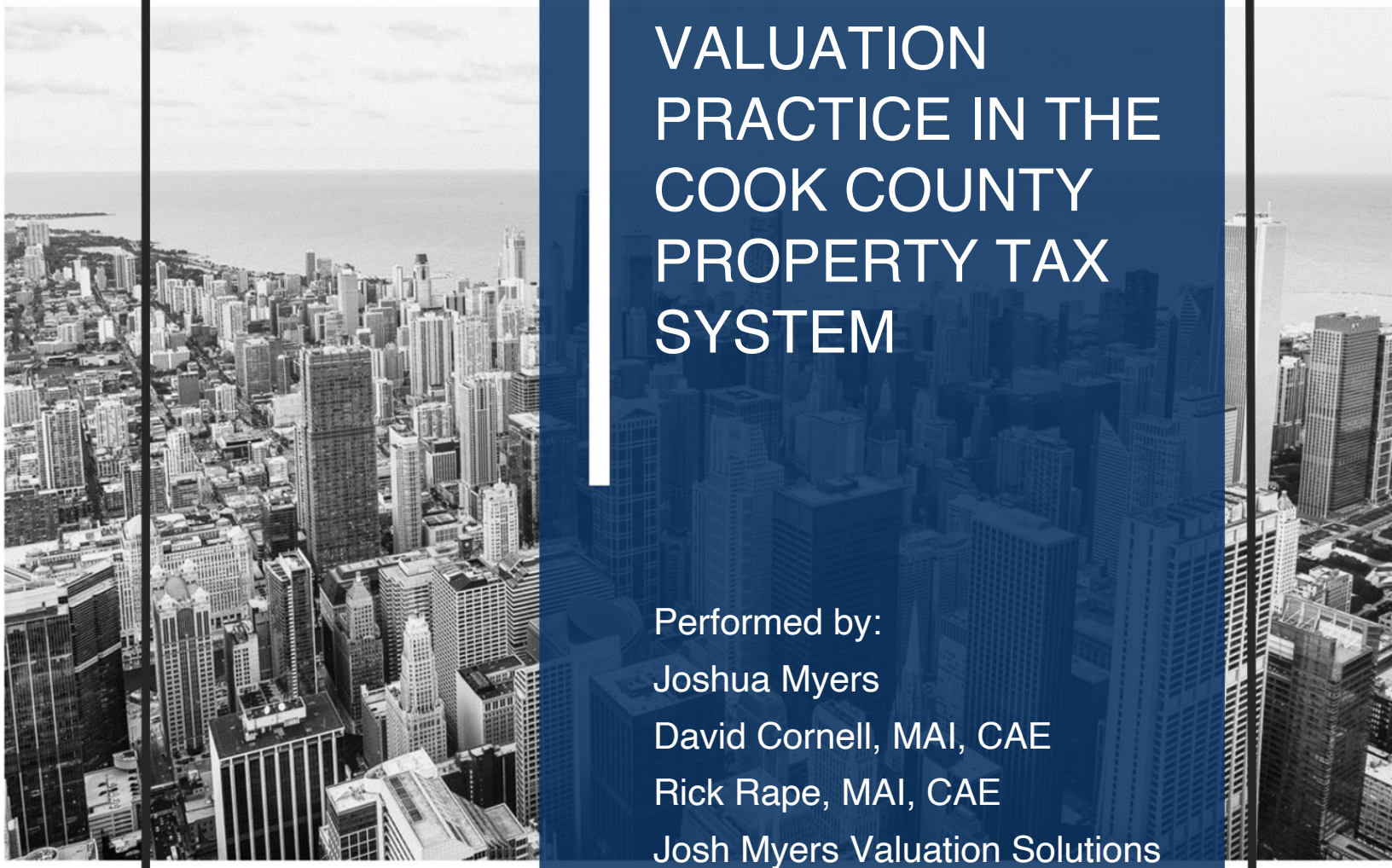

ANALYSIS OF COMMERCIAL VALUATION PRACTICE IN THE COOK COUNTY PROPERTY TAX SYSTEM

Performed by:
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Josh Myers Valuation Solutions

12/11/2024

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December 11, 2024

The Honorable Toni Preckwinkle
President of the Cook County Board of Commissioners
118 N. Clark St., Room 537
Chicago, IL 60602

Dear President Preckwinkle:

Josh Myers Valuation Solutions was retained to conduct a comprehensive review of the Cook County commercial valuation system. This project entailed an analysis of five specific statistical components and five specific operational components. The statistical analysis evaluates the quality of the values coming from the various steps of the commercial valuation process and the operational analysis provides recommendations to improve that overall process. The scope of this project is outlined below.

Statistical Analysis
The following five key components were investigated as part of the statistical component of this project:

1. **Differential Valuation and Appeal Rates**. At each stage, are commercial properties valued differently or granted appeals at different rates based on location, property value, property class, or any other stratification?

2. **Assessment for Accuracy**. Do commercial properties tend to be under- or over-assessed with respect to market value?

3. **Assessment Level Comparison**. How does the level of assessment compare between properties valued by the CCAO and the CCBOR?

4. **Non-Uniformity in Commercial Values**. To what degree do commercial property values demonstrate general non-uniformity and how, if at all, does this impact investors?

5. **Regressivity Analysis**. To what extent is regressivity present? How do the number of appeals and the change of values at each stage affect the degree of regressivity? What impact does the degree of regressivity have on commercial property owners?

This statistical analysis consists of an appeals analysis and a sales ratio study. All ratio studies were conducted in accordance with the 2013 version of the International Association of Assessing Officers (IAAO) Standard on Ratio Studies and accepted statistical practices. The ratio studies were carefully designed and employed important analytical methods such as stratification and time adjustments. All statistical analyses, including ratio studies, were designed to ensure robust and supportable recommendations.

Operational Analysis

The operational component of this project included a study of the existing valuation methods, particularly for high-value properties such as office buildings. We analyzed income capitalization methods used by the Cook County Assessor's Office (CCAO) and compared them with those employed by the Cook County Board of Review (CCBOR). The Income capitalization methodology (as opposed to the cost approach and sales comparison approaches) was given focus, as this is the methodology employed by market participants when making valuation decisions. We also reviewed the current process for data collection and data maintenance, evaluating the use of this data in developing reliable and consistent valuation models.

The scope of work, initially identified by the following five key components, evolved as new insights were obtained. Each component, along with additional issues discovered during our studies, are addressed in this report.

1. **Data Sources and Valuation Practices.** How do the data sources and valuation practices of the CCAO and the CCBOR differ for commercial properties, and what impact do these differences have on the overall assessment system? Specifically, how are capitalization rates determined by each entity, and should loaded or unloaded capitalization rates be used? Are there aspects of the Illinois State Property Tax Code that adversely affect commercial property valuation in Cook County or create unnecessary conflicts with industry standards?

2. **Handling of Valuation Evidence.** How do the CCAO and the three CCBOR Commissioners handle valuation and evidence presented by the property owner?

3. **Appeal Information from the CCAO.** What information does the CCAO provide the CCBOR, and how does the CCBOR use this information? How effectively does this information communicate the justification for the CCAO's valuation to the CCBOR?

4. **Sale Validation and Price Adjustments.** How are commercial property sale prices adjusted for various factors during the sales validation process for inclusion in valuation and sales ratio studies? Are these adjustments being performed appropriately using a uniform set of guidelines?

5. **Potential for Regressivity.** What are the potential causes of any regressivity that exists at each stage?

The goal of the operational review was to define the current state of the valuation process for commercial properties, particularly multi-tenant properties, and to make recommendations based on best practices and principles, either directly or indirectly derived from industry standards. Special attention was paid to the differences in appraisal practices between the CCAO and CCBOR.

Acknowledgement

This best practices study was made possible by a thorough understanding of current practices at the CCAO and CCBOR. We extend our gratitude to the analysts and managers of both offices, with whom we had numerous meetings, both in person and via remote tools (Zoom and MS Teams).

The CCAO provided us with access to presentations on valuation issues, while the CCBOR allowed us to observe actual hearings before three analysts, giving us first-hand insights into the CCBOR appeal process. Both offices were consistently open and responsive to our many requests for data and documentation.

We also thank the Cook County President's Office for their continued support, insights, and guidance during the project.

This report must be read in its entirety to completely understand our findings and recommendations. However, an Executive Summary has been included to provide a concise overview of the conclusions and recommendations, without delving into the detailed data and analyses.

Ultimately, this study recommends seventeen areas where the assessing procedures in Cook County could be improved and more clearly understood by other stakeholders. Some of these recommendations have already begun to be implemented by analysts at the CCAO through their own initiative, and we hope that this trend toward improved practices will continue, benefiting all stakeholders.

Respectfully Submitted,

Joshua Myers

President

Josh Myers Valuation Solutions

ABOUT US

The team assembled by Josh Myers Valuation Solutions for this project includes Josh Myers, David Cornell, and Rick Rape. Josh Myers holds a master's degree in Statistics from the University of Virginia and has been consulting in areas such as sales ratio studies and business process audits for over 11 years. Josh is also a current member of the IAAO Research and Standards Committee. David Cornell holds the MAI and CAE designations and is an IAAO Instructor. David is an experienced consultant with expertise in commercial valuation practices. Rick Rape also holds the MAI and CAE designations. Rick is currently the Director of Valuation for the Hillsborough County, FL Property Appraiser and spent 24 years serving as a special magistrate in Florida hearing commercial assessment appeals. A detailed CV for each member of the Josh Myers Valuation Solutions team can be found attached to this report.

EXECUTIVE SUMMARY

Background

The Cook County Illinois Property Tax System involves processes over several stages. Initially, the Cook County Assessor's Office (CCAO) conducts the commercial valuation for all properties (this report focuses on the assessment and appeal process for commercial properties). This is followed by an opportunity for taxpayers to lodge an appeal at the CCAO level. Whether appealed at the CCAO level or not, property owners (taxpayers and owners are used interchangeably in this report) have the right to appeal their valuations to the Cook County Board of Review (CCBOR) and subsequently, to the State Property Tax Appeal Board (PTAB) or Circuit Court. This analysis focuses solely on the practices of the CCAO and the CCBOR.

Concerns have been raised by stakeholders in these processes regarding the accuracy of mass valuations, the number of appeals, the large number of appeals at the CCBOR level that result in reductions, and the dynamics of the CCAO and CCBOR relationship.

The following is a summary of observations and general recommendations. Links in the following summary allow the reader to quickly access the section of the report with the details and specific recommendations.

Summary of Our Observations and Recommendations

The statistical analysis is organized around five key statistical questions and includes an analysis of appeal changes and two forms of a sales ratio study. One sales ratio study assesses the overall quality of the appraised values at each valuation step (Assessor Notice, Assessor Certified, and Board of Review) for each triad (South Triad - 2020, City Triad - 2021, and North Triad - 2022). Another sales ratio study specifically evaluates the effect of the CCAO and CCBOR appeals processes on just those properties under appeal for the same valuation steps and the same triads. This project analyzes the full appraised value of the property before an assessment percentage is applied. All sales ratio studies are performed according to International Association of Assessing Officers (IAAO) standards and a set of documented procedures.

In summary, the detailed statistical analysis in this report finds that the commercial values often do not meet IAAO industry standards for appraisal level and uniformity. The level of general non-uniformity is usually greater than the IAAO industry standard range across the three triads and the different property use groups. At the same time, the values tend to be regressive but the levels of regressivity that exist are mostly within allowable limits set in the IAAO industry standards. In two of the three triads measured (South – 2020 and North – 2022), the final appraisal level after the completion of the CCBOR appeals step is lower than the IAAO industry standard range of 90% to 110%, meaning that the property values on the whole tend to be too far below their market value. The appeals analysis indicates that a large number of properties and an even larger percentage of property value receive a reduction during either the CCAO or CCBOR appeal periods,

with CCBOR receiving appeals at a higher rate and also granting reductions at a higher rate than the CCAO. This analysis indicates, however, that the two appeals processes do not always serve to improve the quality of the commercial values on the whole.

It is worth noting that this statistical analysis is conducted using sales and valuation data that occurred during the COVID-19 pandemic. It is not precisely known the degree to which the pandemic may have had an effect on any of the analyses that were conducted. The importance of analyzing the most recent data, however, outweighed any of these concerns when designing the statistical analysis.

The following list contains additional summarizations of the general findings for the statistical section. The Statistical Findings Summary includes a complete set of these observations.

- Commercial properties tend to be valued at different levels of appraisal depending on the triad year (relative to the triad-year's effective valuation date) and property use group. This is a source of non-uniformity present throughout all of this analysis.

- The rate at which commercial properties are appealed and the rate at which these properties are granted value changes tends to vary by triad, township, appraised value range, and property use group. The clearest and most consistent of these trends exists with respect to the appraised value range, where high-valued properties are more likely to appeal than lower-valued properties and those that appeal are more likely to receive a value change. This trend is present in both the CCAO and CCBOR appeal periods, but its impact is more pronounced at the CCBOR at least partly due to the higher appeal rates there.

- Considering the final set of commercial values after the CCBOR finishes its work, we found that the commercial property values were under-valued with respect to market value in the South Triad (2020) and the North Triad (2022) overall, with median sales ratios of 81.37% and 71.79%, respectively. This constitutes a system-wide issue with valuing properties as a whole at the target percentage in these triads. However, this same issue was not present with the City Triad (2021) because its median sales ratio of 98.96% meets the IAAO industry standard and is very close to the 100% target. When stratifying by property use group, this study finds this same general pattern by triad.

- The appraisal level after the CCBOR appeals period has been completed (Board step) is statistically significantly less than after the CCAO appeals period has been completed (Assessor Certified step) on an overall basis. In most cases, the appraisal level after the Board step decreases and moves farther away from the IAAO industry standard range, sometimes greatly so. This same general trend exists by property use group strata. The exception was in the City Triad (2021), where the final values after the Board step were an improvement over the Assessor Certified step overall with regard to the appraisal level. The CCBOR tends to reduce the appraisal level by more than the CCAO on the properties that were actually under appeal.

- Commercial values in Cook County generally are more non-uniform than IAAO industry standards permit. This non-uniformity in the valuation system is present across triads, steps in the valuation process, and property use groups. The CCBOR appeals process does not generally improve uniformity statistics by a statistically significant amount on properties under appeal. This degree of non-uniformity (variability) could be masking other issues with the quality of the values and making it more difficult to derive proper time (market condition) adjustments to sale prices used as a bedrock in sales ratio studies. Reducing the non-uniformity of the sales ratios through the adoption of the recommendations in this report would allow sales ratio studies to be more effective diagnostic tools in the future. Property owners are undoubtedly being negatively impacted by the uncertainty that comes along with this degree of non-uniformity.

- Commercial valuations do tend to be somewhat regressive, but these levels are within allowable limits set by IAAO industry standards.

The results of these analyses should impact decision-making. Both CCAO and CCBOR should view these results through the lens of how each could learn and change to improve the quality of the value estimates at their respective steps. These findings support the fact that recommendations are needed to improve commercial valuation practices.

The operational analysis section of this report is organized around five key operational questions. With the statistical analysis indicating that the commercial valuation system needs improvement, the operational analysis seeks to identify which areas could be improved and recommendations for how to improve them.

The commercial valuation practices of the CCAO used to differ substantially from those employed by the CCBOR, regarding the treatment of real estate taxes in the income capitalization approach. Further, the methods more recently adopted by the CCAO have not been communicated effectively to the CCBOR. At present the CCAO and CCBOR use methodologies regarding the treatment of real estate taxes that would result in the same value conclusion, all other variables held constant.

While the CCAO and CCBOR use many of the same resources to identify market norms by property type and location, the quantity of property-specific data supplied to the CCBOR is robust and includes actual income and expense (I&E) data from each of the tens of thousands of commercial properties that are appealed each year (overwhelmingly the valuation arguments before the CCBOR are based on the income capitalization approach). In contrast, the CCAO receives far less I&E data. At present, whether presented to the CCAO or the CCBOR, there is no robust, mutually query-able system for sharing the data between the two entities. Given the number of appeals and adjustments to value at the CCBOR level, effectively both the CCAO and CCBOR collectively set the values for commercial properties. Given these observations, shared data, along with common valuation methodologies and perspectives, could significantly enhance the consistency of value determinations by the CCAO and CCBOR, while still maintaining the independence of the two offices.

These and other related issues, along with our recommendations and the reasoning behind them, are covered in each of the five sections of this report's operational analysis section. Our recommendations include improvements that can be made to the policies, practices, and operations of the CCAO and CCBOR, as well as improvements to the system as a whole that may rely on state policy changes or budgetary processes. This executive summary links to each of these five sections, while providing a short summary of each section's content as well as a list of the recommendations made therein.

Section 1. Data Sources and Valuation Practices includes a discussion of data management, data sharing, income model best practices and standardization, and income and expense data disclosure legislation.

Recommendations — Section 1: Data Sources and Valuation Practices

1. The CCAO should formally request copies of all appraisals submitted to the CCBOR.
2. The CCAO should formally request copies of all I&E data submitted to the CCBOR. Even though the data can be up to a year old, this would be very helpful to CCAO.

3. All I&E data should be entered into a centralized database, which should be accessible by the CCAO and CCBOR. The database should also include property type, physical attributes, and location data.

4. In addition to the third-party capitalization reports, the CCAO should conduct an annual capitalization rate study. This study could be integrated with the sales validation recommendations discussed later in this report. We would further recommend the annual capitalization reports be a joint project between the CCAO and the CCBOR. This collaboration can be achieved without compromising the agencies' statutory independence.

5. The CCAO and the CCBOR should adopt a unified methodology for loading capitalization rates.

6. Adopt an Effective Tax Rate based approach to loading capitalization rates.

7. Both the CCAO and CCBOR should jointly develop a model to estimate the upcoming tax rate for use in the Effective Tax Rate – Assessment Ratio – Tax Rate (EAT) formula. This approach aligns with professional appraisal practices, which recognize that buyers consider future income streams rather than relying solely on historical tax rates. Current data science staff would be valuable in this effort.

8. CCAO should maximize the use of Enterprise Assessment and Tax by entering all relevant data, including more detailed use codes such as "anchored retail," "unanchored strip centers," "one-story suburban office," and "multi-story office." Explore the database's capabilities to handle market sales, I&E data, and other relevant metrics.

9. Although the submission of I&E data is not mandated by law, the CCBOR frequently receives substantial historical data. All historical I&E data should be entered into a centralized database, which should be accessible to CCAO and CCBOR.

10. The CCAO should support efforts (which they are currently doing) to change the law to have I&E data required.

Section 2. Handling of Valuation Evidence is tangentially related to Section 1 and emphasizes points made therein about processes to share and manage data, but in particular evidence presented during appeals.

Recommendation — Sections 2: Handling of Valuation Evidence

1. The CCAO should formally request all valuation evidence submitted to the CCBOR. Additionally, key pieces of evidence, notably I&E data, should be stored in a shared database (as previously addressed in section 1. Data Sources and Valuation Practices).

Section 3. Appeal Information from the CCAO is in the context of what is provided by the CCAO to the CCBOR for their review during the appeals process. At present there is substantially no participation by the CCAO in the CCBOR appeal process, with the exception being some high profile, high-value properties.

Recommendations in this section could go a long way to fostering a good relationship between the CCAO and CCBOR, resulting in more uniform valuation methodologies, shared resources, and market perspectives.

Recommendations — Section 3: Appeal Information from the CCAO

1. The CCAO should prepare and submit "hearing packets" for all commercial appeals. These packets should include methodology and supporting data used to calculate the assessed values.
2. To streamline the process of creating "hearing packets" for commercial appeals, developing or acquiring automated tools should be a priority in producing the hearing packets.
3. The CCAO should attend hearings and present their case at hearings before the CCBOR. They should also address property-specific valuation issues.
4. CCAO and CCBOR analysts should meet regularly to discuss overall valuation methodologies and market trends and share data. Shared educational opportunities offered by the two offices could further the adoption of consistent methodologies and perspectives between the two entities.
5. Both the CCBOR and CCAO should post key processes and policies on the internet for review by all stakeholders and should keep them updated over time as changes occur. Those policies and processes that relate to areas of valuation that tend to involve professional discretion and judgement would be of greatest benefit.

Section 4. Sale Validation and Price Adjustments addresses the lack of a sale validation process but recognizes the CCAO has begun this absolutely essential process. A lack of qualified sales negatively impacts the ability of an entity to measure the quality of the set of value estimates. The lack of a proper sales validation process certainly presented a challenge in developing the sales ratio study for this project and likely caused some inflation in the levels of non-uniformity measured. Using the various important ratio study metrics that are calculated using mass valuations and validated market sales could guide both bodies more effectively toward a more accurate and defensible tax roll. Once again, sharing this sales validation data with the CCBOR could further enhance the consistency with which the two entities view valuations and enhance the perceived reliability of valuations by the CCAO.

Recommendation — Section 4: Sale Validation and Price Adjustment

1. The CCAO should establish a comprehensive sales validation procedure to review all commercial sales according to best practice standards found in the IAAO Standard on the validation and Adjustment of Sales. Additionally, the sales database and sales validation process should be shared with the CCBOR, and the CCAO should communicate validated sales to representatives from the Illinois Department of Revenue (IDOR).

Section 5 Potential for Regressivity. This project's sales ratio study generally found that, on the whole, appraised values were regressive but that the level of regressivity present was within acceptable limits found in IAAO industry standards. Further, this project found that the appeals process, at both the CCAO and the CCBOR, tended to add some regressivity but, again, this was not enough to fall outside of the range of IAAO industry standards. Given the fact that our findings do not include levels of regressivity that do not meet IAAO industry standards, we cannot comment on the degree to which regressivity may be impacting property owners. The larger issue is certainly the level of non-uniformity present in the system.

Recommendation — Section 5: Potential for Regressivity

1. Both the CCAO and the CCBOR should regularly perform commercial ratio studies using a consistent set of practices and statistical measures that are in keeping with the current IAAO Standard on Ratio Studies. For CCAO, this should be an integral part of their mass valuation process.

STATISTICAL FINDINGS SUMMARY

The key findings of the statistical analysis are summarized as follows, organized according to the key project questions for the statistical phase. This summary of findings is produced in more straightforward language but depends on the key findings from the Detailed Statistical Analysis section of this report. These conclusions are presented here instead of in that section in order to facilitate a better flow for this report.

Key Question: At each stage, are commercial properties being valued differently or granted appeals at different rates based on location, property value, property class, or any other stratification?

Summary of Findings:

- Commercial properties tend to be valued at substantially different levels of appraisal depending on the triad year (relative to the triad-year's effective valuation date) and property use group. This is a source of non-uniformity present throughout all of this analysis.

- The rate at which commercial properties are appealed and the rate at which these properties are granted value changes tends to vary by triad, township, appraised value range, and property use group. The clearest and most consistent of these trends exists with respect to the appraised value range, where high-valued properties are more likely to appeal than lower-valued properties and those that appeal are more likely to receive a value change. This trend is present in both CCAO and CCBOR appeal periods but is more pronounced at the CCBOR at least partly due to the higher appeal rates there. The effect of this is that a greater percentage of the total appraised value is under appeal than the percentage of the total number of properties and that a greater percentage of the total appraised value is being changed than the percentage of the total number of parcels being changed.

- There was a clear drop in the percentage of properties appealed with the CCAO in the South Triad (2020) and the City Triad (2021) in comparison to the percentage appealed with the North Triad (2019).

- A greater percentage of properties file appeals in year one of the three-year assessment cycle than do in the two subsequent years. This is true for both CCAO and CCBOR appeals.

