a. **Outlier Identification:** PPRC used four methods to examine outlier ratios. Analysts carefully reviewed the results of each of these methods, and excluded sales that were identified as outliers from multiple methods.

        i. Sales Ratio - IQR Method: PPRC coded outliers using the inter-quartile range (IQR) method described in Table 1, page 20 of the IAAO standard. These were identified for guidance, but not necessarily trimmed.

        ii. Log Sales Ratio - IQR Method: Sometimes outliers can concentrate at the high end, which suggests a transformation of the data might allow better analysis of outliers on both ends. PPRC used the logarithm of the sale ratio in the IQR method to provide additional scrutiny.

        iii. Boundary Method: PPRC identified sales beyond two standard deviations of the mean as potential outliers. Without compelling support from the other outlier identification methods, trims inside this boundary were not allowed

        iv. Natural Breaks: Finally, PPRC examined both low and high ratios to identify "natural breaks" where the ratios beyond the breakpoint were clearly unrepresentative of the rest of the data. The previous methods were considered guidelines, with this method the preferred means of identifying unrepresentative ratios that should be trimmed.

    b. **Outlier Results**: The result of this process was that a very small set of ratios was identified as outliers. Exhibit 4 shows the outliers trimmed, which constituted a small percentage of the sample.

Exhibit 4. Results of Outlier Trimming

Locator	Sale Ratio	Outlier IQR	Outlier LOG	2 Std. Deviation	Natural Break
17U340090	0.108	No	Yes	No	Yes
12J431871	2.942	Yes	Yes	Yes	Yes
13G440151	0.182	No	Yes	Yes	Yes
14M120383	1.439	No	No	Yes	Yes
14K430961	1.575	Yes	No	Yes	Yes
12E111461	1.660	Yes	No	Yes	Yes
11N120170	1.814	Yes	No	Yes	Yes
19K640680	0.191	Yes	Yes	Yes	Yes

3. **Proportionality:** When considering the validity of a ratio study, it is essential to make sure that the sample is representative of the population. The initial analysis of the study sample indicated that the differences between sample and the population were significant. While the Standard notes that this alone does not mean that the sample is invalid, particularly when care is given in the selection and size of the sample, it suggests the use of stratification and weighting to ensure that the proportionality. PPRC employed those recommended methods.

   a. **Stratification:** As previously mentioned in Section III, properties were stratified on the basis of use and location to allow for better analysis and to ensure proportionality. (Standard, Section 5.5.1)

   b. **Combining Results**: In addition to stratification, PPRC used weighting measures based on the proportions in the study population to combine results for each of the three measures of central tendency (Standard, Section 7.3.5).

4. **Comparable Valuation for Sold and Unsold Parcels**: PPRC used two separate methods prescribed by the IAAO to determine whether any evidence of sales chasing existed (Standard, Section 10). One is a graphic comparison of ratios from sales occurring during a period where sales chasing could exist to periods too late for sale chasing. The other involves comparing changes in assessments for sold properties to those for unsold properties. The results are found in Appendix E. No evidence of sales chasing was found. Therefore, this condition for a valid study is met.

5. **Final Sales Sample**: The tables below describe the final sales sample after all screening and outlier trimming were completed.

Exhibit 5a: Actual Sale Prices by Property Location

Location Category	Minimum	Maximum	Median	Mean	N
North	53,500	22,000,000	263,500	1,427,385	45
West	69,600	13,800,000	400,000	1,871,925	24
South	69,900	9,300,000	489,250	1,231,941	38
70 Corridor	25,000	2,200,000	350,000	549,663	22
Central	90,000	235,000,000	350,000	7,845,766	40
270 Olive Corridor	82,000	2,490,000	490,000	752,616	40
Unimproved	85,000	6,224,000	555,726	1,075,643	18

Exhibit 5b: Actual Sale Prices by Property Use

Use Category	Minimum	Maximum	Median	Mean	N
Industrial/Warehouse	65,000	2,842,514	525,000	683,791	31
Retail	80,000	235,000,000	400,000	3,631,022	91
Office	60,000	51,250,000	305,000	2,389,127	49
Miscellaneous Commercial	25,000	20,248,740	332,500	1,139,802	38
Unimproved	85,000	6,224,000	555,726	1,075,643	18

6. **Distribution of Final Sample Sale Ratios:** The following graph depicts the distribution of ratios used in the ratio study. Further examination of normality reported in the Appendix demonstrates that the sample is normally distributed.
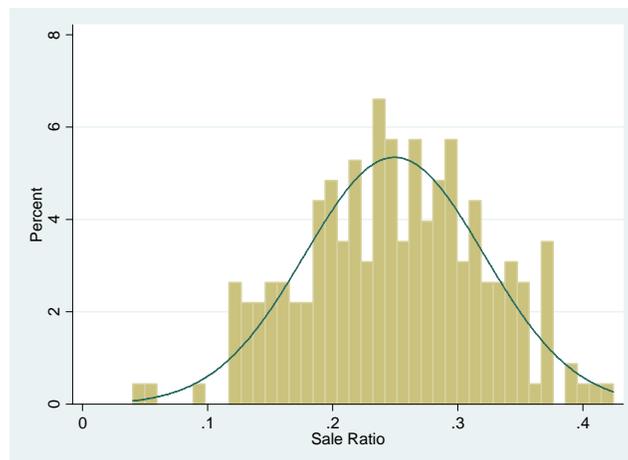
7. **Conclusion/Summary:** PPRC has adopted methods to assure that sale prices reflect market values, that the final sample will accomplish proportionality and assured that the study is not compromised by sales chasing. Therefore, all conditions for a valid study as set forth by the Standard exist.

Section VI. Ratio Study Results

This section is the culmination of all the previous preparation in order to provide the final results. In order to provide a clearer presentation, only summary measures are presented in this Section. However, all of the underlying analysis and results appear in the Appendix. Knowing what is there is important to understanding this section. Therefore, the next subsection describes the organization and content of the Appendix.