- A greater percentage of appeal properties receive a value change at the CCBOR in year one of the three-year assessment cycle than do with the CCAO. But these numbers flip in years two and three. In the second and third years of the assessment cycle, the CCAO grants a value change on a greater percentage of incoming appeals than does the CCBOR. The raw numbers of appeals with a value change remain higher for the CCBOR in years two and three simply because there are so many more CCBOR appeals filed in those years in comparison to the number of CCAO appeals.

Key Question: Do commercial properties tend to be under or over-assessed with respect to market value?

Summary of Findings:

- Considering the final set of commercial values after the CCBOR finishes its work, we found that the commercial property values were statistically significantly under-valued with respect to market value in the South Triad (2020) and the North Triad (2022) overall, with median sales ratios of 81.37% and 71.79%, respectively. This constitutes a system-wide issue with valuing properties as a whole at the target percentage in these triads. However, this same issue was not present with the City Triad (2021) because its median sales ratio of 98.96% meets the IAAO industry standard and is very close to the 100% target.

- When stratifying by property use group, this study finds that this same general pattern by triad tends to persist.

Key Question: How does the level of assessment compare between properties valued by both the CCAO and the CCBOR?

Summary of Findings:

- The appraisal level after the CCBOR appeals period has been completed (Board step) is statistically significantly less than after the CCAO appeals period has been completed (Assessor Certified step) on an overall basis. In most cases, the appraisal level after the Board step decreases and moves farther away from the IAAO industry standard range, sometimes greatly so. This same general trend exists by property use group strata. The exception was in the City Triad (2021), where the final values after the Board step were an improvement over the Assessor Certified step overall with regard to the appraisal level.

- During their respective appeal periods, the CCBOR and the CCAO both tend to statistically significantly lower the appraisal level for the group of properties that are appealed. This is not surprising given the number of properties under appeal that are granted a reduction. The CCBOR, however, tends to reduce the appraisal level by more than the CCAO on the properties that were under appeal with each body.

Key Question: To what extent do commercial values exhibit general non-uniformity and in what ways, if any, are investors impacted by this?

Summary of Findings:

- Commercial values in Cook County generally are more non-uniform than IAAO industry standards permit, sometimes much more so.

- This non-uniformity in the valuation system is present across triads, steps in the valuation process, and property use groups.

- Both the CCAO and CCBOR appeals processes do not usually result in a statistically significant improvement in general appraisal uniformity (as measured by the COD) on properties under appeal. This suggests that the CCBOR and CCAO appeals processes do not go a long way in improving the general uniformity of commercial valuations.

- This degree of non-uniformity (variability) could be masking other issues with the quality of the values and making it more difficult to derive proper time (market condition) adjustments to sale prices used as a bedrock in sales ratio studies. Reducing the non-uniformity of the sales ratios through the adoption of the recommendations in this report would allow sales ratio studies to be more effective diagnostic tools in the future.

- Property owners are undoubtedly being negatively impacted by the uncertainty that comes along with this degree of non-uniformity.

Key Question: **To what extent is regressivity present? How do the number of appeals and the change of values at each stage affect the degree of regressivity? What effect does the degree of regressivity have on property owners of commercial property?**

Summary of Findings:

- Although commercial property values do tend to display some regressivity, the level of regressivity present does not fall outside the range of IAAO industry standards. Therefore, there is generally no statistical evidence of a broad issue with regressivity (or, more generally, vertical inequity) with commercial property values in Cook County.

- The number of properties that file commercial appeals and then undergo a change in value is indeed extraordinary. Both the CCAO appeals and the CCBOR appeals process do tend to produce appraised values that are slightly more regressive than they were previously, but these differences are not necessarily statistically significant and do not cause the values to fall outside of IAAO industry standards.

- Given the fact that our findings do not include levels of regressivity that do not meet IAAO industry standards, we cannot comment on the degree to which regressivity may be impacting property owners. The larger issue is certainly the level of non-uniformity present in the system; this issue was addressed elsewhere.

OPERATIONAL REVIEW

We thoroughly address each of the five key components outlined in the original scope of work. We also address any additional issues that presented themselves during our study.

1. Data Sources and Valuation Practices

How do the data sources and valuation practices of the CCAO and the CCBOR differ for commercial properties, and what impact do these differences have on the overall assessment system? Specifically, how are capitalization rates determined by each entity, and should loaded or unloaded capitalization rates be used? Are there aspects of the Illinois State Property Tax Code that adversely affect commercial property valuation in Cook County or create unnecessary conflicts with industry standards?

In the following table, we have identified important data sources used by the CCAO and CCBOR and how they may differ. While the discussion of data quality and data management in this report is focused on Income and Expense (I&E) data and appraisals, the general directives are reflected in the IAAO Standard on Mass Appraisal of Real Property (2017), with emphasis on subsection 3, and the IAAO Standard on Data Quality (2021).

	Assessor's Office	Board of Review	Notes
Appraisals	• Taxpayers may provide appraisals to the CCAO but often do not.	• Almost all commercial appeals to the CCBOR include taxpayer appraisals in the filings.	• Both the CCAO and CCBOR desire for these appraisals to meet accepted appraisal standards. The CCBOR receives significantly more appraisals than the CCAO. There is no procedure in place to share these appraisals with the CCAO.
Income and Expense (I&E) Data	• Submission appraisals are not required by state statute. • Owners might provide I&E data but often do not. • Opportunities to gather I&E data from taxpayers have decreased substantially in recent years due to the decline in the number of appeals with the CCAO.	• The CCBOR almost always receives three years of actual I&E data.	• The CCBOR typically has the most up-to-date actual I&E data. • The CCAO often lacks the most up-to-date I&E data mostly because it is not required to be submitted to CCAO by state law.

Capitalization Rate Sources	CCAO data sources include: • CoStar • Appraisals • Market reports • Market research	CCBOR data sources include: • CoStar • Appraisals • Market reports • Market research	• Similar data sources are used by the CCBOR and the CCAO, but the CCBOR receives much more appraisal-based data.
Treatment of Real Estate Taxes	• The CCAO uses an unconventional method.	• The CCBOR uses a conventional loaded capitalization rate.	• The treatment of real estate taxes is a complex process. Refer to the explanation below for why an effective tax rate should be used, followed by our recommendations regarding loaded and unloaded capitalization rates.

Table 1. Important Data Sources Used by the CCAO and CCBOR

Treatment of Real Estate Taxes for Ad Valorem Tax Purposes

The purpose of ad valorem tax valuation is to determine fair and equitable assessments. Property taxes, as a legitimate expense, should be included in the income approach to value. However, circular reasoning occurs when applying a specific dollar amount as a line-item tax expense, since any change in the assessed value will affect the amount of taxes due. As the International Association of Assessing Officers states:

> *"To avoid circularity, however, property taxes are accounted for in valuation for assessment purposes by adjusting the capitalization rate."*[1]

To remedy this circular dilemma, the tax expense line item is removed which consequently overstates the true NOI. To account for the omitted tax expense, the capitalization rate is increased, or "loaded," by the effective tax rate (ETR). Using the ETR instead of the actual tax amount in question results in a fair and equitable valuation.

> *"When the income approach is used to determine the property value for tax purposes, the practice of treating property taxes as an expense item is based on a preconceived value and discredits the whole approach. Because taxes are often the largest single expense, this practice leaves the final value conclusion subject to considerable error. The problem can be resolved by developing an ETR and by including the rate in the capitalization rate for the property being appraised."*[2]

[1] Property Appraisal and Assessment Administration, the International Association of Assessing Officers, Chicago, Illinois, Page 258
[2] Property Assessment Valuation, the International Association of Assessing Officers, Chicago, Illinois, Page 365

Effective Tax Rate

The ETR represents the property tax as a percentage of market value. It is calculated by multiplying the nominal tax rate of the taxing jurisdiction by the assessment ratio. When the assessment ratio does not equal 100% of the market value, the ETR will differ from the nominal tax rate.

Effective Tax Rate Calculation

The ETR is the percentage of market value that represents the appropriate level of taxes for each property within a jurisdiction. This is detailed in the following statement:

> *"To develop the ETR for any class of property in a jurisdiction, multiply the appropriate level of assessment by the current tax rate expressed as a proper decimal. The value conclusion resulting from the use of an ETR is not prejudiced by a predetermined value judgment as it is when taxes are included as an expense item."*

Below is the "EAT"[3] triangle, which illustrates the calculation for the ETR.

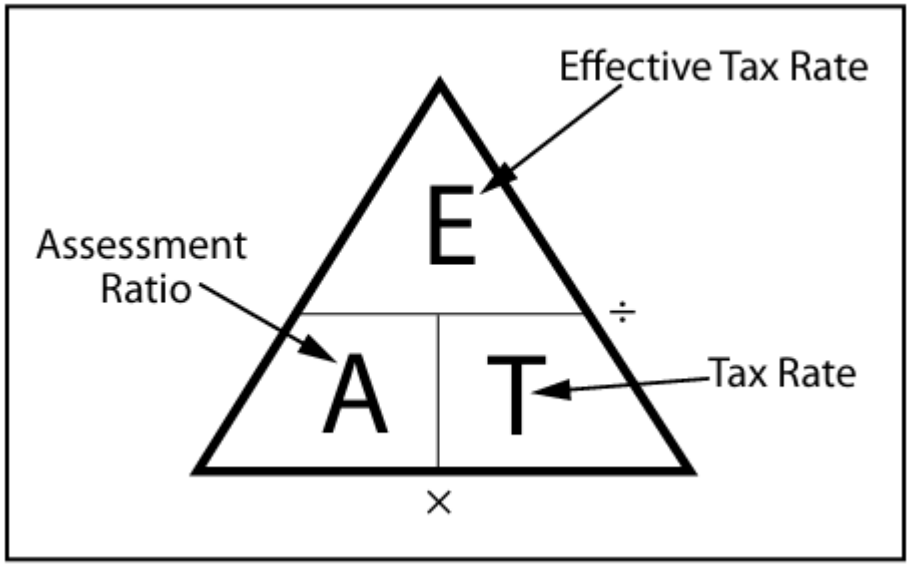

Figure 1. Using the "EAT" Triangle to Calculate the Effective Tax Rate

As shown above, the ETR is calculated by multiplying the assessment ratio by the tax rate.

[3] Property Assessment Valuation, the International Association of Assessing Officers, Chicago, Illinois, Page 357

Effective Tax Rate Imputes

As shown in the EAT triangle formula, the ETR is derived by multiplying the assessment ratio by the tax rate. The final tax rate may be unknown for several reasons.

- Tax rates may be unavailable until preliminary budgets are finalized.
- Non-property tax revenues may fluctuate.
- Changes in the tax base, particularly during revaluation years when all properties are revalued can impact the tax rate.
- Some challenges are common across counties, and they are not unique to Cook County. The industry standard involves using the current tax rate when no changes are anticipated or projecting the tax rate if it is unknown or expected to change.

Hypothetical Example — Gross Leases

The following example illustrates the application of this technique.

In the example table, the real estate taxes are excluded (the current property tax expense is unknown until the value is established). Removing the property tax expense increases net operating income (NOI), but the capitalization rate is also increased by "loading" the rate with the ETR percentage. Thus, the valuation incorporates the effective tax rather than using the existing taxes.

This example demonstrates the flow of calculations through an income analysis.

Example Income Value (Loaded Cap Rate)		Steps	Notes
Income	Total		
Potential Rental Income	$1,000,000		
Vacancy (15%)	$150,000		
Rental Income	$850,000	Step 1	
Expenses			
Real Estate Taxes	$0.00	Step 2	Real estate taxes are removed, because the taxes due are unknown.
Operating Expenses	$ 75,000		
Total Operating Expenses	$ 75,000	Step 3	Does not include taxes
Net Operating Income	$775,000	Step 4	NOI is "Overstated" because property taxes are not paid
Overall Rate (OAR)	*9.0%*		
Tax Loading	2.00%	Step 5	Rate is "Loaded"
OAR Loaded Rate	11.00%	Step 6	This is a "Loaded Capitalization Rate"
Income Value	$ 7,045,455	Step 7	NOI without property taxes / Loaded Capitization Rate

Table 2. Loaded Capitalization Rate Example

As shown, the real estate tax line item is $0 (Step 2), resulting in lower total operating expenses compared to the property's taxes (Step 3). With fewer expenses deducted from the net rental income, NOI is overstated by the exclusion of property taxes (Step 4). The ETR (tax loading) in this example is 2% (Step 5), meaning the annual taxes should be 2% of the market value. The NOI is divided by the loaded capitalization rate (Step 6) to determine the value (Step 7).

Hypothetical Example — Proving the Logic

The previous example resulted in a market value of $7,045,455. Since the market value of the property has been determined, the correct real estate taxes can be calculated. The real estate taxes are calculated by multiplying the market value ($7,045,455) by the ETR (2% or .02). This calculation results in a proper tax bill of $140,909 ($7,045,455 x .02 = $140,909).

Income Value (Loaded Cap Rate)		Steps	Notes
Income	Total		
Potential Rental Income	$1,000,000		
Vacancy (15%)	$150,000		
Rental Income	$850,000	Step 1	
Expenses			
Real Estate Taxes	$ 140,909	Step 2	($7,045,455 x .02)
Operating Expenses	$ 75,000		
Total Operating Expenses	$ 215,909	Step 3	Includes taxes
Net Operating Income	$634,091	Step 4	NOI includes tax expense
Overall Rate (OAR)	*9.0%*		
Tax Loading	0.00%	Step 5	Rate is "Un-Loaded"
OAR Loaded Rate	9.00%	Step 6	
Income Value	$ 7,045,455	Step 7	Note: Values are identical

Table 3. Loaded Capitalization Rate: Proving the Logic

In this scenario, the correct real estate tax expense of $140,909 is included (Step 2) as the accurate real estate tax amount. This adjustment increases the total expenses (Step 3) and decreases the NOI (Step 4). Since the appropriate tax amount is included as an expense, there is no need to "load" the capitalization rate with the ETR (Step 5).

The reduced NOI ($634,091 versus $775,000) is then divided by the unloaded capitalization rate (9%) which is naturally lower compared with the loaded rate (11%). As expected, both methods result in identical values ($7,045,455).

Treatment of Taxes Under Triple Net (NNN) Leases

For properties leased on a triple net (NNN) basis, where tenants are responsible for paying property taxes directly or indirectly through expense reimbursements, an ETR adjustment may not be needed unless there

are expectations of vacancy and collection losses. During the periods of vacancy, the property owner becomes liable for taxes, thus necessitating a partial ETR adjustment.[4]

To calculate the partial ETR, multiply the vacancy and collection loss percentage by the ETR.[5]

V&C % x ETR = Partial ETR

Treatment of Real Estate Taxes — Current Practices

Sound assessing practices require consistency among agencies within the same county to ensure fairness and equity, enhance understanding of property valuations, and build confidence in the property tax system.

Historic Practice — CCAO

The historical method of dealing with the issue of real estate taxes and the question of when to load the cap rate can be summarized by citing excerpts (all italicized) from the CCAO website that address this issue, as follows.

Assessor's Historical Policy and Practice - Using an Unloaded Cap Rate

- ***First Pass Assessment***

  When the Assessor initially sets values for income-producing properties in Cook County (which the office refers to as "First Pass"), it applies prevailing expense ratios that include property taxes, suited for each jurisdiction. The office also looks at actual taxes paid historically. If the estimated value of a commercial property is rising substantially, one can estimate the increase in tax that affects the expense ratio by considering how much assessed value is projected to rise in that jurisdiction.

- ***Second Pass Assessment***

  When reviewing taxpayer-filed appeals (which the office refers to as "Second Pass"), the Assessor uses an unloaded cap rate and considers all of the non-tax factors that come into play during Second Pass.

The Assessor does not load the overall cap rate in any scenario. To properly account for the tax expenses in a gross or modified gross lease, the total operating expense cost is inclusive of the real estate tax, so there is no justification for loading the cap rate. In a NNN lease, operating expenses (including real estate taxes) are passed through to the tenant. This means the expenses are 100 percent reimbursed and there is no justification for loading the cap rate.

[4] Alternatively, some assessing offices transform all leases to gross leases by "grossing up" all expenses passthroughs and reimbursables and use the traditional "loaded" capitalization rate.
[5] International Association of Assessing Officers, Course 112, Page 4-18

A gross lease accounts for a base rental rate plus some level of property operating expenses baked in. The NNN lease assumes a lower base rent because the tenant also must pay the passed through triple net reimbursements, which increases their total lease costs. As such, the amount paid in total by the tenant should roughly equal out (under a NNN or modified gross lease) given similar properties.

Conclusion

The Assessor uses a market-derived unloaded capitalization rate, accounting for real estate taxes upfront, rather than inflating the percentage used on the back end, to produce a present market value.

The historical practice of not loading cap rates when faced with gross leases and modified gross leases was not consistent with professional appraisal practices but has not been the focus of our study, as this practice was not in place when current methodologies were explained to us during our various interviews with representatives of the CCAO office. Meanwhile, we understand that the practice was ill received by analysts at the CCBOR, particularly for properties featuring gross and modified gross leases (less so in net lease situations). In those cases (involving most cases under review by the CCBOR) the CCBOR analysts viewed assessments by the CCAO as inherently in error regarding that aspect of the valuation. This initial predisposition could only act to encourage adjustments to the CCAO value determinations in order to correct the perceived error.

Most importantly, the fact that the CCAO no longer uses this methodology did not appear to be known by the CCBOR analysts at the time of our interviews. The improved communication between the CCAO and CCBOR that this study's recommendations strongly encourage should eliminate this miscommunication and lead to consistent handling of the real estate tax expense along with when and how to load the cap rate.

Current Practice — CCAO

Initial assertions by external parties, notably staff from the CCBOR, indicated that the CCAO office does not exclude real estate taxes as an expense but instead includes historical real estate taxes in expenses and applies an unloaded capitalization rate to determine property value using the income approach. This methodology was reportedly used for valuing properties, such as office buildings. However, subsequent interviews with the CCAO's appraisers revealed a different methodology.

The CCAO analysts employed a methodology wherein they:

1. initially removed taxes from expenses and then
2. applied a loaded capitalization rate to estimate the property's value.

This methodology is consistent with professionally accepted appraisal practices when dealing with properties that feature gross leases.

However, their unconventional practice involved:

1. using the resulting value indication to apply the ETR to estimate real estate taxes. They then

2. included these taxes in a separate income analysis and applied an unloaded capitalization rate.

While the methodology is unconventional, it ultimately yields the same value indication as the professionally accepted appraisal practices of steps 1 and 2. The additional steps (3 and 4) are unnecessary once the value is estimated using steps 1 and 2.[6]

We understand that this methodology was adopted within the past year, representing a departure from the previous practice of using actual historical taxes and an unloaded capitalization rate. The implementation of steps 3 and 4 is unconventional and may create confusion among appraisers and investors who are familiar only with the established appraisal practices represented by steps 1 and 2. Furthermore, this methodology has not been communicated to the CCBOR, which, based on recent interviews, continues to believe that the CCAO office includes historical real estate taxes in expenses and applies an unloaded capitalization rate.

Note that the sales ratio study results are based on values from 2020, 2021, and 2022, all years before this change in methodology by the CCAO.

Current Practice — CCBOR

The CCBOR uses the industry standard of:

1. removing taxes from expenses, and then
2. applying a loaded capitalization rate to estimate the property's value.

Recommendations

Recommendation — Request a Copy of All Appraisals	
Current Practice	The CCAO does not currently request copies of all appraisals submitted to the CCBOR.
Recommendation	The CCAO should formally request copies of all appraisals submitted to the CCBOR.

[6] Notwithstanding any of the foregoing commentary and recommendations, we note that the CCAO web site (as of 7/17/2024) is still promulgating information on the loading of capitalization rates that are not consistent with professional appraisal practices or the methodology currently employed by the CCAO.

Recommendation Benefits	Enhanced Understanding: Acquire a more comprehensive view of the physical attributes of the subject properties. Market Insights: Gain valuable market insights from the appraisals. Data Comparison: Compare the appraisal data with information contained in Cook County's CAMA records for consistency and accuracy. Data Extraction: Extract critical subject and market data, to include rental rates, market vacancy rates, and expense rates. In-Depth Analysis: Garner unique property insights from detailed analyses conducted by fee appraisers.

Recommendation — Request Income and Expense Information	
Current Practice	The CCAO typically receives I&E data for parcels under appeal to the CCAO However, the CCAO does not receive copies of all I&E data submitted to the CCBOR.
Recommendation	The CCAO should formally request copies of all I&E data submitted to the CCBOR. Even though the data can be up to a year old, this would be very helpful to CCAO.
Recommendation Benefits	Enhanced Understanding: Gain a better understanding of properties subject to appeal. Data Utilization: Use the data to develop and refine income valuation models based on property type, physical attributes, location, and other factors. Improved Accuracy: Achieve more accurate appraisals through data-driving modeling.

Recommendation — Enter All Income and Expense Data Into a Database	
Current Practice	Minimal I&E data is entered into the centralized database. The CCAO is in the process of developing this system.
Recommendation	All I&E data should be entered into a centralized database, which should be accessible by the CCAO and CCBOR. The database should also include property type, physical attributes, and location data.
Recommendation Benefits	Accurate Valuation Models: Develop highly accurate valuation models using comprehensive property type, physical attributes, and location. Enhanced Support for Appeals: Provide better data to support appeals with more detailed and accurate information. Data Uniformity: Ensure consistency in valuation conclusions by using shared data between the CCAO and CCBOR.

Recommendation — Joint Internal Capitalization Rate Study	
Current Practice	The CCAO and CCBOR currently rely on third-party capitalization reports.
Recommendation	In addition to the third-party capitalization reports, the CCAO should conduct an annual capitalization rate study. This study could be integrated with the sales validation recommendations discussed later in this report. We would further recommend the annual capitalization reports be a joint project between the CCAO and the CCBOR. This collaboration can be achieved without compromising the agencies' statutory independence.
Recommendation Benefits	Enhanced Reliability: Improve the reliability of capitalization rates by extracting data from market sales and supplementing rates derived from market/investor surveys. Accurate Valuation Models: Accurate capitalization rates are essential for developing reliable valuation models. Benchmark for Valuations: Use the capitalization report as a matrix for developing valuation models and as a benchmark for appeals before the CCBOR. Increased Consistency: Collaboratively creating or sharing the study results will enhance the consistency in capitalization rate between the CCAO and CCBOR.

Recommendation — Standardize Methodology for Loaded Capitalization Rates	
Current Practice	The CCAO and CCBOR currently use different methodologies for loading the capitalization rates.

Recommendation	The CCAO and the CCBOR should adopt a unified methodology for loading capitalization rates.
Recommendation Benefits	Increased Public Confidence: Enhance public trust in the Cook County assessing system. Clarity for Market Participants: Reduce confusion among market participants by aligning methodologies with professional appraisal practices, even if final value indications might be accurate. Create Consistency: Eliminate any ambiguity present at CCBOR when evaluating CCAO values during appeals.

Recommendation — Use an ETR for Loaded Capitalization Rates	
Current Practice	Differences in methodology between the CCAO and the CCBOR have led to significant confusion among stakeholders.
Recommendation	Adopt an Effective Tax Rate-based approach to loading capitalization rates.
Recommendation Benefits	Unified Process: Streamline the process for the CCBOR and CCAO, reducing confusion and simplifying stakeholder understanding Accuracy: Achieve more accurate valuation outcomes. Industry Standard: Align with industry standards, making methodology more understandable for a broad range of investors, including those from national and international markets. Enhanced Perception: Aligning methodologies with industry practices will address assumptions of flawed valuations and improve the perception of CCAO values.

Recommendation — Estimate Tax Rates within the "EAT" Triangle Formula	
Current Practice	The CCAO traditionally uses some form of a three-year average of historical tax rates when estimating the tax rate for the base capitalization rate. The CCBOR uses the tax rate from the previous year.
Recommendation	Both the CCAO and CCBOR should jointly develop a model to estimate the upcoming tax rate for use in the Effective Tax Rate – Assessment Ratio – Tax Rate (EAT) formula. This approach aligns with professional appraisal practices, which recognize that buyers consider future income streams rather than relying solely on historical tax rates. Data science staff would be valuable in this effort.

Recommendation Benefits	Accuracy: Ensure the appropriate ETR is used, especially during revaluation years when the tax rates might fluctuate significantly. Consistency: Align with decision-making models used by market participants and adhere to professional appraisal practices.

Recommendation — Fully Utilize Enterprise Assessment and Tax for Data Entry and Use Codes	
Current Practice	Currently, only some critical data is entered into the CAMA system, Enterprise Assessment and Tax, by CCAO. Efforts are underway to improve this system.
Recommendation	CCAO should maximize the use of Enterprise Assessment and Tax by entering all relevant data, including more detailed use codes such as “anchored retail,” “unanchored strip centers,” “one-story suburban office,” and “multi-story office.” Explore the database's capabilities to handle market sales, I&E data, and other relevant metrics.
Recommendation Benefits	Efficiency: Fully utilizing Enterprise Assessment and Tax may lead to significant time savings and reduce the need for alternative software solutions. Enhanced Accuracy: More descriptive use codes will facilitate the creation of more accurate valuation models for various real property sub-categories. Data Sharing: CCBOR has access to Enterprise Assessment and Tax and so would be able to see information stored there that supports the CCAO value estimate.

Recommendation — Enter all Historical Income and Expense Data into a Centralized Database Shared with CCAO	
Current Practice	Income and Expense (I&E) data submitted to CCBOR is not regularly requested by or made available to the CCAO.
Recommendation	Although the submission of I&E data is not mandated by law, the CCBOR frequently receives substantial historical data. All historical I&E data should be entered into a centralized database, which should be accessible to CCAO and CCBOR.
Recommendation Benefits	Enhanced Valuation Models: Facilitate the development of highly accurate valuation models. Improved Appeal Support: Provide superior data to support appeals. Advanced Analytics: Enable advanced analytic capabilities Detailed Valuation Stratification: Allow for greater stratification of valuation models.

We did not discover any instances where the State Property Tax Code conflicted with industry standards directly. However, there is currently no State requirement to submit current income and expense (I&E) data to the CCAO. In valuing commercial property, it is essential to have the current and historical I&E data to accurately value the property. Having the current and historical I&E data would assist in creating more accurate assessment values.

Recommendation — Support Legislation Requiring Income and Expense Data	
Current Practice	There is no legal requirement to submit current I&E data to the CCAO.
Recommendation	The CCAO should support efforts (which they are currently doing) to change the law to have I&E data required.
Recommendation Benefits	Having the current and historical I&E data would assist in creating more accurate assessment values from the very beginning of the valuation process. This could reduce the reliance on the appeals process to correct potential issues that are based solely on estimated vs. actual income and expenses.

2. Handling of Valuation Evidence

How do the CCAO and the three CCBOR Commissioners handle valuation and evidence presented by the property owner?

Assessor's Office	Board of Review	Notes
• The CCAO receives taxpayer information.	• The CCBOR receives taxpayer information.	• The CCAO and the CCBOR receive taxpayer information. However, the CCBOR receives considerably more information.

Table 4. Evidence Presented to CCAO and CCBOR for Valuation

The CCBOR, as an appellate body, typically receives extensive information, which includes the actual I&E data and often an appraisal. Because it is not required by law and appeals to the CCAO are few, compared to the CCBOR, the CCAO receives very limited data, notably little I&E data.

The CCBOR and the CCAO do not have a robust, jointly established process for retaining evidence in a mutually query-able database. While not directly on point, the idea of collecting and reviewing this data is part of the IAAO Standard on Mass Appraisal of Real Property (2017), notably Subsection 3.5. Principles of sound data management are also found in the IAAO Standard on Data Quality (2021).

Recommendations

Recommendation — Share Valuation Evidence	
Current Practice	The CCBOR, as a hearing board, receives considerably more information than the CCAO. Currently, minimal data is shared between the CCAO and CCBOR.
Recommendation	The CCAO should formally request all valuation evidence submitted to the CCBOR. Additionally, key pieces of evidence, notably I&E data, should be stored in a shared database (as previously addressed in section 1. Data Sources and Valuation Practices).
Recommendation Benefits	Enhanced understanding: Obtain a more comprehensive understanding of the subject properties. Improved Accuracy: Achieve more accurate appraisals by leveraging a broader data set. Better Data for Valuation Models: Access improved data for developing more reliable valuation models

3. Appeal Information from the CCAO

What information does the CCAO provide the CCBOR, and how does the CCBOR use this information? How effectively does this information communicate the justification for the CCAO's valuation to the CCBOR?

There is no significant ongoing participation by the CCAO in the CCBOR appellate process, but there certainly should be (IAAO Standard on Assessment Appeal, 2016). It is a rare occurrence that the CCAO formally requests an "intervenor" and provides evidence for consideration by the CCBOR. While the CCAO promulgates the valuation models on their website, they do not provide all of the pertinent supporting data and reasoning associated with these conclusions. In short, the CCAO does not provide the CCBOR with any information in nearly all cases, but this question points to issues we have come to believe should be given serious consideration, to wit, we offer the following.

The extensive use of the appellate system in Cook County effectively creates a second mass appraisal system in the form of CCBOR appeals and results in new values for over ten thousand commercial parcels each year. The system encourages appeals of the findings by the CCAO through actions that fall short of best practices. In 2023, there were 21,347 appeals to CCAO and 59,742 appeals to CCBOR out of 95,594 total parcels. More detailed statistics on the number of appeals, outcomes of those appeals, and how the final values differed from the determination by the CCAO, can be found in the Statistical Component of this project, presented after we discuss the commercial appraisal and appeals process.

One of the important observations in the statistical discussion is that the appellate process has not statistically significantly served to improve the quality of the valuation roll consistently. Meanwhile, reductions to the

values determined by the CCAO are common and if not achieved at the CCBOR level, can be taken to the Property Tax Appeal Board (PTAB) or to Circuit Court (CC), where there is typically a negotiated settlement between the CCBOR and the taxpayer. Both CCAO and CCBOR report that they lack the staff to effectively defend their determinations at their respective next levels. As discussed earlier, the CCAO very seldom offers evidence at all, let alone enough evidence to allow the CCBOR to be more effective at the PTAB/CC level, and CCBOR does not consistently offer a robust set of evidence at the next level.

Lastly, and while not directly on point for this section, we have explored how information flows from the CCBOR to the CCAO and the public. Our various interviews revealed a lack of understanding by CCAO staff of exactly what processes are used by CCBOR analysts. We were also interested in the level of consistency among the CCBOR analysts. In short, a "two-way" street of information flow, especially as it relates to CCBOR review processes and areas of valuation where it is typical for professional discretion to occur (e.g. atypical vacancy) would increase transparency and build public trust in a system that essentially relies on two bodies to establish many of the commercial property values.

When we were graciously allowed to observe the CCBOR hearings, we noted consistency among the analysts, as they generally followed accepted professional appraisal practices, such as those promulgated by the IAAO and Appraisal Institute. Meanwhile, we noted a lack of documentation of what the review process consisted of and particulars on how common subjective issues were handled. For instance, how atypically high vacancy, not consistent with overall market vacancy, was handled. If the CCBOR were to promulgate their processes for review and provide insights into how some of the more subjective aspects of their valuation methods (the handling of unusual vacancy issues is but one example) are handled, the CCAO and other stakeholders would be better informed and better understand the CCBOR review processes. Indeed, after reviewing this data, the CCAO could provide their feedback on the more subjective valuation issues and perhaps the CCAO and CCBOR would arrive on the same page, further reducing the potential for adjustment to CCAO assessments.

Recommendations

Recommendation — Create Informational Packets for Each Appeal	
Current Practice	The CCAO currently does not provide any information for consideration by the CCBOR in most hearings.
Recommendation	The CCAO should prepare and submit "hearing packets" for all commercial appeals. These packets should include methodology and supporting data used to calculate the assessed values.
Recommendation Benefits	Enhanced clarity: Enable the CCBOR to understand the CCAO's methodology and analysis. Reduced confusion: address confusion regarding valuation methodologies, notably for multi-tenant properties involving gross leases.

Recommendation — Develop Automated Tools to Produce Hearing Packets	
Current Practice	The CCAO does not typically provide information to the CCBOR for most hearings, and creating such information manually is time-consuming.
Recommendation	To streamline the process of creating "hearing packets" for commercial appeals, developing or acquiring automated tools should be a priority in producing the hearing packets.
Recommendation Benefits	Significant Time Savings: Reduce the time required to prepare documentation. Increased Efficiency: Enable the handling of thousands of appeals more effectively given staffing concerns.

Recommendation — CCAO Staff Should Attend Hearings and Defend Values Before the CCBOR	
Current Practice	The CCAO does not attend hearings or provide information to the CCBOR.
Recommendation	The CCAO should attend hearings and present their case at hearings before the CCBOR. They should also address property-specific valuation issues.
Recommendation Benefits	Reduced Appeal Rates: Lower the rate of appeals. Fewer Value Reductions: Result in fewer reductions in assessed values. Increased Consistency: Promote valuation consistency between the CCAO and CCBOR.

Recommendation —CCAO and CCBOR Staff Should Share Data, Methodologies, and Valuation/Market Perspectives	
Current Practice	Currently, there is little communication and data sharing between the CCAO and CCBOR.
Recommendation	CCAO and CCBOR analysts should meet regularly to discuss overall valuation methodologies and market trends and share data. Shared educational opportunities offered by the two offices could further the adoption of consistent methodologies and perspectives between the two entities.

Recommendation Benefits	Improved Understanding: Foster a better understanding of valuation methods and market perspectives between the two entities. Operational Efficiency: Avoid duplicate efforts through shared data. Enhanced Consistency: Achieve greater valuation consistency between the two agencies.

Recommendation — Post Updated Processes and Policies	
Current Practice	The CCAO and CCBOR do not consistently promulgate updated versions of their processes and policies for review by the respective offices and other stakeholders.
Recommendation	Both the CCBOR and CCAO should post key processes and policies on the internet for review by all stakeholders and should keep them updated over time as changes occur. Those policies and processes that relate to areas of valuation that tend to involve professional discretion and judgement would be of greatest benefit.
Recommendation Benefits	A better understanding of how the two offices handle valuation and valuation review processes would highlight any differences, foster inter-office discussion, and quite reasonably lead to consensus on issues involving professional discretion and judgement. Increased transparency would also instill greater trust in the public for both offices.

4. Sale Validation and Price Adjustments

How are commercial property sale prices adjusted for various factors during the sales validation process for inclusion in valuation and sales ratio studies? Are these adjustments being performed appropriately using a uniform set of guidelines?

Our interviews with representatives of the CCAO reveal that they have only recently begun to develop a process to validate market sales, and this process is still in a nascent form. We strongly encourage the development of a process to comprehensively validate and store market sales data according to the standards laid out in the IAAO Standard on Verification and Adjustments of Sales (IAAO, 2020). Without validated market sales to test valuations, the CCAO is unaware of the value of the many ratio study metrics that gauge the level, uniformity, and reliability of assessments. Further, there is no doubt that the lack of a proper sales validation process makes it difficult to measure true valuation performance and likely caused some inflation in the levels of non-uniformity measured in the statistical portion of this review. This does not absolve an assessing jurisdiction of responsibility, however, because, according to best practices, assessing jurisdictions are responsible for determining the list of valid market transactions on which to measure the quality of the values (IAAO, 2020). Also, without validated market sales, CCAO would not be armed with a complete list of comparable market sales to use in value defense.

A reliable comparable sales database could be shared with the CCBOR, further encouraging lines of communication between the CCAO and the CCBOR. Noting that assessments are tested for consistency with market prices would further bolster public confidence in the valuations by the CCAO.

Recommendations

Recommendation — Verify All Commercial Sales	
Current Practice	The CCAO currently lacks a systematic procedure for verifying all commercial sales.
Recommendation	The CCAO should establish a comprehensive sales validation procedure to review all commercial sales according to best practice standards found in the IAAO Standard on the validation and Adjustment of Sales. Additionally, the sales database and sales validation process should be shared with the CCBOR, and the CCAO should communicate validated sales to representatives from the Illinois Department of Revenue (IDOR).
Recommendation Benefits	Enhanced Valuation Accuracy: Improve the precision of valuation models. Improved Ratio Studies: Achieve more accurate ratio studies. Eliminate Non-Market Sales: Exclude non-market sales from analyses. Reliable Capitalization Reports: Create capitalization reports using only valid sales. Support for Appeals: Ensure that only valid sales support a value during appeals.

5. Potential for Regressivity

What are the potential causes of any regressivity that exists at each stage?

This project's sales ratio study found that appraised values were generally regressive but that the levels of the regressivity present were within the IAAO industry standards found in the IAAO Standard on Ratio Studies (IAAO 2013, p.19). Further, this project found that the appeals process, at both the CCAO and the CCBOR, tended to add some regressivity but, again, not enough to fall outside of IAAO industry standards. Please see the Statistical Analysis portion of this report for more details.

The amount of general non-uniformity (variability) present does make it more difficult to draw statistical conclusions about the degree of regressivity (or, more broadly, vertical inequity) present. Improving overall uniformity and implementing a proper sales validation process will in turn allow the degree of regressivity to be measured more accurately and for statistical conclusions to be drawn more easily.

Recommendations

Recommendation — Both the CCAO and CCBOR Should Regularly Perform Commercial Ratio Studies According to IAAO Standards	
Current Practice	Neither the CCAO nor the CCBOR currently performs commercial sales ratio studies, and neither office could share historical sales ratio studies that they performed in the past.
Recommendation	Both the CCAO and the CCBOR should regularly perform commercial ratio studies using a consistent set of practices and statistical measures that are in keeping with the current IAAO Standard on Ratio Studies. For CCAO, this should be an integral part of their mass valuation process.
Recommendation Benefits	Ratio studies are needed to evaluate the performance of mass valuation models and are an important part of the mass valuation process. Ratio studies provide an objective measure of mass valuation performance, particularly when they evaluate appraised values against a set of agreed-upon industry standards. Ratio studies can be used to measure the impact of the appeals process.

DETAILED STATISTICAL ANALYSIS

Purpose of a Ratio Study

The purpose of a sales ratio study is to evaluate assessment performance (IAAO 2013, p.7). A sales ratio is the estimated value of a property divided by its sale price. For example, a sales ratio of 40% (or 0.40) means that the appraised value is set to 40% of that of the sale price. The estimated value is sometimes called the predicted price or the appraised value; this report may use these terms synonymously and interchangeably. Sale prices, which are valid for analysis and otherwise recorded appropriately, are the "most objective estimates of market value" and are used as the basis for evaluating assessment performance in a sales ratio study (IAAO 2013, p.7). A set of well-collected, properly validated sales is a critically important part of a sales ratio study. Ratio studies analyze a set of ratios to determine the degree to which groups of appraised (or assessed) values accurately reflect market value. The IAAO ***Standard on Ratio Studies*** states the following on page 7:

> *"There are two major aspects of appraisal accuracy: level and uniformity. Appraisal level refers to the overall ratio of appraised values to market values. Level measurements provide information about the degree to which goals or certain legal requirements are met. Uniformity refers to the degree to which properties are appraised at equal percentages of market value."*

Appraisal estimates of market value are typically not used in a ratio study instead of sale prices unless validated sales are largely unavailable; even then, appraisal estimates of market value must be calculated independently.

All value estimates, whether produced by the CCAO, the CCBOR, or an external appraiser, are inherently subject to a degree of statistical error depending on several factors such as the accuracy of available property data and the skill of the appraiser or model developer. The IAAO Standard on Ratio Studies sets professional standards for appraisal level and uniformity that recognize there is some degree of imperfection in any set of value estimates. Sales ratio studies can answer the question of whether a set of appraised value estimates meets the acceptable standards as promulgated by the IAAO with respect to level and uniformity.

A population is the full set of properties defined by a set of criteria, and a sample is a subset of properties that is drawn from a given population. For a sales ratio study, a sales sample is drawn from the population of all properties by the fact that the properties in the sample are sold during the relevant period and meet all other data constraints and filters. A foundational principle of ratio studies is that conclusions can be made about the appraisal performance for the population of properties using the sales sample (IAAO 2013, pp.7-8), so long as the sales sample has been appropriately collected, is free from statistically and practically significant selective reappraisal, and is sufficiently representative of the population (IAAO 2013, p.11).

Key Uses of Ratio Studies

The IAAO ***Standard on Ratio Studies*** lists the key uses of ratio studies as follows (Page 7):

- measurement and evaluation of the level and uniformity of mass appraisal models
- internal quality assurance and identification of appraisal priorities
- determination of whether administrative or statutory standards have been met
- determination of time trends
- adjustment of appraised values between reappraisals

Seven Steps in a Ratio Study

Ratio studies generally involve the seven basic steps listed below. (IAAO 2013, p. 8)

Step 1: Define the Purpose, Scope, and Objectives

Every well-constructed ratio study has an intended purpose, which is broadly defined according to the end goal or key questions being posed to the researcher. The scope and objectives of the ratio study are then defined accordingly.

Step 2: Design

The design of the ratio study is the methodologies by which the purpose, scope, and objectives of the ratio study are investigated. The design includes the choice of analyses, statistical tests, and means of presenting the results.

Step 3: Stratification

Stratification is the process of dividing the sale properties in the ratio study into two or more groups called strata and then running the ratio study in each stratum as well as for the overall set of properties. Stratification can be a useful tool to provide a more detailed picture of appraisal performance (IAAO 2013, p.9). In ratio studies, a stratification framework should be derived according to several factors, including the goal of the sales ratio study, the availability of appropriate variables to use as a basis for stratification, and the number of sales in each proposed stratum.

Step 4: Collection and Preparation of Market Data

It is important to accurately collect appropriate market data, such as sales, to use in a ratio study and to prepare it for analysis. This includes the sales validation (sales validation) process where information about the sale and the sale property are verified and a decision is made on whether a given sale is valid for analysis. It also includes the preparation of all sales data in an appropriate format. Part of this process in a sales ratio study is defining an appropriate sale date range, where all verified sales within the sale date range are candidates for inclusion in the ratio study.

Step 5: Matching of Appraisal and Market Data

Once market data has been collected and prepared in a usable format, it must be appropriately matched with appraisal data. This forms the basis for the ratio analysis because the ratios analyzed in the study are simply the assessed (or appraised) value divided by the proxy for market value. In the case of a sales ratio study, this proxy for market value is the validated sale price. Properties that are fundamentally different between the sale date and the appraisal data are not matched appropriately and should be removed from the study.

Step 6: Statistical Analysis

The statistical analysis generates the key statistics evaluated in the ratio study. These analyses are defined in the ratio study design according to the purpose, scope, and objectives of the study. The researcher has the power to choose the most appropriate set of statistical analyses based on their experience, knowledge of relevant standards, and statistical knowledge.

Step 7: Evaluation and Use of Result

The key statistics generated from the statistical analysis must be interpreted and evaluated, with the end goal of fashioning them into a usable set of results.

Statistical Background

Calculating a Sales Ratio

A sales ratio study is an analysis of sales ratios. A sales ratio is calculated by taking an appraised (or assessed) value and dividing it by the sale price of a valid sale transaction. Consider the following example:

- An office building has an assessed value of $1,000,000 as of the assessment date.

- The same office building has a verified and validated sale price of $4,000,000 during the sale date range included in the study. Assume that no time adjustment to the sale price is appropriate in this case.
- The sales ratio is equal to $1,000,000 / $4,000,000 = 0.25 or 25%.
- This means that the assessed value is set to 25% of the sale price in this instance.

All sales ratios included in the study are aggregated for stratification and statistical analysis. The sales ratios for multiple parcel sales are calculated in the same way except that the assessed values for all of the parcels in the sale are added together to form an aggregated assessed value for the sale.

Outlier Handling

Outliers have unusual values that are far from the center of the distribution and could occur for a variety of reasons. According to the IAAO ***Standard on Ratio Studies*** on page 13:

> *"The validity of ratio study statistics used to make inferences about population parameters could be compromised by the presence of outliers that distort the statistics computed from the sample."*

Therefore, outliers must be dealt with appropriately in a sales ratio study. It is often best practice to first investigate outliers, if possible, in case they are a result of data that can be corrected, such as an inaccurately recorded sale price. If outliers are unable to be corrected, they are then candidates for removal using an accepted statistical procedure in accordance with the size removal restrictions outlined in the IAAO Standard on Ratio Studies[7]. Sales ratio outliers are sales ratios with unusually small or large values which could distort certain measures like the Coefficient of Dispersion (COD).

Confidence Intervals

The primary concern of ratio studies is to make conclusions about the population of properties based on a sample. Because not all properties sell in a given period, all properties that do sell make up a sales sample of the population of properties. Point estimate statistics calculated from a sales sample inherently contain sampling error, defined as the type of error resulting solely from the sampling process (IAAO 2013, p.43). For example, if 100 samples are drawn from a given population of properties, then 100-point estimate statistics will be calculated. The difference between the 100-point estimate statistics is explained by sampling error.

Confidence intervals account for sampling error and thus serve as a measure of the precision for the calculated point estimate statistic as an estimate of the unknown population parameter with a given degree of confidence. For example, if the point estimate of the median sales ratio is 99% and the 90% confidence interval for the unknown population median sales ratio is 94% to 104%, then the best estimate of the unknown population median ratio is 99% and that it can be said with 90% confidence that the population median sales ratio is in the range of 94% to 104%.

[7] This procedure is found in Appendix B of the IAAO Standard on Ratio Studies.

Statistical Hypothesis Testing

Statistical hypothesis testing is used to make conclusions about a population based on a sample. Confidence intervals can also be used to conduct statistical hypothesis testing. Conclusions about the population of properties, including non-compliance with IAAO Standards, cannot be made without using statistical hypothesis testing to account for sampling error (IAAO 2013, p.15). If the confidence interval overlaps a standard range, then that statistic is said to have met the standard, regardless of the value of the statistic's point estimate (IAAO 2013, pp.34-35). A variety of statistical tests can be employed depending on the design of the ratio study.

Sale Price Time Trend Analysis

Sale price time trends measure sale price fluctuations over a given date range. There are a variety of methods available to measure sale price trends and certain methods are preferred in certain contexts. Time adjustments can be derived from sale price time trend models as a multiplicative factor to adjust each sale to the estimated market value as of a given date.

Appraisal Level Statistics

Ratio studies typically include measures of appraisal level and appraisal uniformity. The appraisal level is a measure of central tendency for the distribution of sales ratios. Depending on the purpose for which the study is being made, different measures of appraisal level may be used such as the median ratio or the weighted mean ratio. The IAAO ***Standard on Ratio Studies*** states that the mean ratio is generally not the preferred measure of the appraisal level (IAAO 2013, p. 28).

- The median sales ratio is the middle value of the sales ratios sorted in increasing order, if the number of sales ratios is odd, or the average of the two middle sales ratios, if the number of sales ratios is even. The median is resistant to the effect of sales ratio outliers (IAAO 2013, p.13). According to the IAAO Standard on Ratio Studies, "the median is the generally preferred measure of central tendency for direct equalization, monitoring of appraisal performance, or evaluation of the need for a reappraisal" (IAAO 2013, p.27).