1. **Organization of Appendix:** Detailed statistical results appear in the appendix along with some brief commentary. A separate appendix is provided for each of the two methods of stratification: Appendix B for results stratified by location and Appendix C for results stratified by property use. Each of these appendices includes the following:

    1. A table demonstrating the proportionality (or lack of proportionality) for each stratum based on parcel and dollar representivity.
    2. A table showing the final combined results for the measures of central tendency.
    3. A table reporting all ratio results by stratum, including:
        a. The mean, median and weighted mean and their confidence intervals.
        b. The range of ratios for the stratum.
        c. The standard deviation, price related differential (PRD) and coefficient of dispersion (COD).
    4. Three tables: one each used to calculate the combined measures for the mean, median and weighted mean.
    5. A table reporting the results of normality testing for each stratum

2. **Summary of all results:** Within the appendices, there are nine measures of central tendency, three for each stratification approach and three for the un-stratified sample.[3] However, these measures are not equally applicable. The following subsections describe the process for selecting the best measure(s) used to reach a conclusion.

	Overall Un-stratified Sample	Location	Use
Mean	.249	.247	.248
Median	.249	.246	.247
Weighted Mean	.260	.255	.262

3. **Weighting method:** Once all measures for each stratum were calculated, it was necessary to combine stratum results to reach an overall measure. The Standard provides guidance for this process. Once completed, the results from each stratification method are proportional to the population on the stratification characteristic. The Standard is clear that for evaluation of a discrimination claim, the weighting for this combination should be dollar weighted, "For indirect equalization or the evaluation of a discrimination claim, the weight assigned a measure of central tendency of a stratum should be proportional to the share of that stratum's total estimated market value (Standard, Section 7.3.5). This standard is logical, because the potential effect of a discrimination claim is to re-distribute the tax burden amongst owners within the affected class (or sub-class). Therefore, the impact of large properties must be taken into account.

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[3] Identical results for the un-stratified sample appear in each table under the heading "Overall".

4. **Selecting stratification method:** This report used two methods of stratification. While there is little overall difference in the combined results, one method is considerably more useful. Stratification is employed as the first step of a process to generate a proportional sample, but it has other purposes as well. One is to more closely look at the measures for a more homogenous sub-grouping of properties. Another and the one most relevant here is to determine whether some sub-groups are assessed at levels statistically different from the overall. Capturing these differences allows use of weighting to assure that those differences are properly reflected in the overall result. When the detailed stratum results from the Appendix are examined relative to stratification by use, little variation is identified, except for unimproved properties. The medians vary from .231 to .263, the means from .234 to .263 and the weighted means from .251 to .277. In other words, it does not appear that property use is a strong indicator of the variance in levels of assessment. More variation is found when comparing results for location strata. The medians for location strata (again excluding the low values found for un-improved properties) vary from .202 to .274, the means from .214 to .274 and the weighted means from .244 to .265. Except for the weighted mean, the overall variances when using location strata are much greater. A thorough review of individual results also shows more variance from stratum to stratum (i.e. not just between the extremes, but within). Therefore, results from the location stratification should be more strongly considered when developing a final conclusion.

5. **Selecting a measure:** The Standard does not endorse a particular measure of central tendency when ratio studies are used in discrimination appeals. On the other hand, the Standard and ratio study practices usually suggest the use of the median, except for the purpose of indirect equalization. The potential use of these results is not similar to indirect equalization. Instead, they are more like direct equalization or an overall evaluation of assessment levels, for which the Standard identifies the median as the preferred measure. Nevertheless, all three measures are examined.

    a. **Mean:** In most ratio studies the mean is calculated and reported, then ignored. There are several reasons the mean is discredited in ratio studies. First, there are two mathematical reasons that cause the mean to be a biased indicator in ratio studies. Those mathematical biases produce a positive skew, i.e. a higher mean in the sample than in the population. In this study, the mean, as usual is consistently above the median, but only marginally. A second reason for the dismissal of the mean is that its use requires a normal (or sufficiently normal) distribution of ratios, which often does not occur in ratio studies. However, in this study, the distribution of ratios for most strata was normal. In sum, while the mean may not be the best measure, it does provide confirmation for the median.

    b. **Median:** In most ratio studies, except those for indirect equalization, the median is the preferred measure of central tendency. It is appealing for a variety of reasons. The median is not heavily affected by ratio outliers. Value outliers have no effect. It is well understood within the assessment community and is the recommended measure for most purposes. Its results merit primary consideration for the purposes of this study.

    c. **Weighted mean:** The weighted mean is the recommended measure for indirect equalization, but the potential use of this study does not involve indirect equalization. Though the weighted mean might have some theoretical appeal, it suffers from a significant disadvantage in this study. The weighted mean is fragile when value outliers are included in the strata. This is demonstrated in the table that follows showing the effect on various strata by removing just one sample. The Standard suggests two approaches for reducing the influence of influential value outliers. Given the data for

this study, neither of those approaches holds much appeal. One approach is to remove the influential value outliers and place them into a separate stratum. If this were done, dollar weighting to combine measures becomes impossible without a myriad of assumptions. The second approach is to discard them. In a jurisdiction such as St. Louis County where some commercial properties have values in excess of $100 million this is not justifiable – it would introduce a strong bias into the sample.

Effect of Value Outliers on Weighted Mean (Samples)				
	Locator	Multi Parcel #	Price	Weighted Mean (by % mkt value)
North Overall				79.5%
North	09G110068	10	$22,000,000	82.2%
West Overall				81.3%
West	19P330056		$13,800,000	76.8%
South Overall				76.6%
South	30K210802		$4,427,481	80.2%
South	26N630145		$9,300,000	72.3%
70-Corridor Overall				76.2%
70-Corridor	10N110419		$2,200,000	72.7%
Central Overall				82.7%
Central	19K641241		$51,250,000	80.5%
270-Olive Corridor Overall				80.4%
270-Olive Corridor	17N130560		$1,807,000	82.2%
Unimproved Overall				80.1%
Unimproved	14J110486		$2,750,000	77.7%
Unimproved	14K320310		$6,224,000	71.2%

6. **Level of Assessment:**

    a. **Using stratification:** Giving the median for location stratification the highest weight, the result would be .246. Most other measures are slightly higher.

    b. **Using overall sample:** Prior to adopting stratification approaches, the original un-stratified sample was determined as disproportionate to the population. This does not make the results from the un-stratified sample invalid; it merely makes them initially suspect [5.5.1]. When, however, such a sample's results are not statistically different from those from a proportionate study, the suspicion is alleviated [5.5.1]. This is the case in this instance. The median for the un-stratified sample was .249 as compared to the fully stratified and weighted finding of .246 – not statistically different.

c. **Result:** Beginning with the location based median and recognizing the higher results for most other measures, this study concludes that the best single point estimate is approximately 25% (78% of market value).

7. **Reliability:**

   a. **Data reliability:** This study benefited from the availability of high quantity and high quality data available from the County in electronic form. This was supplemented with a rigorous exam of the data by PPRC and the appraiser. While the data used in ratio studies is never perfect, the data that informs this study is superior.

   b. **Sample size:** There is a positive relationship between sample size and the precision of a statistical study (Standard, Section 8.1). The sample size used in this study should produce a margin of error of approximately plus or minus 3% of market value (i.e. approximately 1% on a scale of 32%) (Standard, Section 8.2).

   c. **Confidence interval:** Another way to measure reliability is by the 95% confidence interval. These are difficult to calculate when using combined measures. However, since the overall result is the same as that from the un-stratified sample, those confidence intervals provide good guidance. Taking those measures into consideration, along with 7.b above and results for all measures within this study, the conclusion is that the actual level of assessment in the population is highly likely to fall within a range of 24% to 26%.

8. **Other Support for Results:**

   a. **Reassessment:** Every two years the County is required to reassess all properties to bring values into line with market values. The commercial assessment level of the County as of January 1, 2001 was evaluated in a report dated November 15, 2004 that was introduced in a previous appeal (Gloudemans, 2004). That study concluded the 2001 level was .25 (versus the required .32). Using those results as a starting point, then the County assessment level for 2003 could be indicated to some degree by the net assessment change for existing properties in 2003's reassessment. As the following table shows, the increase in assessments for the 2003 reassessment was relatively low. In other words, this data provides no suggestion that assessments levels rose between 2001 and 2003.

   Reassessment Results for St. Louis County.

Actual Commercial Value Changes from Reassessment (Net of New Construction)	
Reassessment Year	**Net Assessment Change (%)**
1999	8.4
2001	12.3
2003	5.8
2005	8.5

   b. **Interest rates:** Interest rates can have a dramatic impact on values for income producing properties. While they may have little short-term impact on net cash flow, they

seriously impact capitalization rates used by current buyers and lenders. As the following table demonstrates the short, medium and long-term rates that serve as indexes for such borrowing were in a major decline during the period leading up to the 2003 reassessment. The changes in assessment for existing properties reported in the previous table do not seem to take changes in capitalization rates into full consideration, which may be a reason for our findings of low assessment levels.

Interest Rate Trends

	Prime Rate	**3 Year TCM Index**	**10 Year TCM Index**
January 2000	9.50	6.49	6.66
January 2001	9.00	4.77	5.16
January 2002	4.75	3.56	5.04
January 2003	4.25	2.18	4.05

    c. **Previous PPRC study:** The PPRC previously conducted a sales ratio study (Gardner 2004) examining commercial assessment levels in St. Louis County as of 2003. That study was performed for a different purpose - to gain a general understanding of assessment levels and related measures. That study was much less rigorous in all aspects of its conduct. Nevertheless, the conclusion of that study was that commercial assessment levels were approximately 79% of market value, almost identical to those found in this study.

9. Equity Issues: Because the purpose of this study is limited, there is no need to discuss horizontal or vertical equity issues, except to point out that the results do not show the kind of measures reasonably expected for a county of this nature. For interested parties, all of the traditional measures are reported in the Appendix.

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APPENDICES

Appendix A. Un-Stratified Sample

Appendix A-1. Measures of Central Tendency for Un-Stratified Sample

Assessment Level (Based on 32 % of Market Value)			
Stratification and Weighting	**Weighted Mean**	**Median**	**Mean**
Un-stratified Sample	26.0	24.9	24.9

Appendix B. Location Stratification

Appendix B-1. Representivity by Location

Comparing Representivity								
	Population Distribution				PPRC 2003 Sale Sample			
Stratum	**N**	**N weight**	**$**	**$ weight**	**N**	**N weight**	**$**	**$ weight**
North	2,288	17.5%	597,049,180	13.9%	45	19.8%	16,262,520	12.1%
West	1,612	12.3%	803,837,340	18.8%	24	10.6%	11,801,170	8.8%
South	1,957	15.0%	648,211,060	15.1%	38	16.7%	11,488,090	8.5%
70 Corridor	1,611	12.3%	511,459,840	11.9%	22	9.7%	2,905,950	2.2%
Central	1,882	14.4%	724,089,500	16.9%	40	17.6%	79,608,430	59.0%
270 Olive Corridor	1,714	13.1%	693,704,620	16.2%	40	17.6%	7,841,530	5.8%
Unimproved	2,013	15.4%	306,413,990	7.2%	18	7.9%	4,961,390	3.7%
Total	13,077	100.0%	4,284,765,530	100.0%	227	100.0%	134,869,080	100.0%