- The weighted mean sales ratio is the mean ratio weighted by the sale price. This is sometimes called the aggregate ratio and can be calculated by dividing the sum of the appraised (assessed) values by the sum of the sale prices. Larger sale prices will have a greater effect on the value of the weighted mean than smaller sale prices. For example, a $5,000,000 sale will have ten times the weight of a $500,000 sale in the calculation of the weighted mean. Unlike the median, the weighted mean is not resistant to either sales ratio outliers or large value outliers. Large sale price value outliers can distort the weighted mean (IAAO 2013, p.28). In medium to large-sized samples, wide confidence intervals for the weighted mean may be indicative of the effect that only a few larger-valued sales have on the value of this statistic.

Appraisal Uniformity Statistics

Appraisal uniformity is a measure of the variability of the ratio distribution. Ratio studies are usually concerned with a general measure of overall variability, like the Coefficient of Dispersion (COD), and a measure of variability that specifically measures vertical inequity, like the Coefficient of Price-Related Bias (PRB).

Coefficient of Dispersion (COD)
The Coefficient of Dispersion (COD) is a general measure of appraisal variability. It is equal to the average absolute deviation of the sales ratios from the median sales ratio divided by the median sales ratio and is calculated as follows: (IAAO 2013, p. 13)

Calculate the median sales ratio

- Subtract the median sales ratio from each ratio
- Take the absolute value of the calculated differences
- Sum the absolute differences
- Divide by the number of ratios to obtain the average absolute deviation
- Divide by the median sales ratio
- Multiply by 100

The COD is based on the median and is therefore not resistant to the effect of ratio outliers. The COD provides a general measure of how tightly the sales ratios are distributed around the median sales ratio. The lower the COD, the more tightly the sales ratios are distributed around the median sales ratio. Conversely, the higher the COD, the more spread out the sales ratios are around the median sales ratio.

Figure 2 provides a useful visualization of the COD where two hypothetical sales ratio distributions with different CODs are superimposed. The density lines show how the sales ratios fall in a distribution around the median of the sales ratios. The COD is a measure of this variability. Notice how the sales ratio distribution with a COD of 15 is more tightly distributed around the median sales ratio and the sales ratio distribution with a COD of 25 is more spread out. This means that the lower the COD, the more tightly distributed the sales ratios are around the median sales ratio and so the more accurate the appraised (assessed) values are.

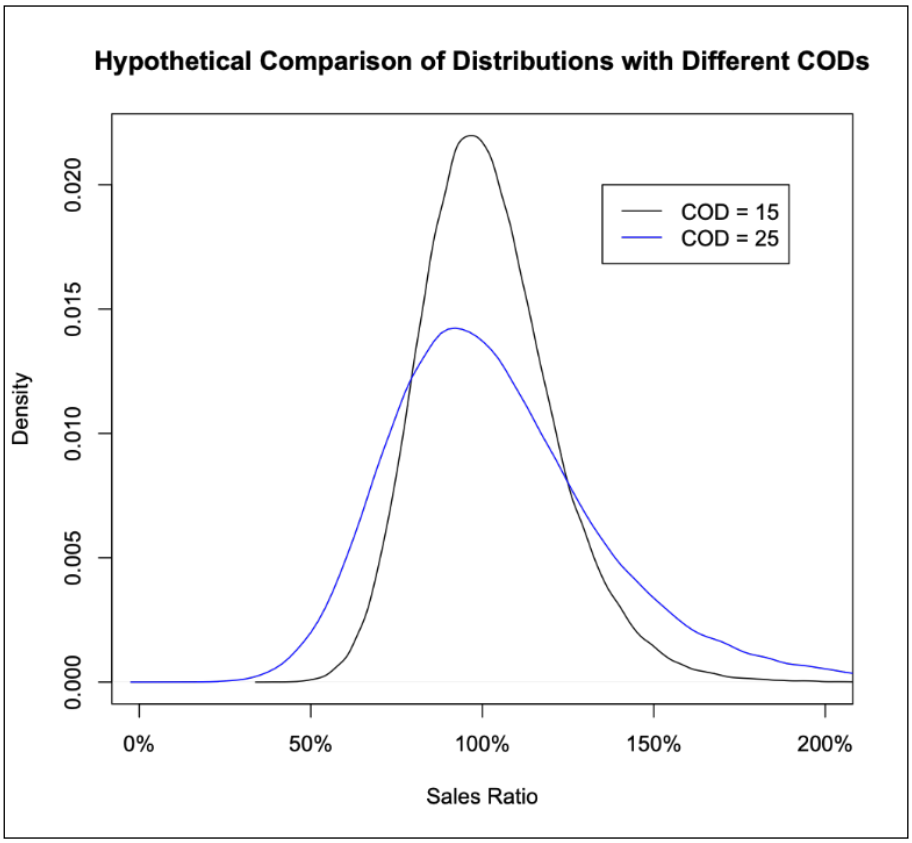

Figure 2: A Hypothetical Comparison of Two CODs: 15 and 25

The IAAO Standard on Ratio Studies has promulgated standard ranges for the COD based on the type of property. There are two different tables of acceptable standard ranges (found on p.17 and p. 34 of the Standard, respectively) and both are shown in **Tables 3 and 4** for context. Demonstrating the predictive error inherent in the assessment process, the lower end of each acceptable range is 5% and this is thought to be the best COD achievable in most circumstances assuming the assessment process has been conducted properly (IAAO 2013, p.19).

Type of property—General	Type of property—Specific	COD Range**
Single-family residential (including residential condominiums)	Newer or more homogeneous areas	5.0 to 10.0
Single-family residential	Older or more heterogeneous areas	5.0 to 15.0
Other residential	Rural, seasonal, recreational, manufactured housing, 2–4 unit family housing	5.0 to 20.0
Income-producing properties	Larger areas represented by large samples	5.0 to 15.0
Income-producing properties	Smaller areas represented by smaller samples	5.0 to 20.0
Vacant land		5.0 to 25.0
Other real and personal property		Varies with local conditions

Table 5. IAAO Standard Ranges Part 1 for the COD by Type of Property

General Property Class	Jurisdiction Size/Profile/Market Activity	COD Range
Residential improved (single family dwellings, condominiums, manuf. housing, 2-4 family units)	Very large jurisdictions/densely populated/newer properties/active markets	5.0 to 10.0
	Large to mid-sized jurisdictions/older & newer properties/less active markets	5.0 to 15.0
	Rural or small jurisdictions/older properties/depressed market areas	5.0 to 20.0
Income-producing properties (commercial, industrial, apartments,)	Very large jurisdictions/densely populated/newer properties/active markets	5.0 to 15.0
	Large to mid-sized jurisdictions/older & newer properties/less active markets	5.0 to 20.0
	Rural or small jurisdictions/older properties/depressed market areas	5.0 to 25.0
Residential vacant land	Very large jurisdictions/rapid development/active markets	5.0 to 15.0
	Large to mid-sized jurisdictions/slower development/less active markets	5.0 to 20.0
	Rural or small jurisdictions/little development/depressed markets	5.0 to 25.0
Other (non-agricultural) vacant land	Very large jurisdictions/rapid development/active markets	5.0 to 20.0
	Large to mid-sized jurisdictions/slower development/less active markets	5.0 to 25.0
	Rural or small jurisdictions/little development/depressed markets	5.0 to 30.0

Table 6. IAAO Standard Ranges Part 2 for the COD by Type of Property

Coefficient of Price-Related Bias (PRB)

The Coefficient of Price-Related Bias (PRB) is a measure of market-value vertical inequity and is based on regressing the percent difference between the sales ratios and the median sales ratio versus the log base 2 of a market value proxy. Market-value vertical inequity is when properties with different market values have different levels of appraisal. The PRB gives an indication of whether the vertical inequity, if any, is generally in a regressive (favoring higher-valued properties) or progressive (favoring lower-valued properties) direction by its sign. If the PRB is negative, the vertical inequity is regressive; if the PRB is positive, the vertical inequity is progressive.

The PRB is generally statistically superior to the Price-Related Differential (PRD), an alternative statistic used to measure vertical inequity, chiefly because it is usually less biased toward regressivity. The PRD is based on the weighted mean and therefore suffers from problems when there are large value outliers; the PRB also suffers from this same problem but to a lesser extent. The PRD is also more biased toward regressivity in cases when the sale price is a less reliable indicator of market value; this can happen in inefficient markets or when the sales validation process has not been conducted properly. The IAAO Standard on Ratio Studies says, “The coefficient of price-related bias (PRB) provides a more meaningful and easily interpreted index of price-related bias than the PRD” (IAAO 2013, p.14). Therefore, the PRB is used in this analysis rather than the PRD. Assuming the straight-line relationship holds, the PRB can be interpreted as the percentage by which sales ratios rise (if the PRB is positive) or fall (if the PRB is negative) as the appraised values double (e.g. a PRB coefficient of 0.04 means that as appraised values double the sales ratios increase by 4%, indicating progressive vertical inequity).

The IAAO Standard on Ratio Studies states that the PRB standard range is -0.10 to 0.10 and that values outside of this range constitute unacceptable vertical inequities (IAAO 2013, p.36). IAAO also gives general guidance that values of the PRB should fall within the range of -0.05 to 0.05 (IAAO 2013, p.36).

Figure 3 provides a useful visualization of the PRB where two hypothetical sales ratio distributions with different PRBs are shown side by side. Here, the percent change between the sales ratios and the median sales ratio is plotted against the market value proxy of the property. This is the typical PRB setup, except that the market value is expressed in a monetary scale instead of the log scale for ease of understanding. The two PRBs show varying degrees of regressive bias, with one being mildly regressive but within acceptable limits (PRB = -0.02) and the other being more regressive and outside acceptable limits (PRB = -0.12). The

PRB fitted line is displayed for both cases. The PRB fitted line is almost flat in the case where the PRB = -0.02 but is noticeably steeper and more regressive in the case where the PRB = -0.12. As the PRB becomes increasingly regressive, note that lower-valued properties are being appraised at a greater and greater percentage of their market value than higher-valued properties.

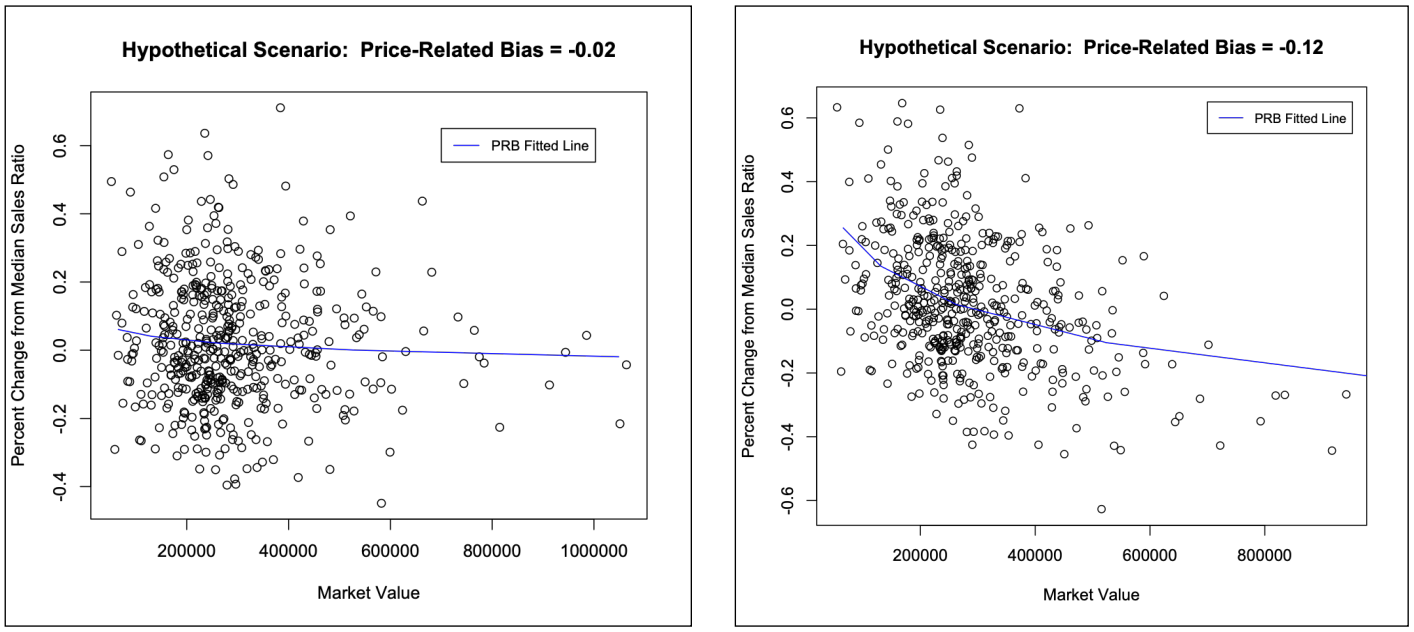

Figure 3. A Hypothetical Comparison of Two PRBs: -0.02 and -0.12

Uniformity Test of Group Medians

The IAAO Standard on Ratio Studies also presents another test of uniformity based on a comparison of group appraisal levels to the overall appraisal level. Groups could be determined based on geographic region, property use, or some other category. Under this test, if an estimate of the group appraisal level is statistically significantly greater than the appraisal level plus 5% or statistically significantly less than the appraisal level minus 5%, then the conclusion is that there is a lack of uniformity (IAAO 2013, p. 18-19).

This test can also be applied specifically in the context of vertical equity through the creation of value groups (calculated by first sorting the sales by a market value proxy, such as the average of the appraised value and the sale price, and then creating groups of sales through the use of cut points), calculating the median for each value group, and then performing the proper statistical test for each value group.

Selective Reappraisal

Selective reappraisal occurs when sold and unsold parcels are appraised differently. When practically significant and statistically significant selective reappraisal is present, inferences about the population of properties made from the sales ratio study sample will not be accurate (IAAO 2013, p.59). To properly design a test for selective reappraisal, it is important to first identify a sale date range that could have been subject to selective reappraisal, if present.

Current Ratio Study and Related Statistical Analysis

This section describes the current project in terms of the seven basic steps of creating a sales ratio study.

Step 1: Define the Purpose, Scope, and Objectives

The CCAO completes a reassessment for one triad each year. In 2020, it was the South Triad; in 2021, it was the City Triad; in 2022, it was the North Triad, and so on. The CCAO and the CCBOR each have an appeals period for the entire County each year, regardless of which triad is being reassessed. This project's purpose is to conduct an independent sales ratio study and other associated statistical analyses to investigate the quality of the commercial values at each of these steps for each triad and to otherwise answer each of the key project questions.

This sales ratio study is designed and oriented around this purpose in the following way. The appeals process is investigated using the three most recent triad years that have had their full three appeal year cycles completed (2019 – North Triad, 2020 – South Triad, and 2021 – City Triad). This allows one to see how appeal activity changes for commercial property at the CCAO and the CCBOR levels across each of the three years after a triad is reassessed (the intervening years between reassessments in a triad). In addition, the appeals process is explored more in-depth for the first year in the cycle for the three most recently completed triad-years (City Triad – 2021, North Triad – 2022, and South Triad – 2023). This allows one to have a greater understanding of the initial appeal rates for different types of properties.

The overall quality of the full-market commercial values is measured using a sales ratio study at each of the three steps in the process (the initial values on the assessment notice from the CCAO, the certified values after the CCAO appeals period, and the final set of values after the CCBOR appeals period) for the three most recently completed triads with adequate sales available (South Triad in 2020, City Triad in 2021, and North Triad in 2022). This allows for a fair comparison of the commercial values across each step in each triad to the market value as of January 1 of each triad year. For each triad measured, sales from the next calendar year after the triad's effective reassessment date through 12/31/2023, the last date available, are used. For the South Triad in 2020, this means that sales from 01/01/2021 through 12/31/2023 are used in the sales ratio study; for the City Triad in 2021, sales from 01/01/2022 through 12/31/2023 are used in the sales ratio study; for the North Triad in 2022, sales from 01/01/2023 through 12/31/2023 are used in the sales ratio study. Smaller sales datasets were used in the City and North Triads to report more recent results; these samples were still sufficient in size.

It is worth noting that this statistical analysis is conducted using sales and valuation data that occurred during the COVID-19 pandemic. It is not precisely known the degree to which the pandemic may have had an effect on any of the analyses that were conducted. The importance of analyzing the most recent data, however, outweighed any of these concerns when designing the statistical analysis.

This report also conducts a more direct analysis of the effect of the two appeals processes. In contrast to the overall analysis, this analysis seeks to understand how the appeals processes conducted by the CCAO and the CCBOR affect the quality of only those values that were appealed. This analysis uses the same triad and sale date ranges as the overall analysis.

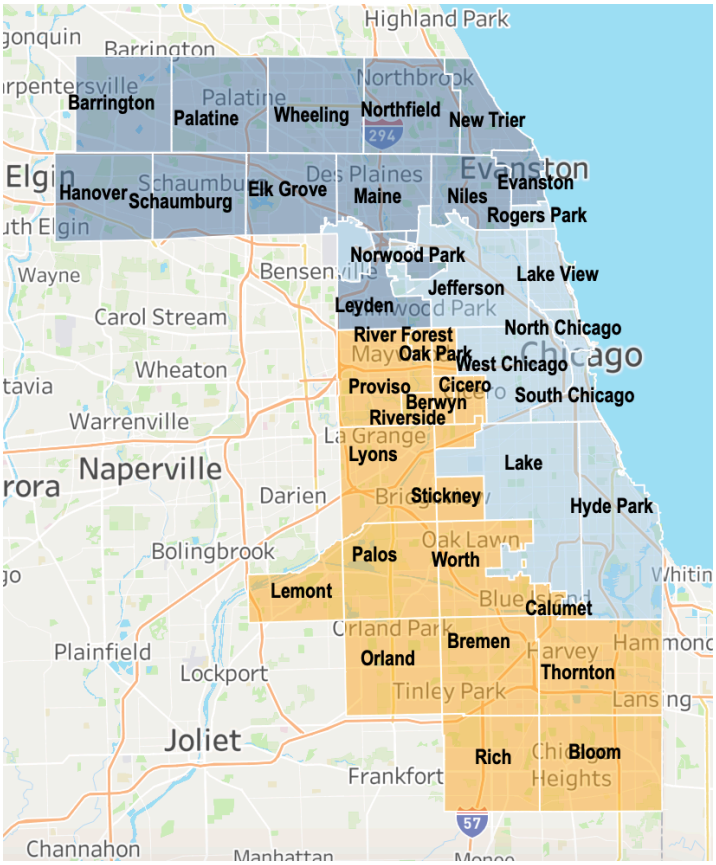

Figure 4. Map of the Cook County, IL

Step 2: Design

Recall that the design of the ratio study is the set of methodologies by which the purpose, scope, and objectives of the ratio study are investigated. This design includes the choice of analyses, statistical tests, and means of presenting the results. This study is performed according to the precepts laid out in the IAAO Standard on Ratio Studies (2013). However, this section describes key elements of the design of this sales ratio study that are worth noting.

Outlier Handling

Sales ratio outliers were trimmed according to a 1.0 x IQR procedure with a log transformation of the sales ratios used to better achieve distributional symmetry, as recommended in the IAAO Standard on Ratio Studies (IAAO 2013)[8]. This less conservative threshold of 1.0 is justified in this case because of the lack of a proper sales validation process in Cook County for the three triad years being studied. The IAAO Standard on the validation and Adjustment of Sales says, “In general, the completeness and accuracy of sales data are best confirmed by requesting the particulars of a sale from parties to the sale” (IAAO 2020, p. This study uses the PTAX-203 Form (Illinois Real Estate Transfer Declaration) information in an attempt to get an approximate list of sales valid for analysis. However, the CCAO performed no sales validation process for commercial

[8] This procedure is found in Appendix B of the IAAO Standard on Ratio Studies. It takes the natural log of the sales ratios, finds the interquartile range (IQR) of the resulting logged ratios, multiplies that IQR by 1.0, and then adds that quantity to the third quartile to achieve the upper trimming bound and then subtracts that same quantity to the first quartile to achieve the lower trimming bound. Sales ratios below the lower trimming bound or above the upper trimming bound are then eliminated (or trimmed) from the study.

properties in any of the years being measured. Given the lack of a sales validation process, which undoubtedly resulted in a lower quality set of sales available for this analysis, the IAAO Standard on Ratio Studies allows for this less conservative trimming threshold to be used when it says that "Trim limits should be developed in consideration of the extent of sales validation" (IAAO 2013, p. 54). Using this less conservative threshold still typically resulted in less than 10% of the sales ratios being trimmed, which is within the IAAO standard of 5-10% for large samples and 10-20% for small samples (IAAO 2013, p. 54).

Sales ratio outliers are trimmed by property use group in the primary stratification scheme. Value outliers are likewise trimmed according to a 3.0 x IQR procedure with a log transformation. It is prudent to use more conservative thresholds for trimming value outliers than for ratio outliers.

Statistical Hypothesis Testing

All conclusions made in this sales ratio study, including determinations of whether measures meet IAAO industry standards, are made using statistical hypothesis testing so that inferences about the given population can be made. All confidence intervals used in this analysis are 90% two-sided intervals, and all statistical hypothesis tests are stated informally and are done at the alpha = 5% level; p-values may not be stated when concluding non-compliance with an IAAO standard so long as they are less than 5% (0.05). The appropriate 90% confidence interval bound yields the correct comparison value for a one-sided statistical test because the bounds of a 90% confidence interval are equivalent to the bounds of an upper and lower 95% one-sided confidence interval (IAAO 2013, p.18). Confidence intervals for the median sales ratio, the Coefficient of Dispersion, and the Coefficient of Price-Related Bias are calculated using a formula. The confidence interval for the median sales ratio is based on the binomial distribution for samples of size greater than 30 and on the procedure outlined for small samples in the IAAO Standard on Ratio Studies[9] for samples of size less than or equal to 30. The confidence interval for the Coefficient of Dispersion is based on the formula developed by Bonet-Seier (Bonett-Seier, 2006). The confidence interval for the Coefficient of Price-Related Bias is directly derived from simple linear regression. P-values listed as zero should technically be understood as $p < 0.0001$.

Permutation tests are statistical tests based on resampling methods. Permutation tests are used to test hypotheses surrounding the median ratio and Coefficient of Dispersion. Permutation tests are used because no parametric test for these measures exists.

Sale Price Time Trend Analysis

Sale price time trend models are fit by triad in this sales ratio study using the inverse sales ratio method, where the sale price divided by the appraised value is regressed against some function of the month of sale. The appraised value used in this method is the notice value from the year before the start of the sales range. For example, for the South Triad (2020), the trend is fit using sales from 01/01/2020 through 12/31/2023 and appraised values from 2019. This was done to rule out the effect of any selective reappraisal on the calculation of the time trend. In this study, one sale price time trend is fit for all commercial properties in each triad given the variability present in the inverse sales ratios. Final time trends were based on generalized additive models.

In developing the time trends, this analysis removes outliers through a process of fitting an initial approximate trend model with the outliers included, using this initial trend model to calculate an initial time-adjusted sale price through which outliers are identified, then a final trend model is calculated without those outliers and used to calculate the final set of time-adjusted sale prices. This is done to eliminate outliers appropriately where the inverse sales ratio statistically varies with time. Outliers were dealt with using the "1.5 x IQR procedure" with the log correction.

[9] This procedure is found in Appendix C of the IAAO Standard on Ratio Studies.