Appendix B-2. Measures of Central Tendency by Location

Assessment Level (Based on 32 % of Market Value)			
Stratification and Weighting	**Weighted Mean**	**Median**	**Mean**
Dollar Weighted by Location	25.5	24.6	24.7

Appendix B-3. Ratio Study Results by Location

			1 North	2 West	3 South	4 70 Corridor	5 Central	6 270 Olive Corridor	7 Unimproved	Overall
						Group by Location				
Mean			.274	.272	.250	.246	.214	.268	.199	.249
95% Confidence Interval for Mean	Lower Bound		.254	.245	.229	.218	.191	.247	.154	.240
	Upper Bound		.293	.298	.271	.273	.238	.288	.245	.259
Median			.262	.274	.254	.247	.202	.274	.205	.249
95% Confidence Interval for Median	Lower Bound		.238	.220	.221	.197	.159	.246	.125	.238
	Upper Bound		.306	.323	.281	.284	.227	.295	.256	.263
Weighted Mean			.255	.260	.245	.244	.265	.257	.256	.260
95% Confidence Interval for Weighted Mean	Lower Bound		.240	.232	.210	.216	.252	.236	.208	.250
	Upper Bound		.270	.288	.280	.272	.277	.279	.305	.270
Minimum			.157	.133	.120	.138	.121	.153	.040	.040
Maximum			.424	.371	.344	.391	.375	.408	.371	.424
Std. Deviation			.065	.062	.063	.062	.074	.064	.091	.072
Price Related Differential			1.074	1.044	1.021	1.008	.811	1.039	.778	.959
Coefficient of Dispersion			.205	.186	.205	.194	.294	.184	.359	.233

Appendix B-4. Combined Results for Dollar Weighting by Location

Post Stratification Weighting to Produce Combined Measure					
Stratum	**Population Valuation**	**Measure**	**Estimated Market Value**	**% of Total Est. Mkt Value**	**Subtotal**
		Mean			
North	597,049,180	0.274	2,179,011,606	12.58%	3.4%
West	803,837,340	0.272	2,955,284,338	17.06%	4.6%
South	648,211,060	0.250	2,592,844,240	14.97%	3.7%
70 Corridor	511,459,840	0.246	2,079,105,041	12.01%	3.0%
Central	724,089,500	0.214	3,383,595,794	19.54%	4.2%
270 Olive Corr	693,704,620	0.268	2,588,450,075	14.95%	4.0%
Unimproved	306,413,990	0.199	1,539,768,794	8.89%	1.8%
Total	4,284,765,530		17,318,059,888	100.00%	24.7%

Post Stratification Weighting to Produce Combined Measure					
Stratum	**Population Valuation**	**Measure**	**Estimated Market Value**	**% of Total Est. Mkt Value**	**Subtotal**
		Median			
North	597,049,180	0.262	2,278,813,664	13.06%	3.4%
West	803,837,340	0.274	2,933,712,920	16.82%	4.6%
South	648,211,060	0.254	2,552,012,047	14.63%	3.7%
70 Corridor	511,459,840	0.247	2,070,687,611	11.87%	2.9%
Central	724,089,500	0.202	3,584,601,485	20.55%	4.2%
270 Olive Corr	693,704,620	0.274	2,531,768,686	14.51%	4.0%
Unimproved	306,413,990	0.205	1,494,702,390	8.57%	1.8%
Total	4,284,765,530		17,446,298,804	100.00%	24.6%

Post Stratification Weighting to Produce Combined Measure					
Stratum	**Population Valuation**	**Measure**	**Estimated Market Value**	**% of Total Est. Mkt Value**	**Subtotal**
		Weighted Mean			
North	597,049,180	0.255	2,341,369,333	13.93%	3.6%
West	803,837,340	0.260	3,091,682,077	18.40%	4.8%
South	648,211,060	0.245	2,645,759,429	15.75%	3.9%
70 Corridor	511,459,840	0.244	2,096,146,885	12.47%	3.0%
Central	724,089,500	0.265	2,732,413,208	16.26%	4.3%
270 Olive Corr	693,704,620	0.257	2,699,239,767	16.06%	4.1%
Unimproved	306,413,990	0.256	1,196,929,648	7.12%	1.8%
Total	4,284,765,530		16,803,540,347	100.00%	25.5%

Appendix B-5. Normality Results by Location

	Skewness and Kurtosis Test for Normality for Property Location				
	Observations	Pr(Skewness)	Pr(Kurtosis)	adj chi2 (2)	Prob>chi2*
North	45	0.407	0.362	1.6	0.4498
West	24	0.627	0.517	0.69	0.7075
South	38	0.477	0.306	1.65	0.4372
70-Corridor	22	0.626	0.718	0.38	0.8289
Central	40	0.062	0.544	4.04	0.1325
270- Olive Corridor	40	0.722	0.759	0.22	0.8953
Unimproved	18	0.848	0.667	0.22	0.8952
*This value represents the indicated probability that the underlying population is normally distributed. A value of less than 0.05 indicates a distribution that is not normal.					

Appendix C. Use Stratification

Appendix C-1. Representivity by Use

Comparing Representivity								
	Population Distribution				**PPRC 2003 Sale Sample**			
Stratum	**N**	**N weight**	**$**	**$ weight**	**N**	**N weight**	**$**	**$ weight**
Industrial/ Warehouse	2,991	22.9%	942,133,050	22.0%	31	13.7%	5,492,280	4.1%
Retail	3,980	30.4%	1,228,657,760	28.7%	91	40.1%	80,646,540	59.8%
Office	1,904	14.6%	1,219,976,540	28.5%	49	21.6%	32,773,110	24.3%
Misc. Commercial	2,189	16.7%	587,584,190	13.7%	38	16.7%	10,995,760	8.2%
Unimproved	2,013	15.4%	306,413,990	7.2%	18	7.9%	4,961,390	3.7%
Total	13,077	100.0%	4,284,765,530	100.0%	227	100.0%	134,869,080	100.0%

Appendix C-2. Measures of Central Tendency by Use

Assessment Level (Based on 32 % of Market Value)			
Stratification and Weighting	**Weighted Mean**	**Median**	**Mean**
Dollar Weighted by Location	26.2	24.7	24.8

Appendix C-3. Ratio Study Results by Use

			Group by Use				
		1 **Industrial/** **Warehouse**	**2** **Retail**	**3** **Office**	**4** **Misc.** **Commercial**	**5** **Unimproved**	**Overall**
Mean		.251	.263	.254	.234	.199	.249
95% Confidence Interval for Mean	Lower Bound	.227	.248	.234	.214	.154	.240
	Upper Bound	.276	.278	.273	.253	.245	.259
Median		.247	.263	.252	.231	.205	.249
95% Confidence Interval for Median	Lower Bound	.220	.245	.221	.205	.125	.238
	Upper Bound	.275	.293	.289	.262	.256	.263
Weighted Mean		.260	.255	.277	.251	.256	.260
95% Confidence Interval for Weighted Mean	Lower Bound	.239	.242	.256	.235	.208	.250
	Upper Bound	.281	.268	.299	.267	.305	.270
Minimum		.125	.120	.135	.122	.040	.040
Maximum		.373	.424	.408	.391	.371	.424
Std. Deviation		.067	.071	.069	.060	.091	.072
Price Related Differential		.965	1.031	.915	.931	.778	.959
Coefficient of Dispersion		.213	.225	.226	.198	.359	.233

Appendix C-4. Combined Results for Dollar Weighting by Use

Post Stratification Weighting to Produce Combined Measure					
Stratum	**Population Valuation**	**Measure**	**Estimated Market Value**	**% of Total Est. Mkt Value**	**Subtotal**
		Mean			
Indstrl/Whse	942,133,050	0.251	3,753,518,127	21.72%	5.5%
Retail	1,228,657,760	0.263	4,671,702,510	27.04%	7.1%
Office	1,219,976,540	0.254	4,803,057,244	27.80%	7.1%
MiscComml	587,584,190	0.234	2,511,043,547	14.53%	3.4%
Unimproved	306,413,990	0.199	1,539,768,794	8.91%	1.8%
Total	4,284,765,530		17,279,090,222	100.00%	24.8%
Post Stratification Weighting to Produce Combined Measure					
Stratum	**Population Valuation**	**Measure**	**Estimated Market Value**	**% of Total Est. Mkt Value**	**Subtotal**
		Median			
Indstrl/Whse	942,133,050	0.247	3,814,303,846	21.96%	5.4%
Retail	1,228,657,760	0.263	4,671,702,510	26.90%	7.1%
Office	1,219,976,540	0.252	4,841,176,746	27.88%	7.0%
MiscComml	587,584,190	0.231	2,543,654,502	14.65%	3.4%
Unimproved	306,413,990	0.205	1,494,702,390	8.61%	1.8%
Total	4,284,765,530		17,365,539,994	100.00%	24.7%
Post Stratification Weighting to Produce Combined Measure					
Stratum	**Population Valuation**	**Measure**	**Estimated Market Value**	**% of Total Est. Mkt Value**	**Subtotal**
		Weighted Mean			
Indstrl/Whse	942,133,050	0.260	3,623,588,654	22.12%	5.8%
Retail	1,228,657,760	0.255	4,818,265,725	29.41%	7.5%
Office	1,219,976,540	0.277	4,404,247,437	26.88%	7.4%
MiscComml	587,584,190	0.251	2,340,972,869	14.29%	3.6%
Unimproved	306,413,990	0.256	1,196,929,648	7.31%	1.9%
Total	4,284,765,530		16,384,004,333	100.00%	26.2%

Appendix C-5. Normality Results by Use

| Skewness and Kurtosis Test for Normality for Property Use					
	Observations	Pr(Skewness)	Pr(Kurtosis)	adj chi2 (2)	Prob>chi2*
Indstrl/Whse	31	0.943	0.529	0.41	0.8145
Retail	91	0.571	0.023	5.33	0.0695
Office	49	0.544	0.47	0.93	0.6296
MiscComml	38	0.276	0.437	1.91	0.3849
Unimproved	18	0.848	0.667	0.22	0.8952
*This value represents the indicated probability that the underlying population is normally distributed. A value of less than 0.05 indicates a distribution that is not normal.					