Appraisal Level Statistics
The median is the most appropriate measure of appraisal level to use in this case because it is the best measure for monitoring appraisal performance. The standard used for the appraisal level is 90% to 110% (IAAO 2013, pp. 34-35) of the estimate of fair market value. The IAAO Standard on Ratio Studies recommends this standard range for several reasons, including potential inflation or deflation during reappraisal cycles that extend beyond one year, the potential lack of available resources, and other limiting conditions "*that may constrain the degree of accuracy that is possible and cost-effective within an assessment jurisdiction*" (IAAO 2013, pp.18,33-34). If an estimate of the appraisal level is not found to be statistically significantly outside of this range, then it will be concluded that this estimate of the assessment level falls in an acceptable range around the 100% target level.

Appraisal Uniformity Statistics
The IAAO standard range used for the COD in this report is 5% to 20% for all strata because while Cook County is a very large jurisdiction with an active market, it also has a certain degree of heterogeneity (IAAO 2013, p.34). An argument for a 5% to 15% standard could be made but ultimately the more conservative range seemed more reasonable given the complexity of the situation.

The Uniformity Test of Group Medians is used to investigate vertical inequity utilizing market value quintiles (a comparison of group medians for five market value groups – the lowest 20% of the market values up through the highest 20% of the market values). This test is more data-intensive, so it is not run by property use group strata.

Selective Reappraisal
This study does not explicitly test for selective reappraisal because it uses a future selection of sales (sales from January 1 of the next calendar year after the effective date of each triad's reassessment through December 31, 2023) which by definition could not have been selectively reappraised. After all, they were largely not known about at the time that values were set at each of the different steps in the valuation process. It was important to use sales from this future period because a single-property appeals process that involves such a large percentage of commercial properties could result in statistically and practically significant levels of selective reappraisal by its very nature and it was important to use a common set of sales to analyze each of the three steps in the valuation process for comparison purposes.

Step 3: Stratification

In this sales ratio study, sales are stratified for the calculation of the sales ratio statistics by property use group (Industrial/Warehouse, Office, Retail, and Other Commercial). The appeals analysis is stratified by property use group, township, and appraised value range (less than 50k, between 50k and 200k, between 200k and 500k, between 500k and 1mil, between 1mil and 5mil, and greater than 5mil).

The property use designations were estimated by the CCAO's data science team as of one point in time in the past and do not come from the Tyler Enterprise Assessment and Tax computer database system (the master record) used by the CCAO at the time of the sale. Rather, it emanates from legacy income model spreadsheets. The CCAO acknowledges that these property uses are only approximately accurate but were provided at our request to give us the best data available. The CCAO has only recently started a process to properly collect this data and record it in their computer database system. The property use yields important information and a judgement was made to use this data as a stratifying mechanism in this analysis. Some effort was taken to verify that this data is mostly in line with existing property class data.

Sample Representativeness
Sample representativeness means that the properties in the sales sample used for the sales ratio study are sufficiently representative of the properties in the population. In this case, an appropriate analysis of sample representativeness was not believed to be prudent because of the quality of the property use data available, the most natural variable to use to test for sample representativeness. If the sample is found to be statistically unrepresentative, which is often the case in large samples like this, re-weighting or re-sampling the current dataset would be chosen as the remedial measure. We believe it would have been too reliant on imperfect property use data to use it as the basis for adopting such a remedial measure in addition to already using it to stratify the analysis. Besides, stratifying the analysis by property use group partially eliminates the sample representativeness concern in and of itself.

Step 4: Collection and Preparation of Market Data

Sales, valuation, CCAO appeals, and property-level data were first formally requested from the CCAO in late April 2024. The CCAO quickly delivered all requested data and likewise responded to several follow-up requests. Appeals data was requested from the CCBOR in early May 2024 and was received in late June 2024.

The data that was delivered was well-composed but unfortunately was still less than ideal. The CCAO provided property class data but this was often non-specific to the actual use of the property. Property use code data was not available but was later imputed by the CCAO for most of the properties through looking at legacy income valuation spreadsheets, as previously described. No sales validation work was performed by the CCAO but the CCAO did provide the sales data as recorded on the PTAX-203 form that we used to arrive at a set of sales for analysis. The net consideration from the PTAX-203 form was used as the sale price in the sales ratio study[10]. Data filters were applied to remove sales from the analysis if they met any of the conditions of an invalid sale or had inconsistent data listed on the form. The end goal was to get the best set of sales for this analysis given the less-than-ideal data circumstances.

Data Filters
As discussed, data filters are applied to produce a sales sample that is appropriate for analysis. Properties that meet the following criteria are excluded from the study:

- Properties that do not have a commercial property class (meaning, their property class prefix is something other than 5, 6, 7, or 8).
- Properties whose notice property class prefix, certified property class prefix, and board-level property class prefix do not match (properties that changed incentive status at some point during that year's valuation process).
- Properties that do not have a property use code imputed by the CCAO from legacy income model spreadsheets.

Sales that meet the following criteria are excluded from the study:

- Sales that are not Warranty or Trustee Deeds.

[10] The net consideration is the consideration minus any personal property or business value indicated on the PTAX-203 form.

- Sales of properties that were not advertised publicly.
- Sales of properties that did not have both a current and intended use of either Office, Retail, Commercial, or Industrial (meaning, not codes F, G, H, or I).
- Sales of properties with a significant physical change to the building since January 1 of the previous year.
- Sales that were the fulfillment of an installment contract or sales that were under contract in the calendar year before the sale.
- Sales between related individuals or corporate affiliates.
- Sales that transferred less than 100% interest.
- Sales that were court-ordered.
- Sales that were in lieu of foreclosure.
- Sales of Condemnation
- Short Sales
- Auction Sales
- Sales where the buyer or seller is a financial institution or a government agency.
- Sales where the buyer was exercising an option to purchase.
- Sales involving the simultaneous trade of property
- Leaseback Sales
- Sales where the number of properties listed on the form in Box 2 is not equal to the number of PINs listed in Box 3 (potentially inconsistent multi-parcel sales).
- Sales with a sale price of less than $1,000.

Due to the sheer size of the dataset and the number of stratification schemes being employed, summary statistics are not reported for the sales sample. Final sample sizes for each stratum before and after outlier trimming are reported in tabular format throughout the forthcoming analysis.

Step 5: Matching of Appraisal and Market Data

The matching of appraisal and market data was handled as thoroughly as possible given the paucity of time-of-sale information and the lack of a proper sales validation process conducted by the CCAO. Sales were eliminated from the sample unless the current and intended use matched the PTAX-203 form. Due to the data limitations present, a more thorough matching exercise could not be performed.

Step 6: Statistical Analysis

The statistical analysis is broken down into sections according to the flow of logic and the priorities identified in the study's purpose, scope, and objectives. First, we present an analysis of the appeals process that sets the stage for subsequent sales ratio study analyses; the analysis of the appeals process uses all properties, not just the sales. Key findings are given on an ongoing basis along with the results.

Analysis of the Appeals Process

This analysis of the appeals process breaks down appeals by status (appealed – changed, appealed – no change, and not appealed) by both levels (CCAO or CCBOR) and Triad (South, City, and North Triads). Appeals are examined on an overall basis by year for each of the last completed three-year appeal cycles for each triad (three-year cycles starting in 2019, 2020, and 2021) and they are examined for each of the last three completed triad appeal years (City Triad – 2021, North Triad – 2022, and City Triad – 2023) across a range of strata (appraised value range, property use group, and township).

Note that when this analysis examines the rate at which appeals result in a value change, it usually does not assess whether such an action is justified or not, even at a group level; instead, such an analysis is typically just recounting what occurred. Appeal rates are important from a systemic point of view in and of themselves and because they tie into one or more of the key project questions. Future research should focus more on the appeals process and delve more into other questions surrounding the nature of these appeals.

Appeal Status Trends over the Three-Year Cycle

Figures 5 – 7 illustrate the status of property appeals with the CCAO and how those appeal statuses change across the three-year cycle.

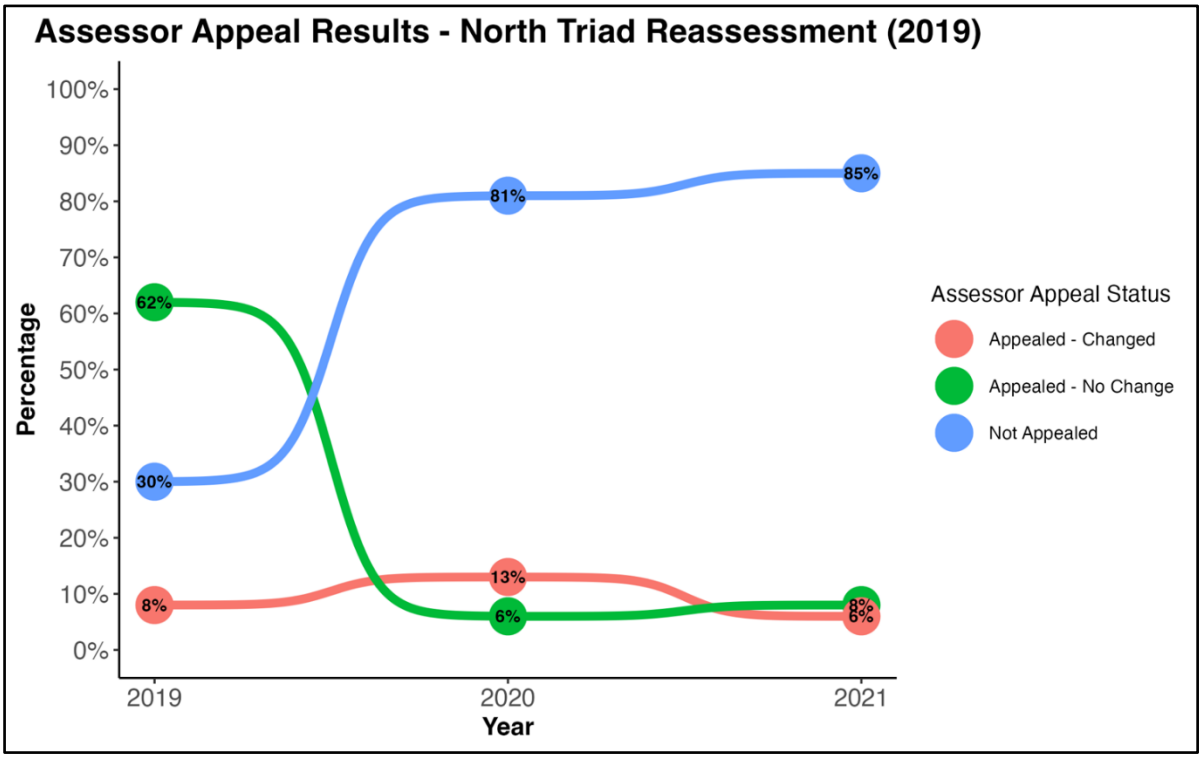

Figure 5. Assessor Appeal Results - North Triad Reassessment (2019)

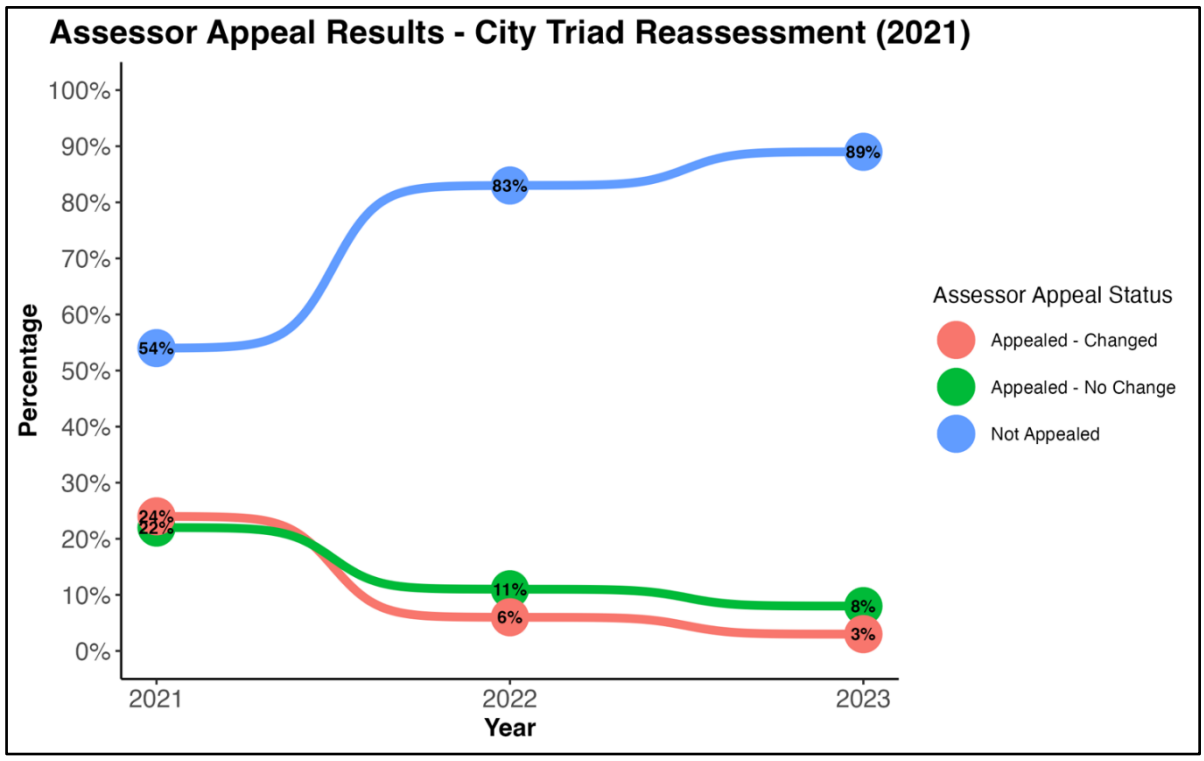

Figure 6. Assessor Appeal Results - City Triad Reassessment (2021)

Key Findings:

- Properties tend to appeal to the CCAO at higher rates in the first year of the three-year cycle when the reassessment has just been completed. Appeal rates tend to decline in each of the next two years.
- In the South Triad (2020) and the City Triad (2021), the majority of commercial properties did not appeal to the CCAO in the first year of the cycle. However, in the North Triad (2019), a majority of commercial properties did appeal but most of them did not receive a change. There was a noticeable drop in the percentage of properties that were appealed to the CCAO after 2019.
- After 2019, the CCAO was more likely to change the value for appeal properties in the first year than they were in the two subsequent years.

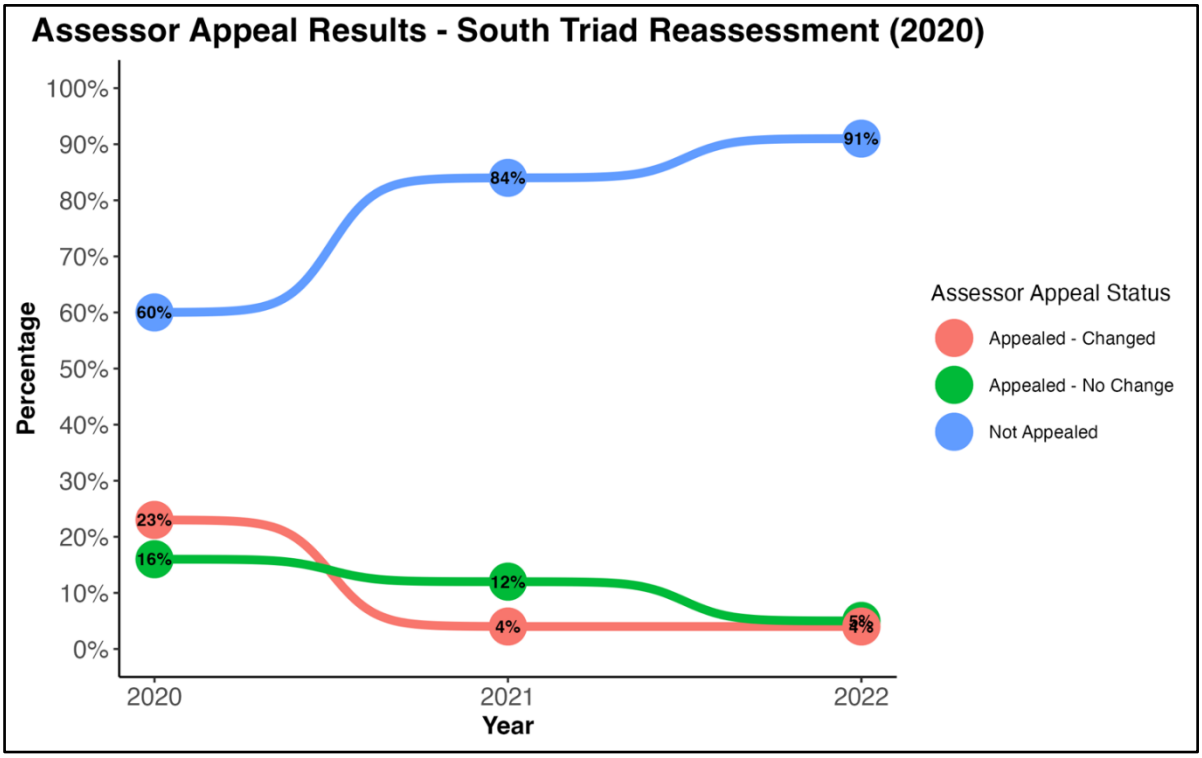

Figure 7. Assessor Appeal Results - South Triad Reassessment (2020)

Figures 8 - 10 illustrate the status of property appeals with the CCBOR and how those appeal statuses change across the three-year cycle.

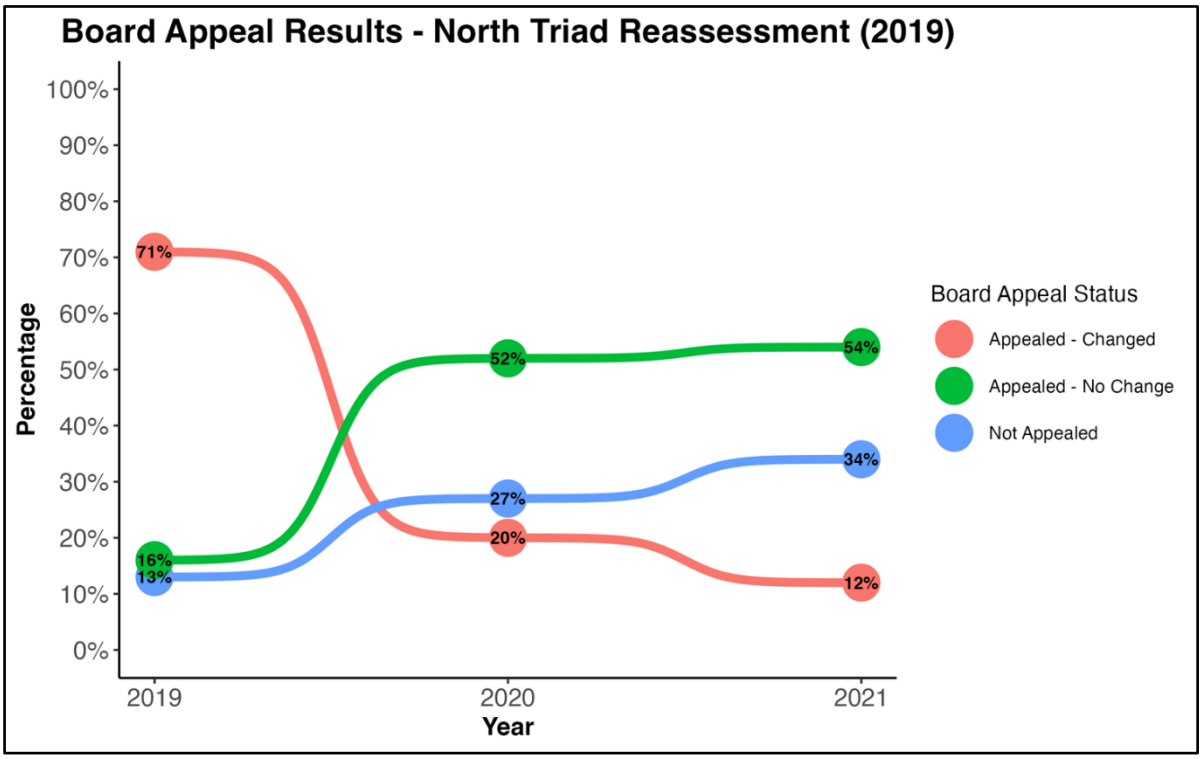

Figure 8. Board Appeal Results - North Triad Reassessment (2019)

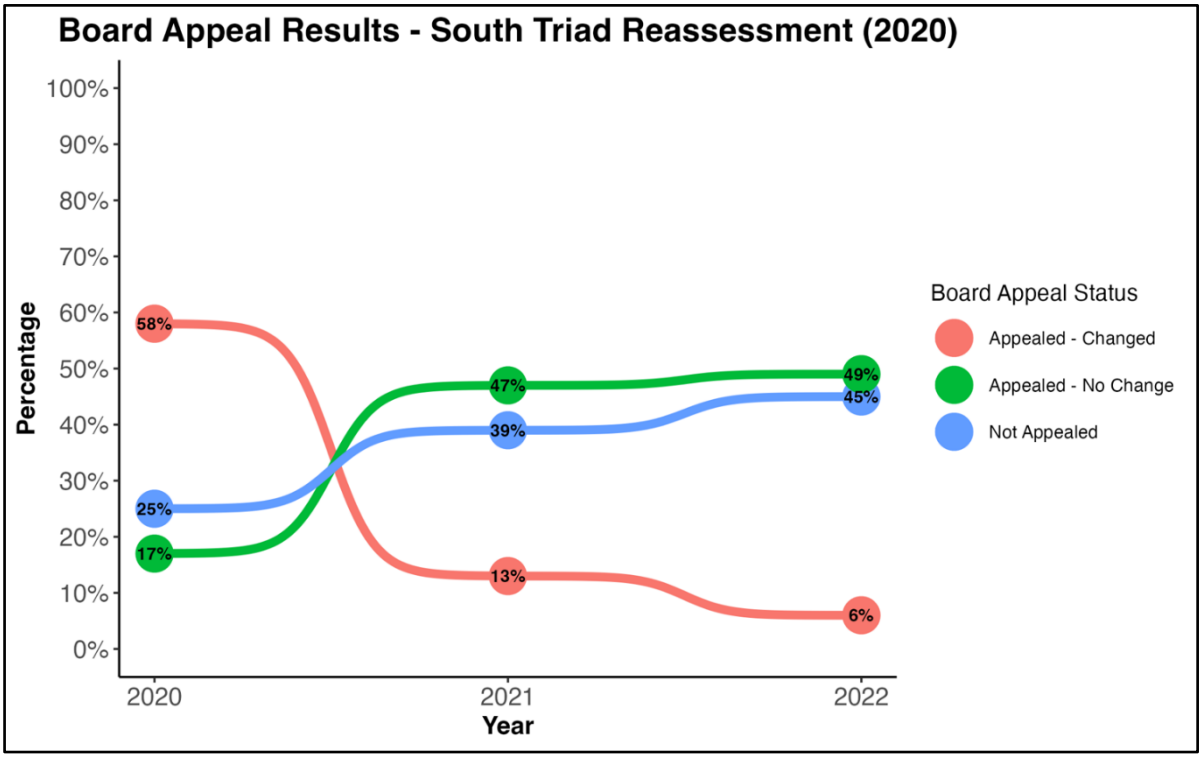

Figure 9. Board Appeal Results - South Triad Reassessment (2020)

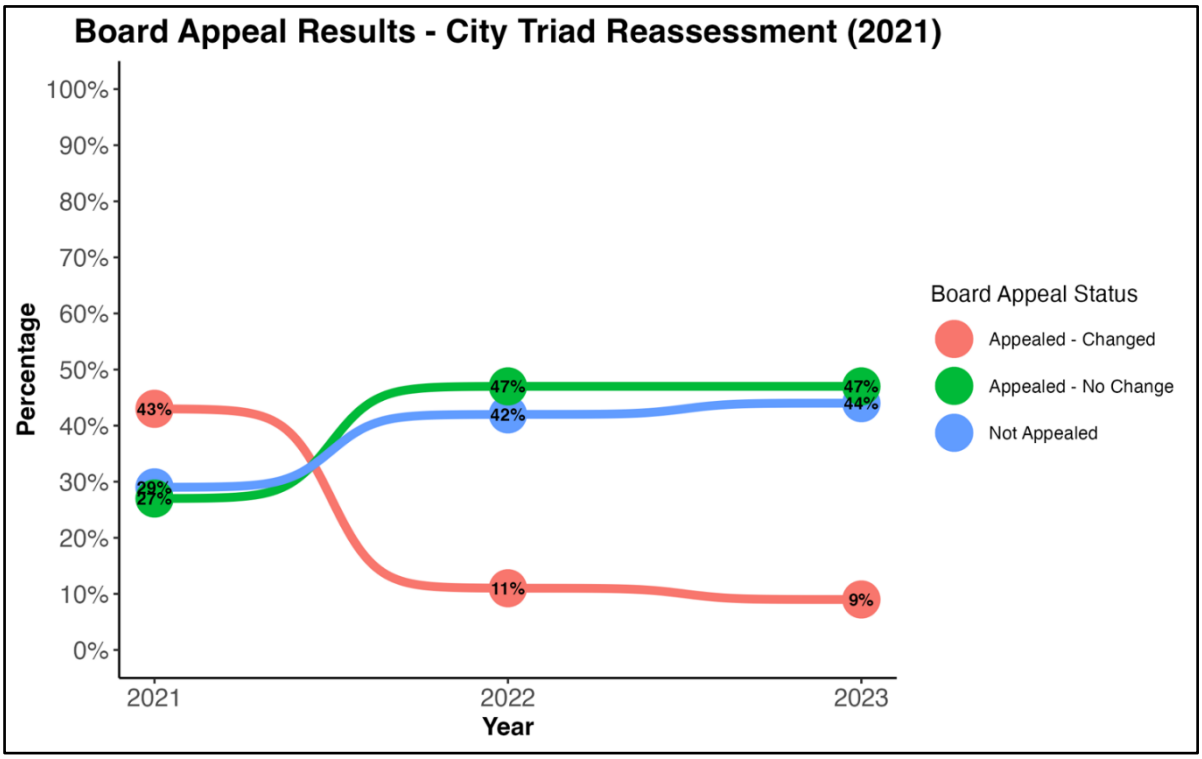

Figure 10. Board Appeal Results - City of Triad Reassessment (2021)

Key Findings:

- Properties tend to appeal to the Board at higher rates in the first year of the three-year cycle when the reassessment has just been completed. Appeal rates tend to decline in each of the next two years.
- Properties appeal to the Board at much higher rates than to the CCAO.
- In the first year, the vast majority of properties file an appeal to the Board and most of those receive a value change (71% in the North, 58% in the South, and 43% in the City).
- In the second and third years, the Board makes a value change on a much lower percentage of appeal properties than they do in the first year.