Appendix D. Price Trend Examination

Appendix D-1. Low Value Improvement Examination

Low Value Improved Properties
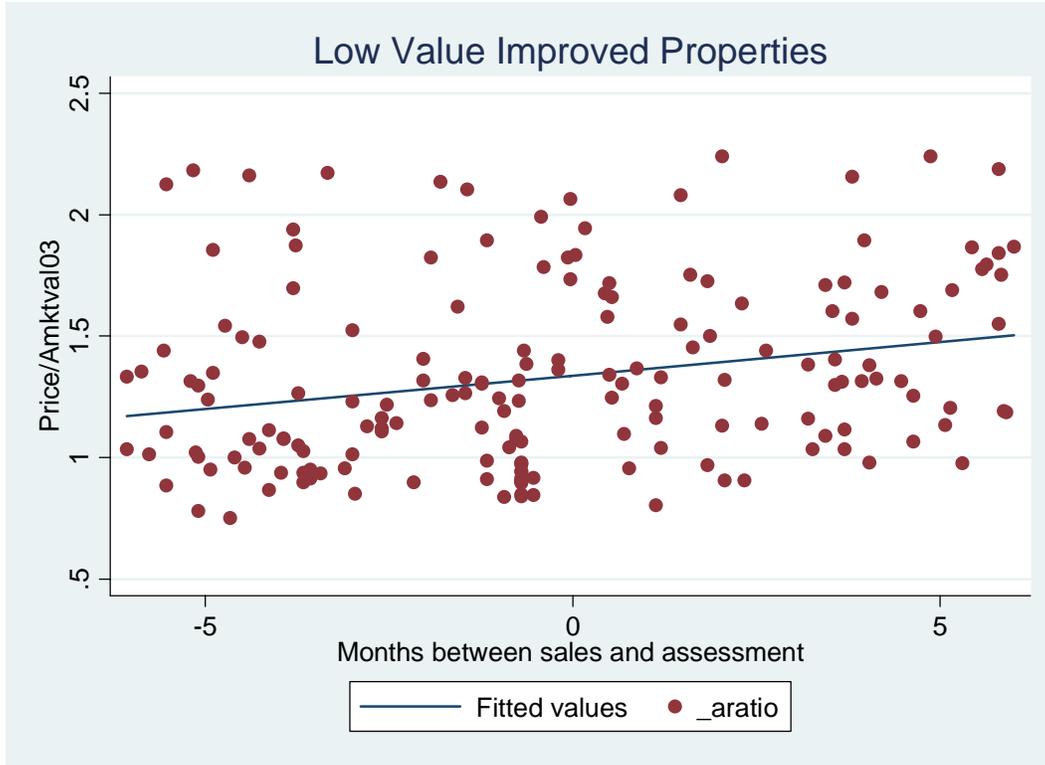
Source	SS	df	MS		Number of obs	176
					F(1, 174)	11.18
Model	1.50185885	1	1.50185885		Prob > F	0.001
Residual	23.3749729	174	0.134338925		R-squared	0.0604
					Adj R-squared	0.055
Total	24.8768317	175	0.142153324		Root MSE	0.36652
_aratio	Coef.	Std. Err.	t	P>t	95% Conf. Interval	
_adjperiod	0.0275072	0.0082268	3.34	0.001	0.01127	0.0437445
_cons	1.337745	0.0277482	48.21	0.000	1.282978	1.392511
Monthly Adjusted Rate = .02056236			Annualized Adjusted Rate = .24674837			

Appendix D-2. High Value Improvement Examination
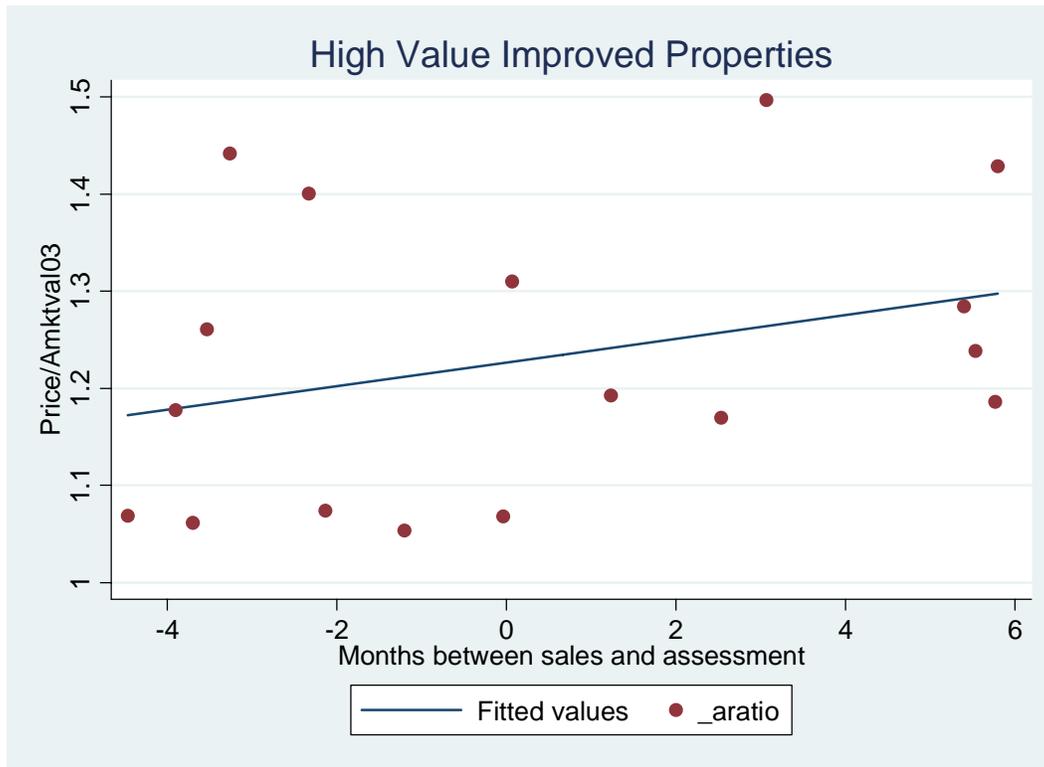
Source	SS	df	MS		Number of obs	17
					F(1, 15)	1.65
Model	0.033797218	1	0.337972		Prob > F	0.2183
Residual	0.307006686	15	0.020467		R-squared	0.0992
					Adj R-squared	0.0391
Total	0.340803904	16	0.0213		Root MSE	0.14306
_aratio	Coef.	Std. Err.	t	P>t	95% Conf. Interval	
_adjperiod	0.0122265	0.0095146	1.29	0.218	-0.0080533	0.0325062
_cons	1.226572	0.0348032	35.24	0.000	1.15239	1.300753
Monthly adjusted rate =.00996802				Annualized adjusted rate = .1196163		

Note: While the regression for this stratum is not quite statistically significant, this is primarily due to the small sample size. The trend is too large to ignore. While trending has no material overall impact on measures of central tendency, left un-trended, it could cause erroneous conclusions about individual stratum results.