Appeal Status for City Triad (2021)

Figures 11 - 13 illustrate the status of property appeals with the CCAO for the City Triad (2021) by property use group, township, and appraised value range strata.

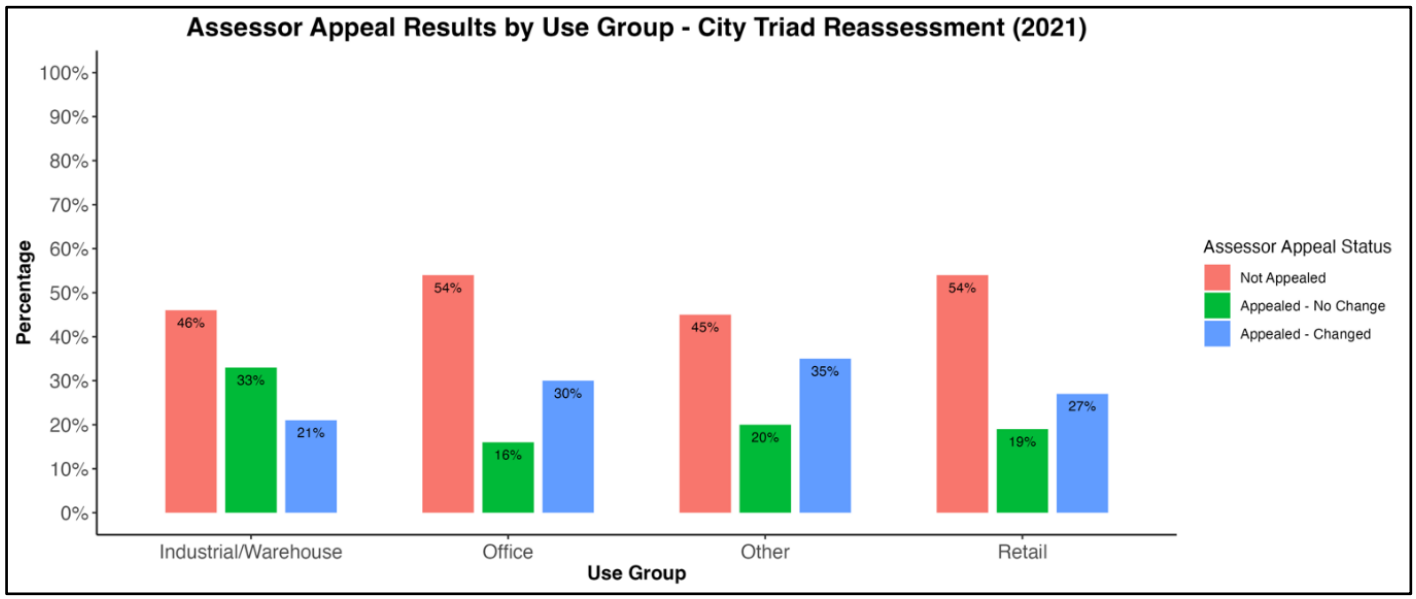

Figure 11. Assessor Appeal Results by Use Group - City Triad Reassessment (2021)

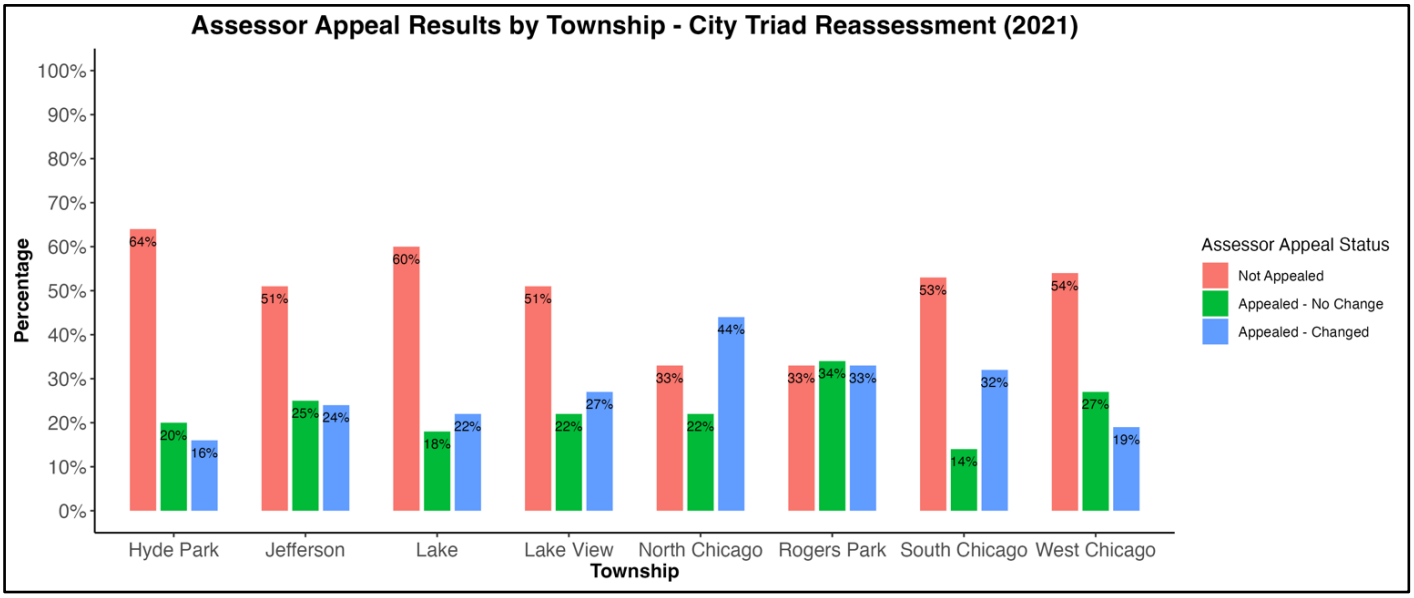

Figure 12. Assessor Appeal Results by Township - City Triad Reassessment (2021)

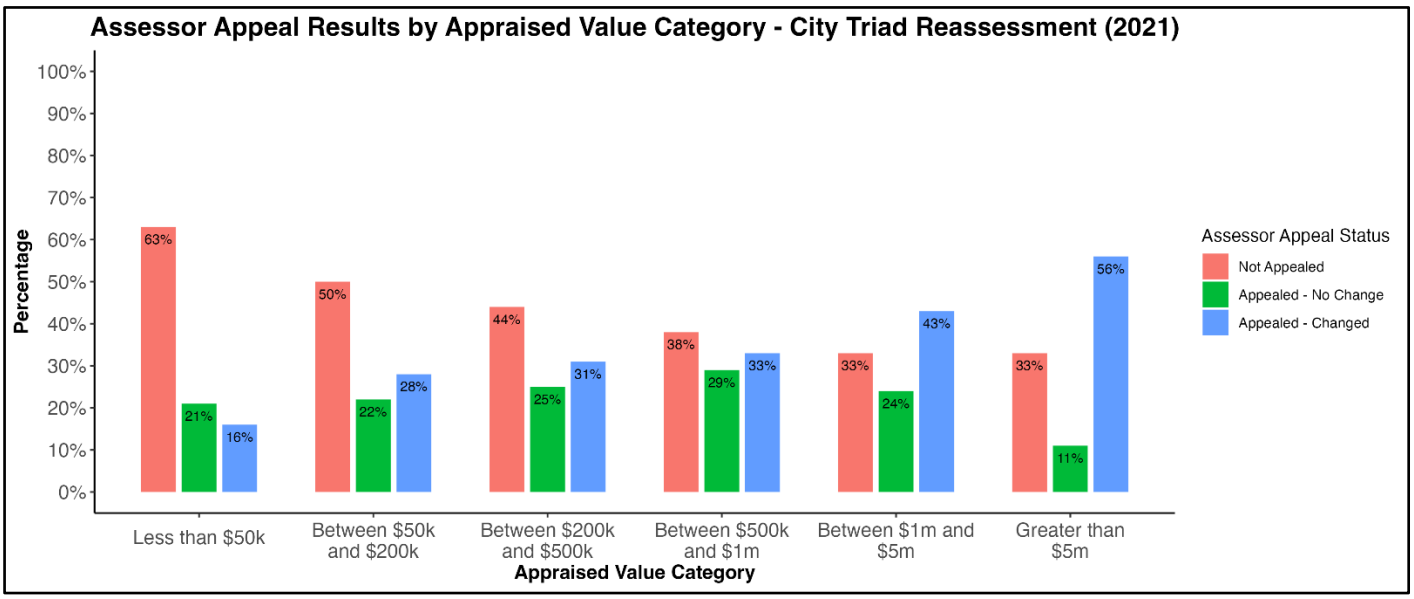

Figure 13. Assessor Appeal Results by Appraised Value Category - City Triad Reassessment (2021)

Key Findings:

- While appeal rates are fairly constant across the different property use group categories, appeals are granted a value change by the CCAO at a lower rate for Industrial / Warehouse properties than for other property use groups.
- Property owners in North Chicago Township and Rogers Park Township filed appeals with the CCAO at much higher rates than the other townships. The CCAO granted value changes during appeals at much higher rates in North Chicago and South Chicago Townships than in the other townships.
- As appraised value increases, not only does the appeal rate tend to increase but also the percentage of appealed properties with a value change tends to increase. The CCAO made a value change in the

majority of appealed properties with an appraised value of over 1 million dollars. The majority of all properties with an appraised value over 5 million dollars received a value change.

Figures 14 - 16 illustrate the status of property appeals with the CCBOR for the City Triad (2021) by property use group, township, and appraised value range strata.

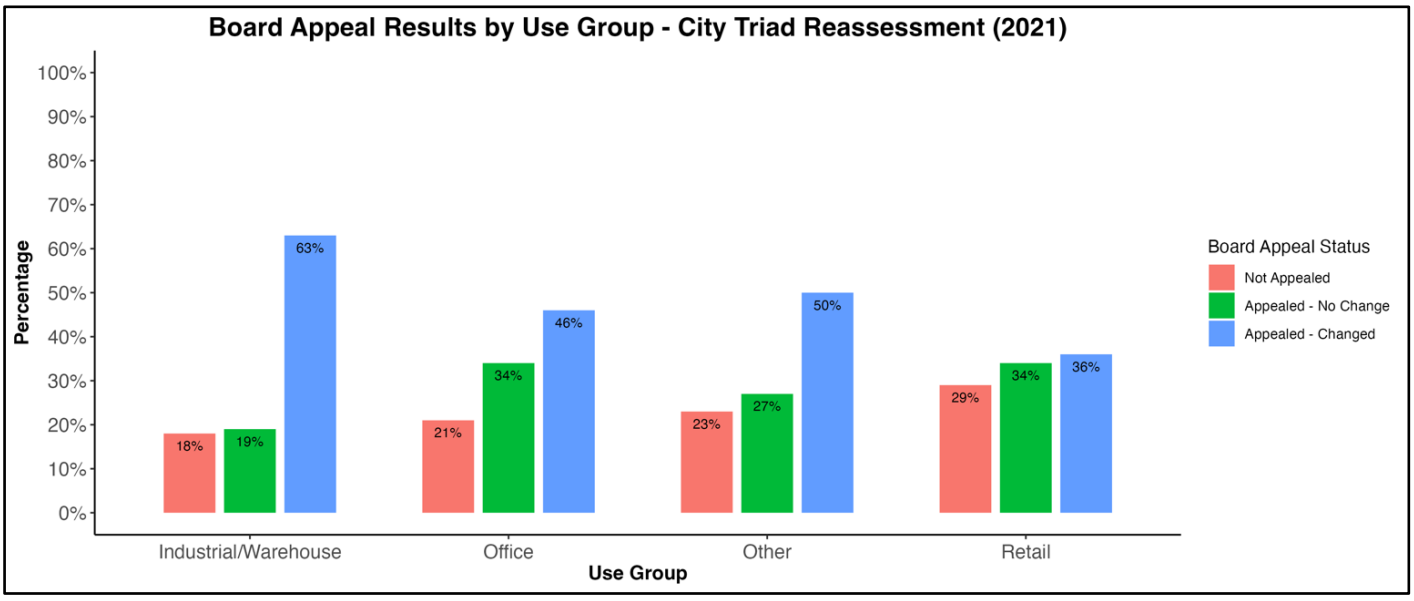

Figure 14. Board Appeal Results by Group - City Triad Reassessment (2021)

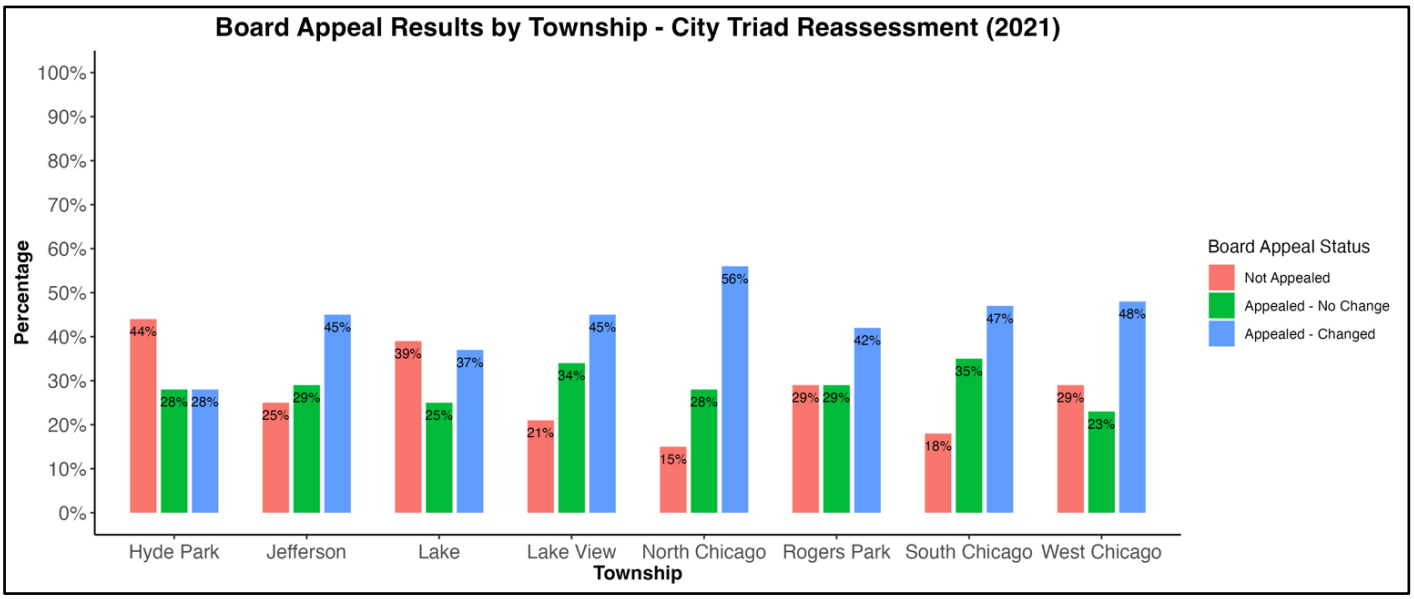

Figure 15. Board Appeal Results by Township - City Triad Reassessment (2021)

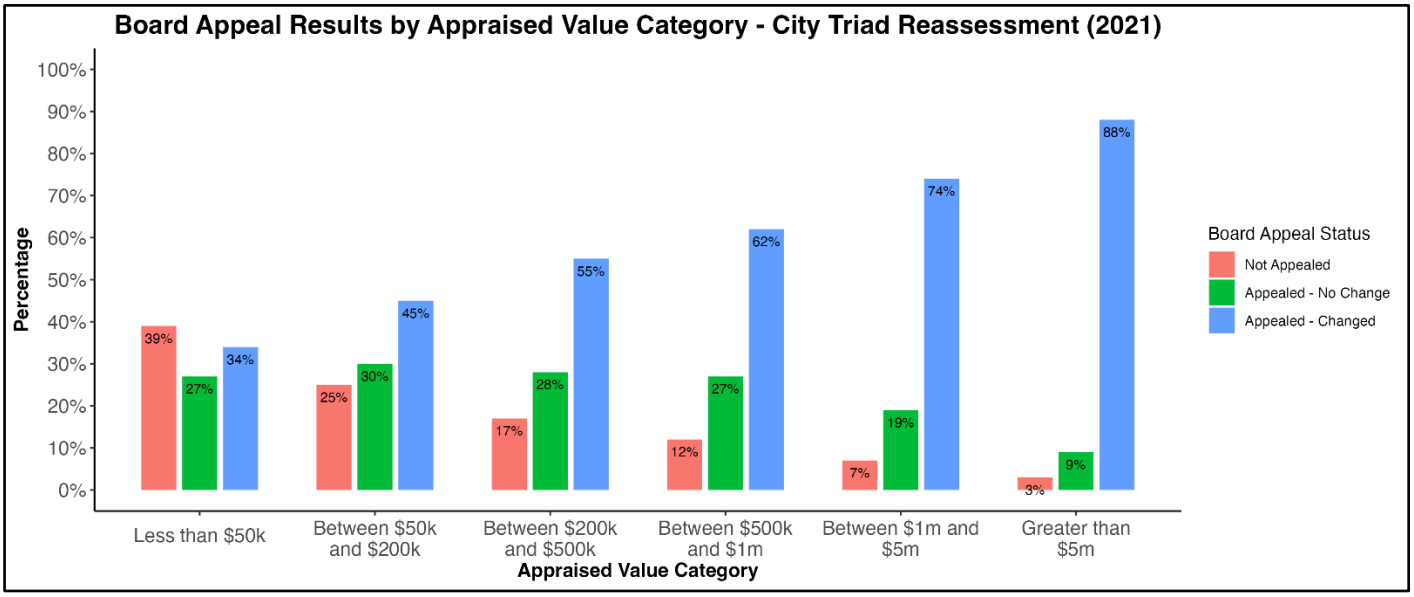

Figure 16. Board Appeal Results by Appraised Value Category - City Triad Reassessment (2021)

Key Findings:

- In contrast to the CCAO appeals period, Industrial / Warehouse property appeals are granted a value change by the CCBOR at a higher rate than for other property use groups. Forthcoming ratio study results show that Industrial / Warehouse properties tend to be over-valued by the CCAO in this triad-year and that the CCBOR's value changes brought these valuations closer to the standard range.

- Property owners in North Chicago, South Chicago, and Lake View Townships filed appeals with the CCBOR at higher rates than the other townships. The CCBOR granted value changes during appeals at higher rates in North Chicago and West Chicago Townships than in the other townships. The majority of all properties in North Chicago Township (56%) saw a value change by the CCBOR.

- The same trends exist with the CCBOR as do with the CCAO with respect to appeal rates by appraised value category, except that they are even more pronounced. As appraised value increases, not only does the appeal rate tend to increase but also the percentage of appealed properties with a value change tends to increase. The appeal rates in Cook County are astounding in general, but the treatment of high-value properties stands out. We find that 97% of all properties with an appraised value greater than 5 million dollars in the City Triad appealed to the CCBOR and 88% of all properties in that category received a value change by the CCBOR.

Appeal Status for North Triad (2022)

Figures 17 - 20 illustrate the status of property appeals with the CCAO for the North Triad (2022) by property use group, township, and appraised value range strata.

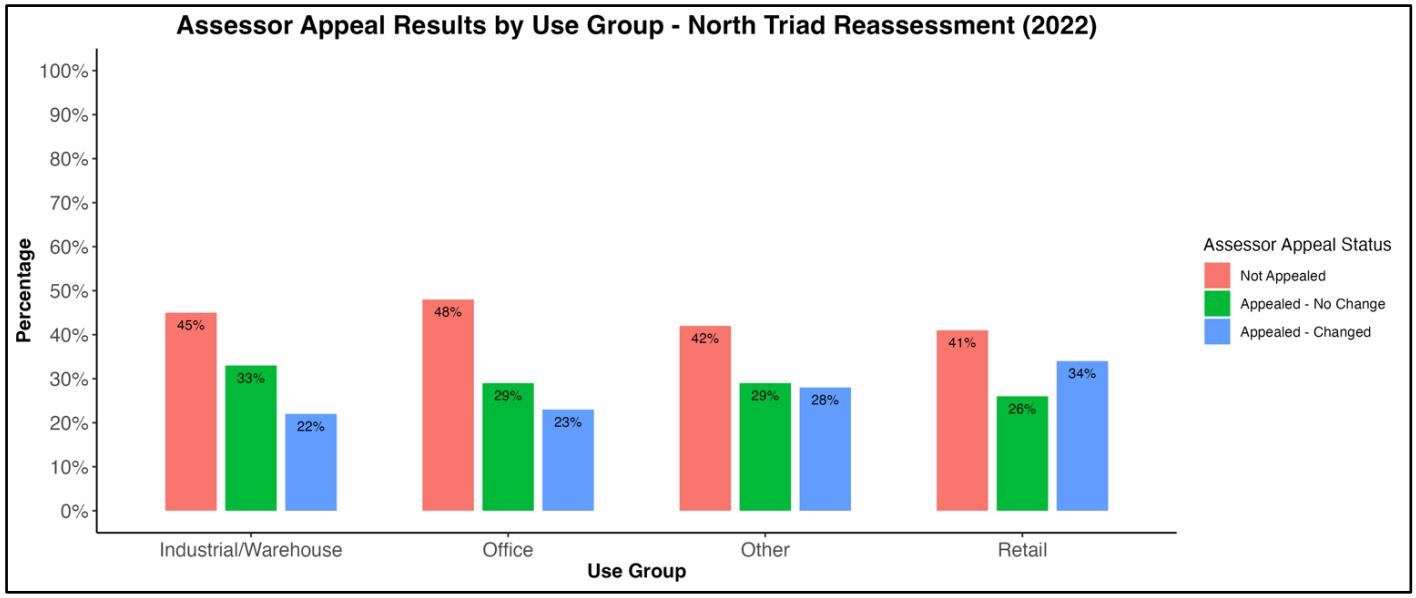

Figure 17. Assessor Appeal Results by Use Group - North Triad Reassessment (2022)

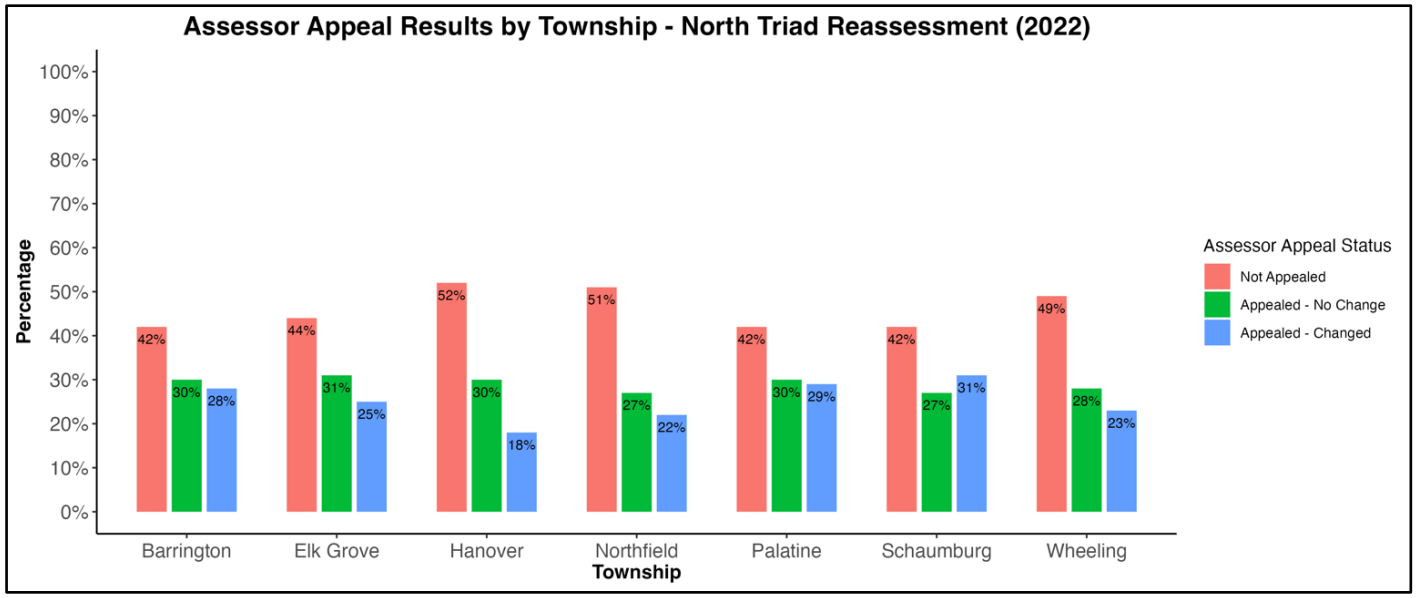

Figure 18. Assessor Appeal Results by Township - North Triad Reassessment (2022)

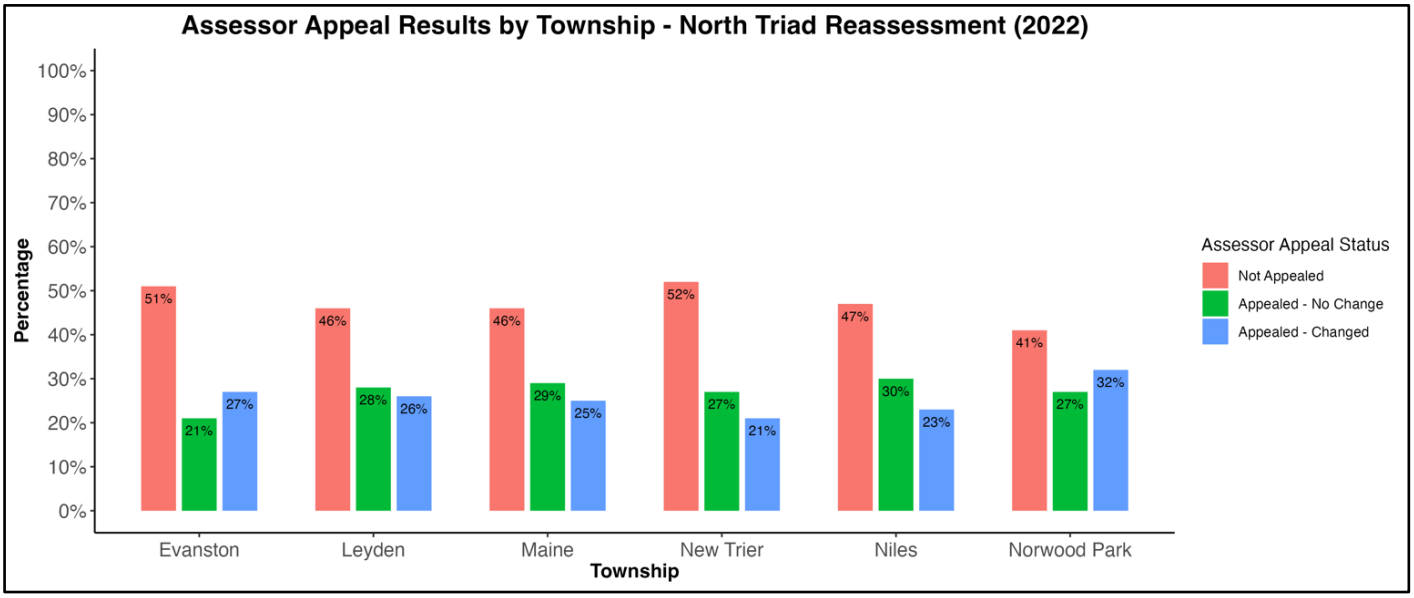

Figure 19. Assessor Appeal Results by Township - North Triad Reassessment (2022)

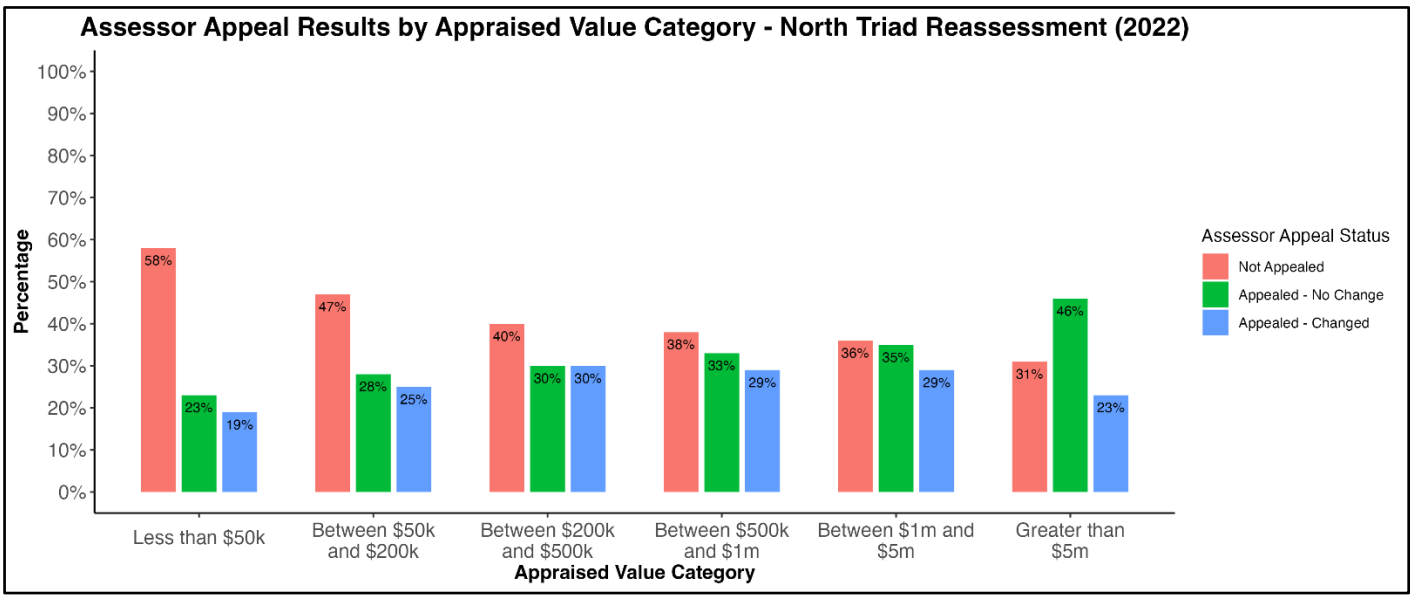

Figure 20. Assessor Appeal Results by Appraised Value Category - North Triad Reassessment (2022)

Key Findings:

- While appeal rates are fairly constant across the different property use group categories, appeals are granted a value change by the CCAO at the lowest rate for Industrial and Warehouse properties and the highest rate for Retail properties.
- Appeal rates to the CCAO are relatively constant across the North Triad (2022) townships, with all of the appeal rates falling in a range approximately 11 percentage points wide. The CCAO tended to grant value changes during appeals at relatively similar rates across all the townships, with the lowest such rate being Hanover Township.

- As appraised value increases, the appeal rate tends to increase and, in contrast to the City Triad just discussed, the percentage of appealed properties with a value change does not have a strong relationship with the appraised value of the property.

Figures 21 - 24 illustrate the status of property appeals with the CCBOR for the North Triad (2022) by property use group, township, and appraised value range strata.

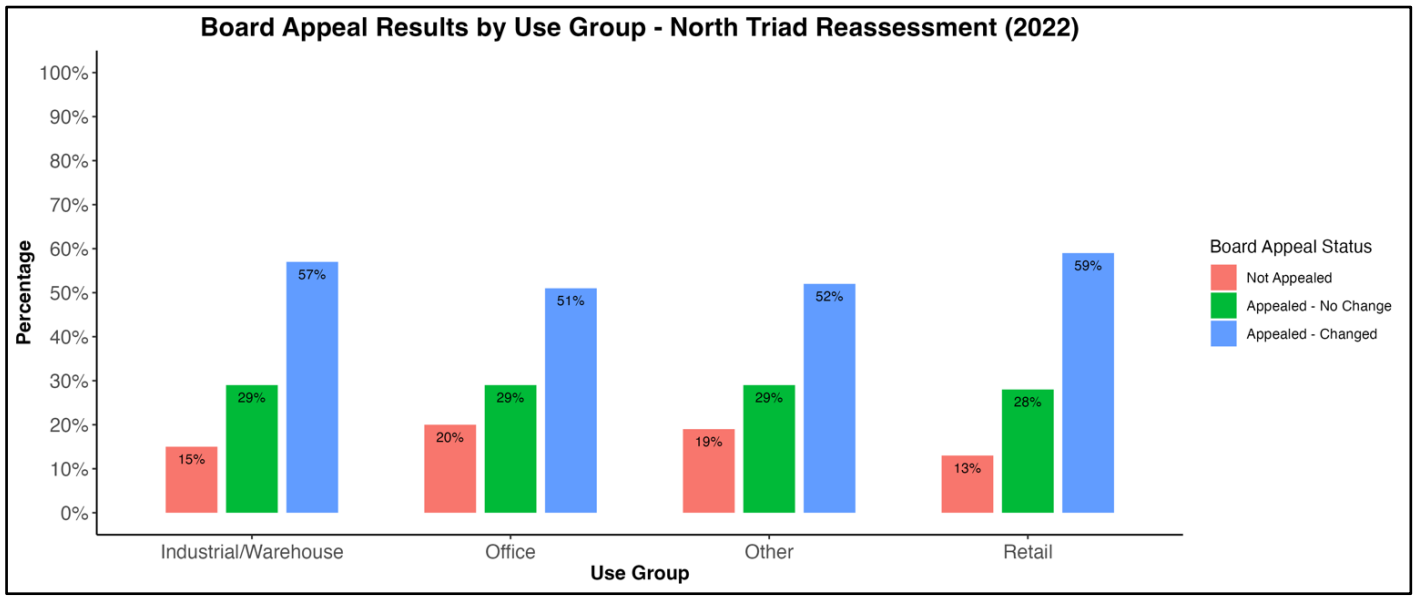

Figure 21. Board Appeal Results by Use Group - North Triad Reassessment (2022)

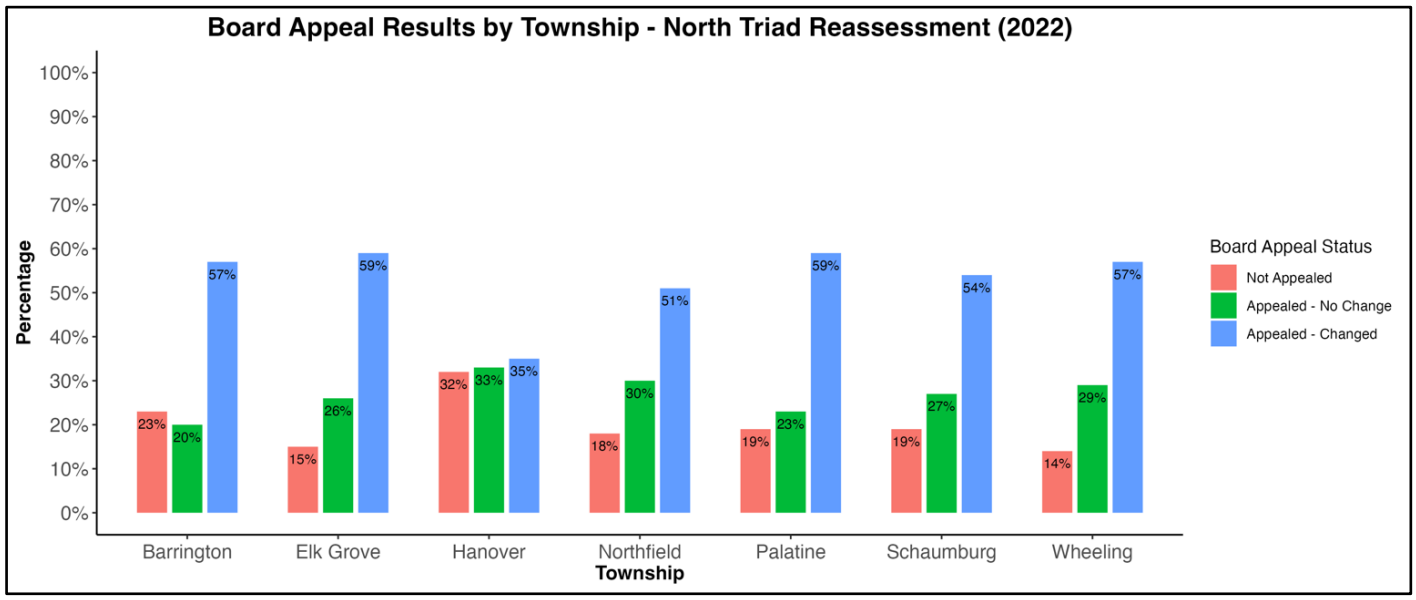

Figure 22. Board Appeal Results by Township - North Triad Reassessment (2022)

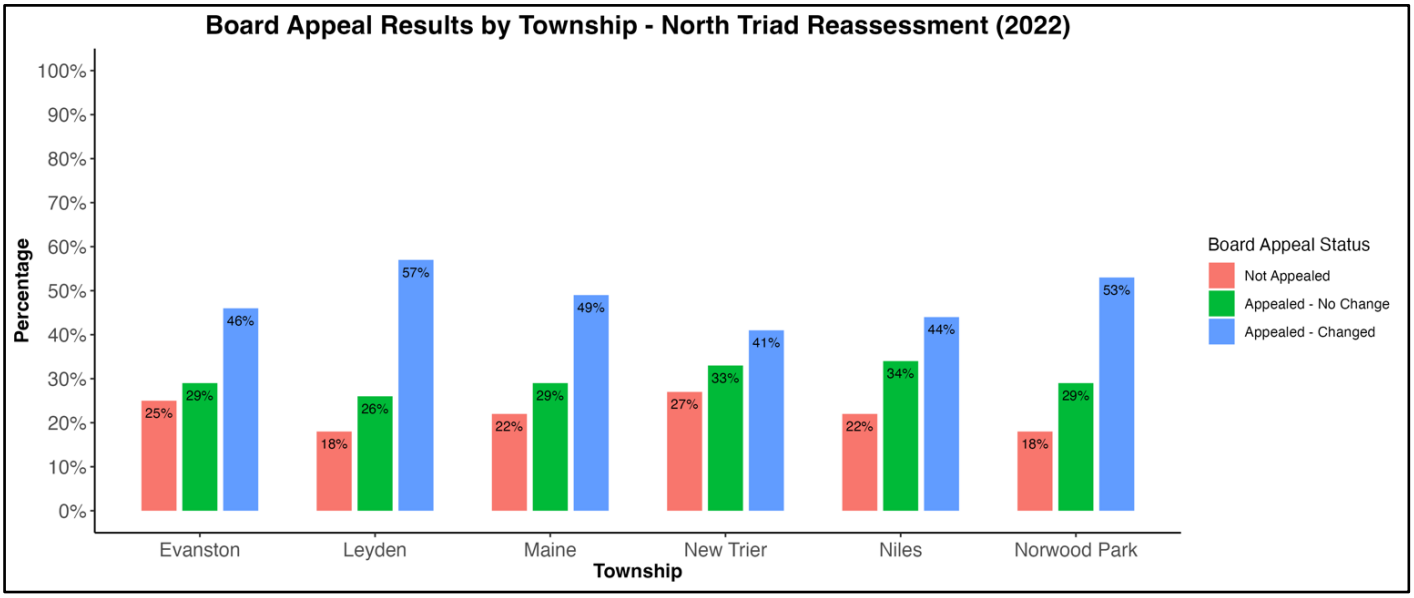

Figure 23. Board Appeal Results by Township - North Triad Reassessment (2022)

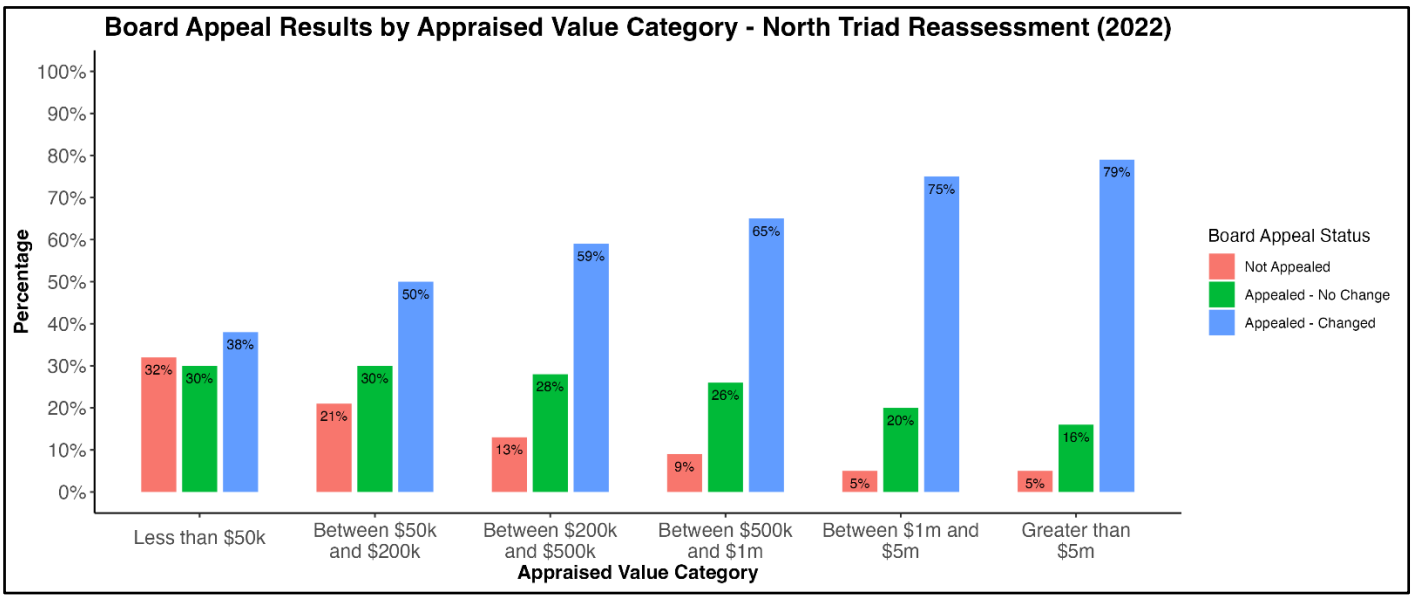

Figure 24. Board Appeal Results by Appraised Value Category - North Triad Reassessment (2022)

Key Findings:

- The breakdown of CCBOR appeal period statuses in the North Triad (2022) is relatively constant across the property use groups.
- As was the case in the CCAO appeal periods, a lower percentage of property owners in Hanover township filed an appeal than in the other townships, and those that filed an appeal were granted a value change at a lower rate. In 8 of the 13 townships, more than 50% of all properties saw a value change by the CCBOR.
- The same trends exist with the CCBOR in the North Triad (2022) as they do in the City Triad (2021) with respect to appeal rates by appraised value category. As appraised value increases, not only does

the appeal rate tend to increase but also the percentage of appealed properties with a value change tends to increase.

Appeal Status for South Triad (2023)

Figures 28 - 28 30 illustrate the status of property appeals with the CCAO for the South Triad (2023) by property use group, township, and appraised value range strata.