Appendix D-3. Unimproved Improvement Examination

Unimproved Properties
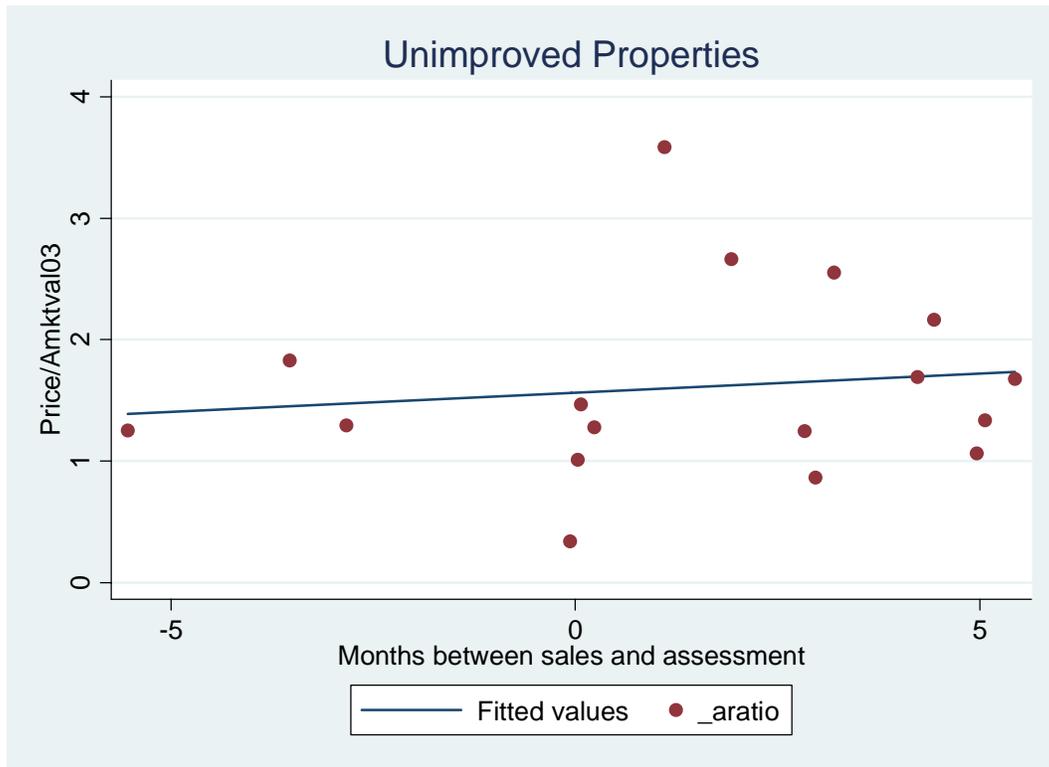
Source	SS	df	MS		Number of obs	17
					F(1, 174)	0.26
Model	.163433086	1	.163433086		Prob > F	0.6191
Residual	9.51400544	15	.634267029		R-squared	0.0169
					Adj R-squared	-0.0487
Total	9.67743853	16	.604839908		Root MSE	.79641
_aratio	Coef.	Std. Err.	t	P>t	95% Conf. Interval	
_adjperiod	.0314492	.061955	0.51	0.619	-.1006047	.1635032
_cons	1.560802	.2128471	7.33	0.000	1.107129	2.014475

Note: These results demonstrate no clear or significant pattern, so no trend was used.

Appendix E. Sales Chasing Examination

## Appendix E-1. Comparison of sale ratio distribution by Quarters
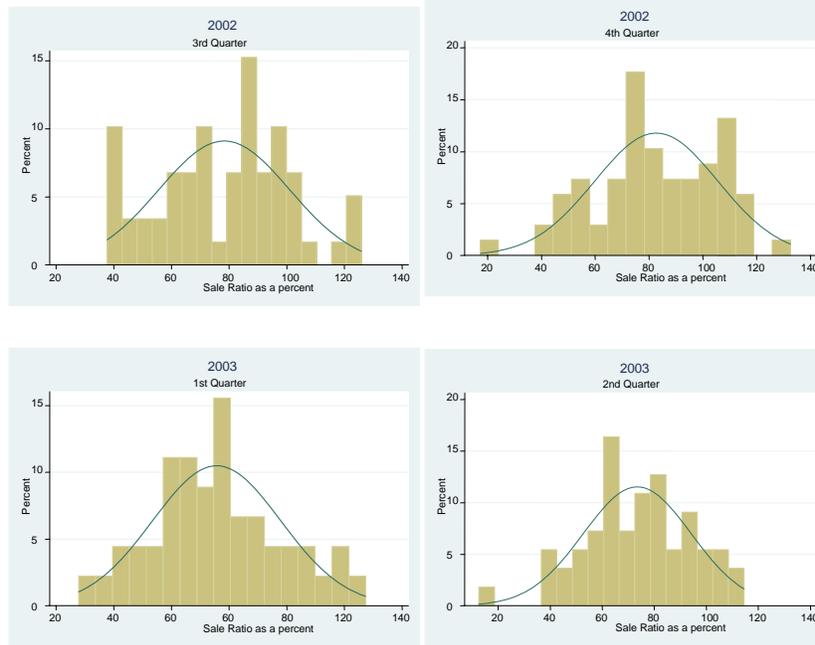
Appendix E-2. Comparison of Average Value Changes

Comparison of Average Value Changes						
	10%	25%	50%	75%	90%	Mean
Unsold	-1.4	-0.1	2.6	8.9	15.3	8.4
Sold	-1.4	0.0	4.6	11.1	16.9	6.7

Appendix F. 2003 GIS Maps of St. Louis County Properties

Appendix F-1. Study Population
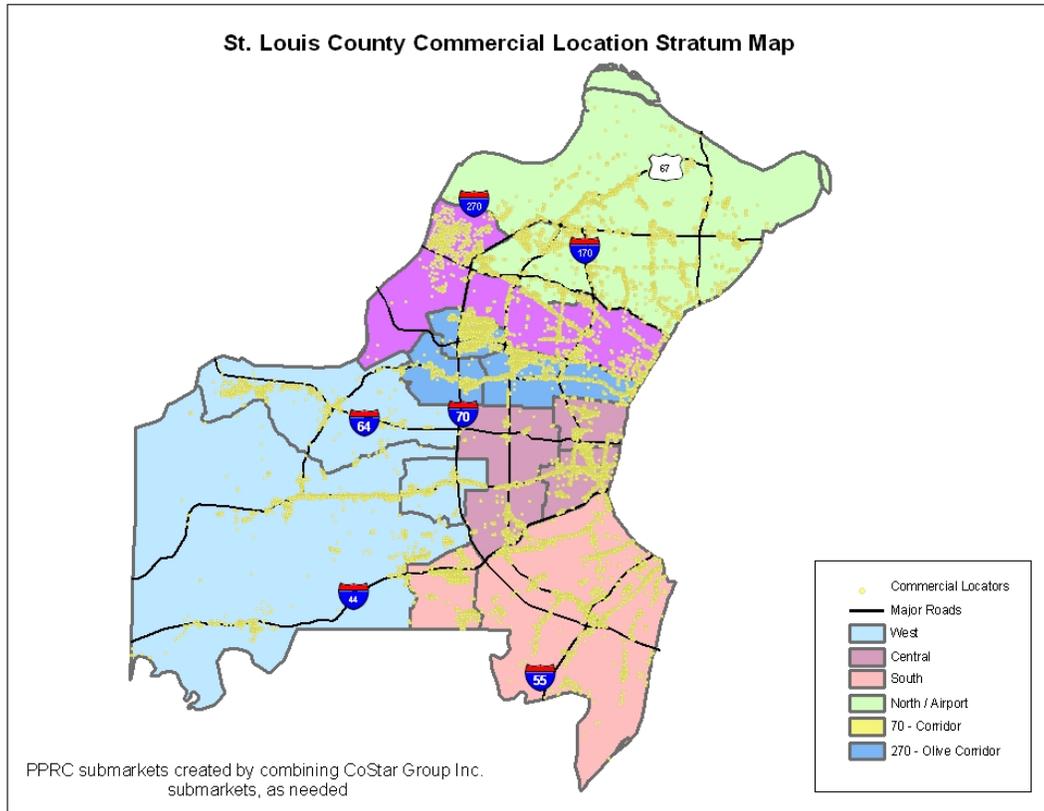
Appendix F-2. Study Sample

St. Louis County Commercial Location Stratum Map - PPRC Sample

PPRC submarkets created by combining CoStar Group Inc. submarkets, as needed

★ Study Sample
— Major Roads
West
Central
South
North / Airport
70 - Corridor
270 - Olive Corridor
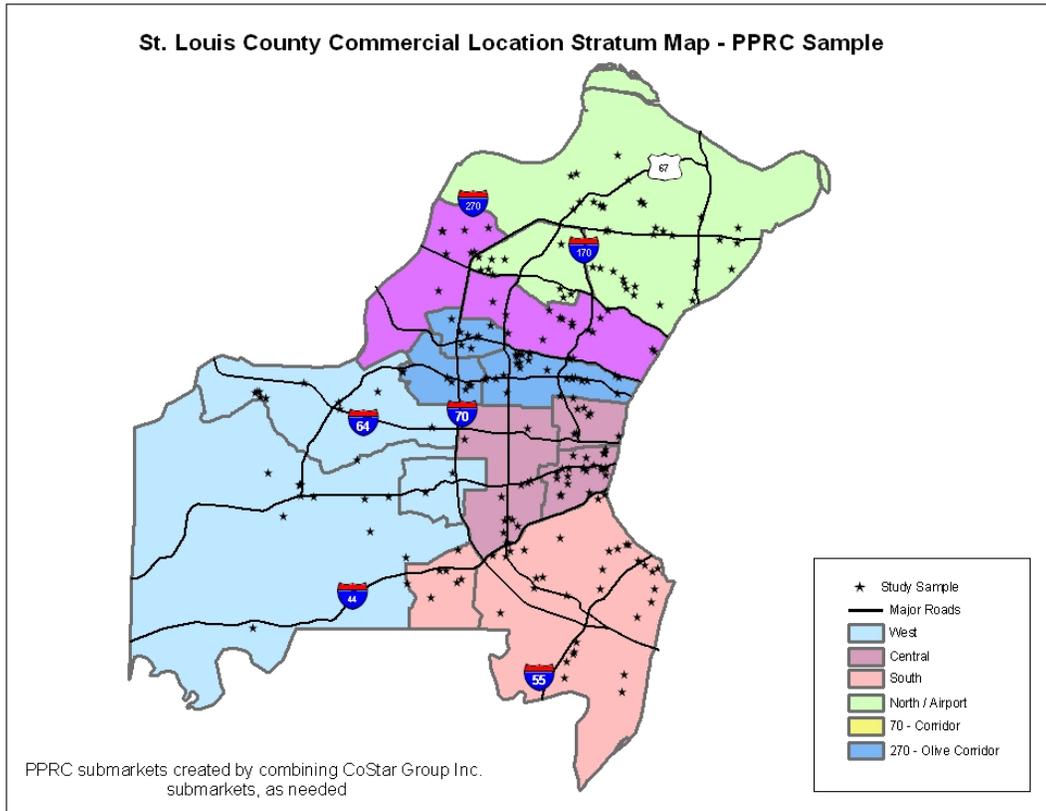
Appendix F-3. Study Sample and Population

PPRC submarkets created by combining CoStar Group Inc. submarkets, as needed

Legend:
- Commercial Locators
- ★ Study Sample
- Major Roads
- West
- Central
- South
- North / Airport
- 70 - Corridor
- 270 - Olive Corridor