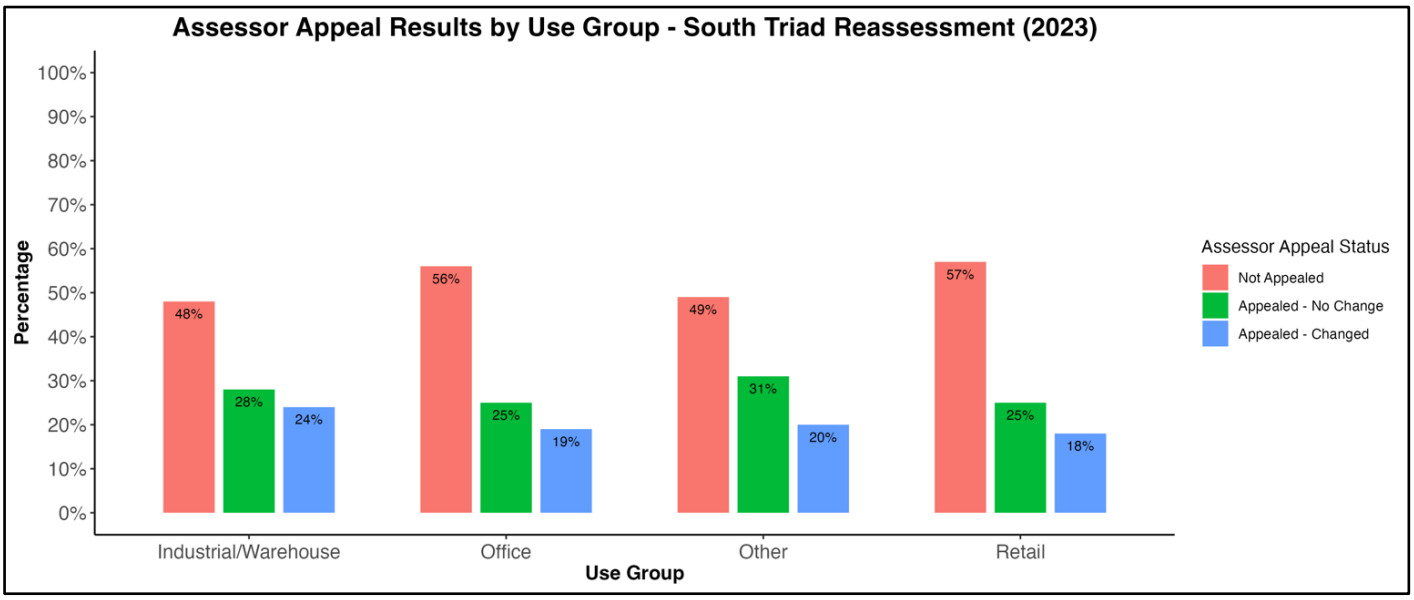

Figure 25. Assessor Appeal Results by Use Group - South Triad Reassessment (2023)

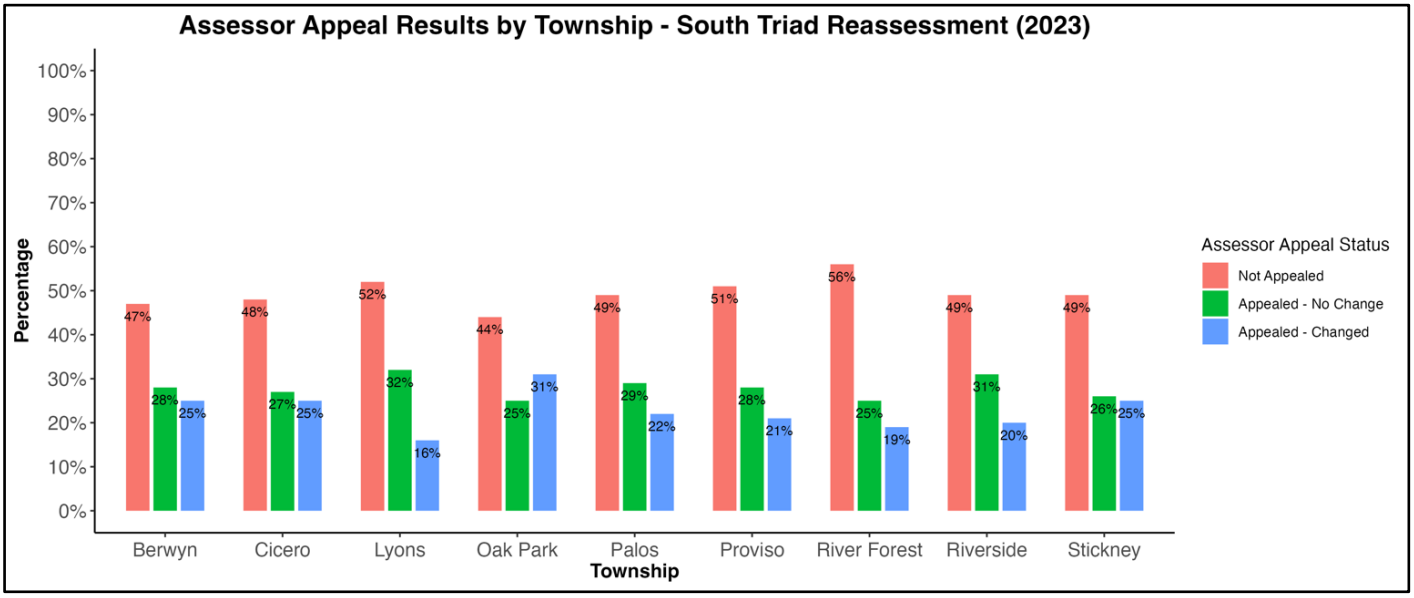

Figure 26. Assessor Appeal Results by Township - South Triad Reassessment (2023)

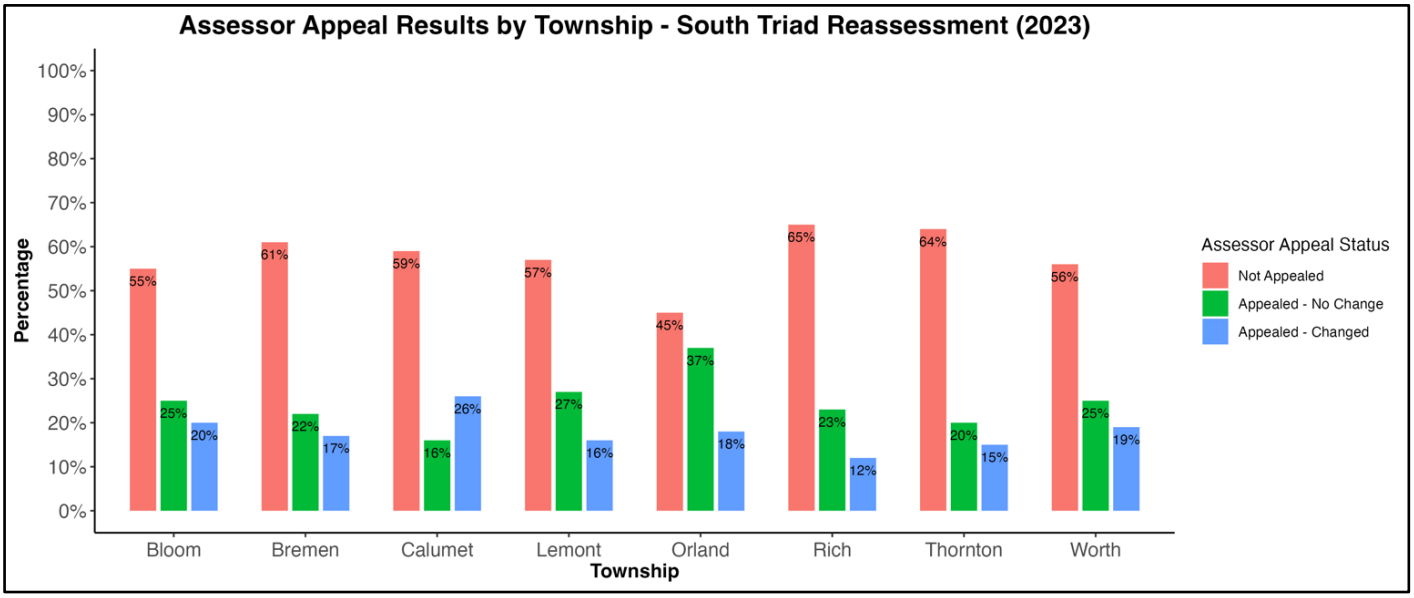

Figure 27. Assessor Appeal Results by Township - South Triad Reassessment (2023)

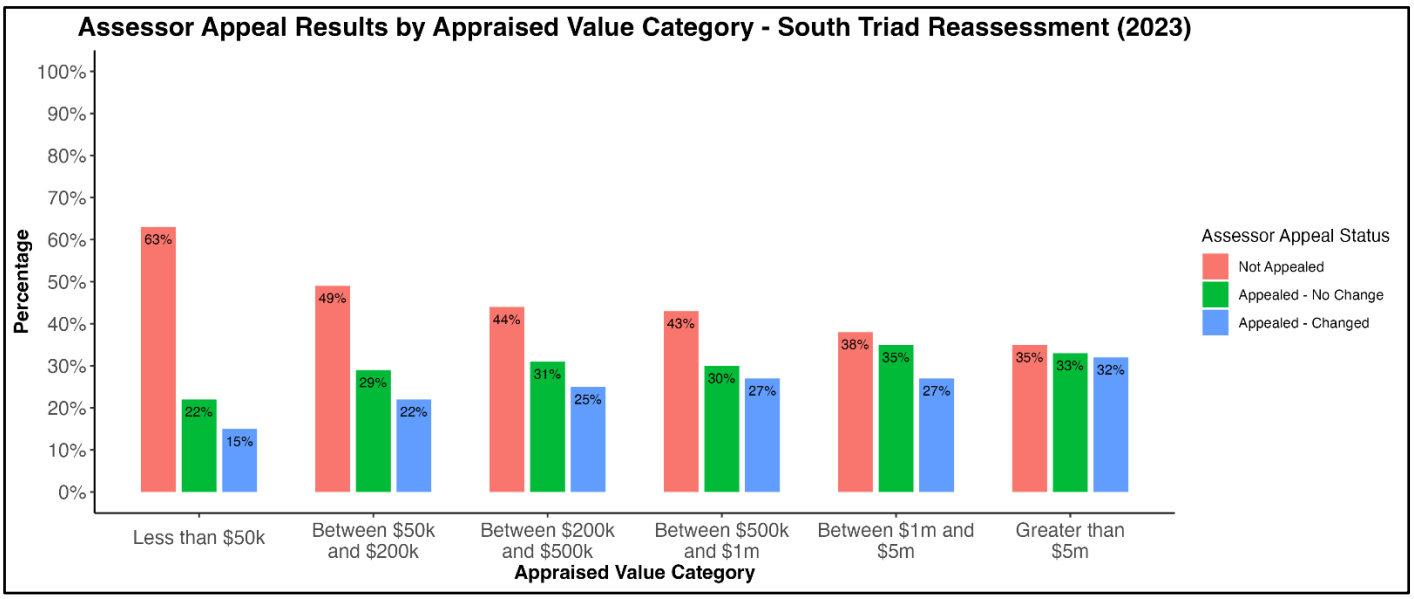

Figure 28. Assessor Appeal Results by Appraised Value Category - South Triad Reassessment (2023)

Key Findings:

- CCAO appeal rates and statuses are fairly constant across the different property use group categories for the South Triad (2023).
- CCAO appeal rates by township range from 35% (Rich Township) to 56% (Oak Park Township). Oak Park Township had the highest percentage of properties with a value change from CCAO appeals and Calumet Township had the highest percentage of appeal properties with a value change from CCAO appeals.
- As appraised value increases, not only does the appeal rate tend to increase but also the percentage of appealed properties with a value change tends to increase.

Figures 31 - 34 illustrate the status of property appeals with the CCBOR for the South Triad (2023) by property use group, township, and appraised value range strata.

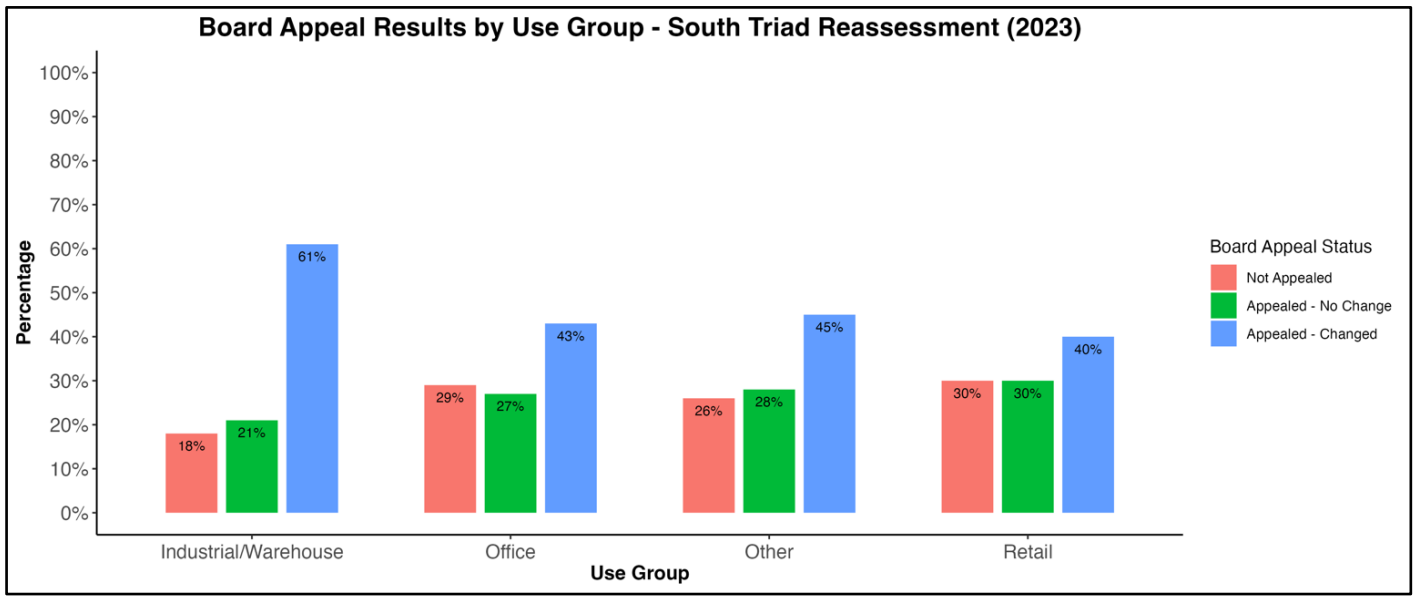

Figure 29. Board Appeal Results by Use Group - South Triad Reassessment (2023)

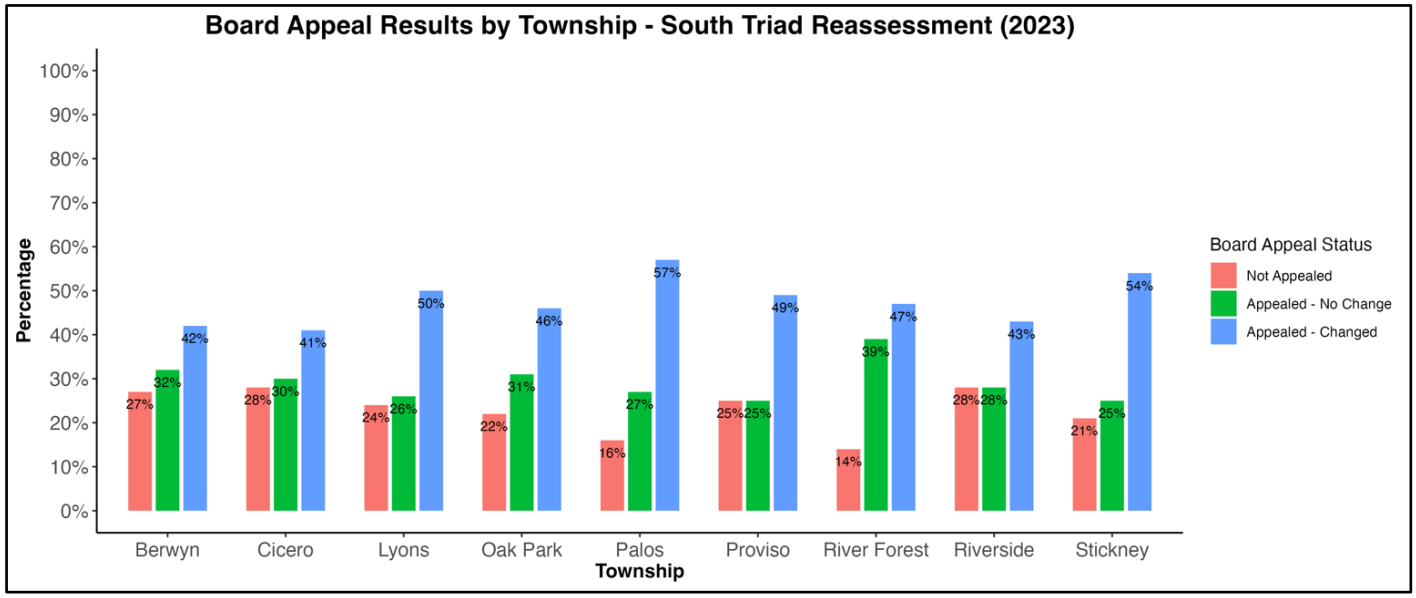

Figure 30. Board Appeal Results by Township - South Triad Reassessment (2023)

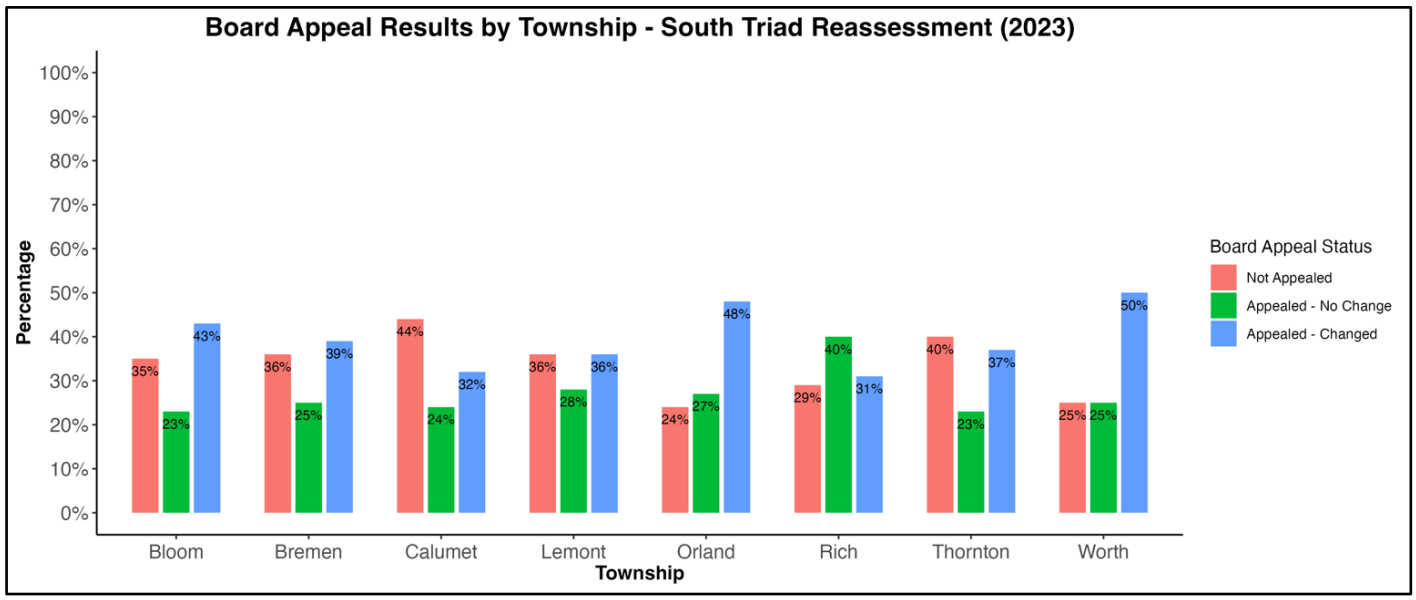

Figure 31. Board Appeal Results by Township - South Triad Reassessment (2023)

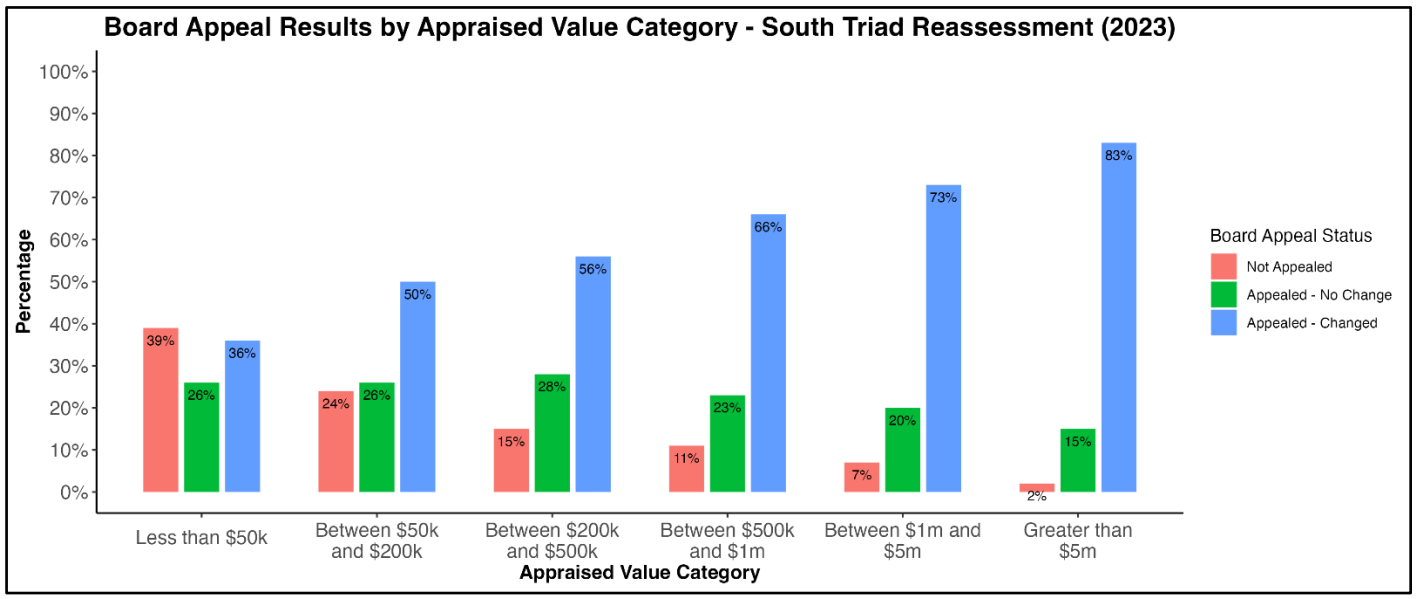

Figure 32. Board Appeal Results by Appraised Value Category - South Triad Reassessment (2023)

Key Findings:

- Industrial / Warehouse properties tend to file CCBOR appeals at a higher rate in the South Triad (2023) and those that appeal tend to be granted value changes at a higher rate than other property use groups.

- There is some heterogeneity in CCBOR appeal status by Township in the South Triad (2023), with different mixes of appeal statuses across the 17 townships. For example, 44% of properties in Calumet Township did not file a Board appeal. In contrast, 16% of properties in Palos Township did not file a Board appeal and also more than half (57%) of the properties in Palos Township received a value change as a result of a Board appeal.

- The same trends exist with the CCBOR in the South Triad (2023) as they do in the City Triad (2021) and the North Triad (2022) with respect to appeal rates by appraised value category. As appraised value increases, not only does the appeal rate tend to increase but also the percentage of appealed properties with a value change tends to increase.

Sales Ratio Analysis by Triad

The purpose of this primary sales ratio analysis is to gather whether the quality of the commercial valuation roll at each of the process steps meets industry standards. These results are first reported for each triad-year (South Triad – 2020, City Triad – 2021, and North Triad – 2022) as a whole and then when stratified by property use group.

Summary Results by Triad

This section examines overall results by triad and process step.

--Appraisal Level

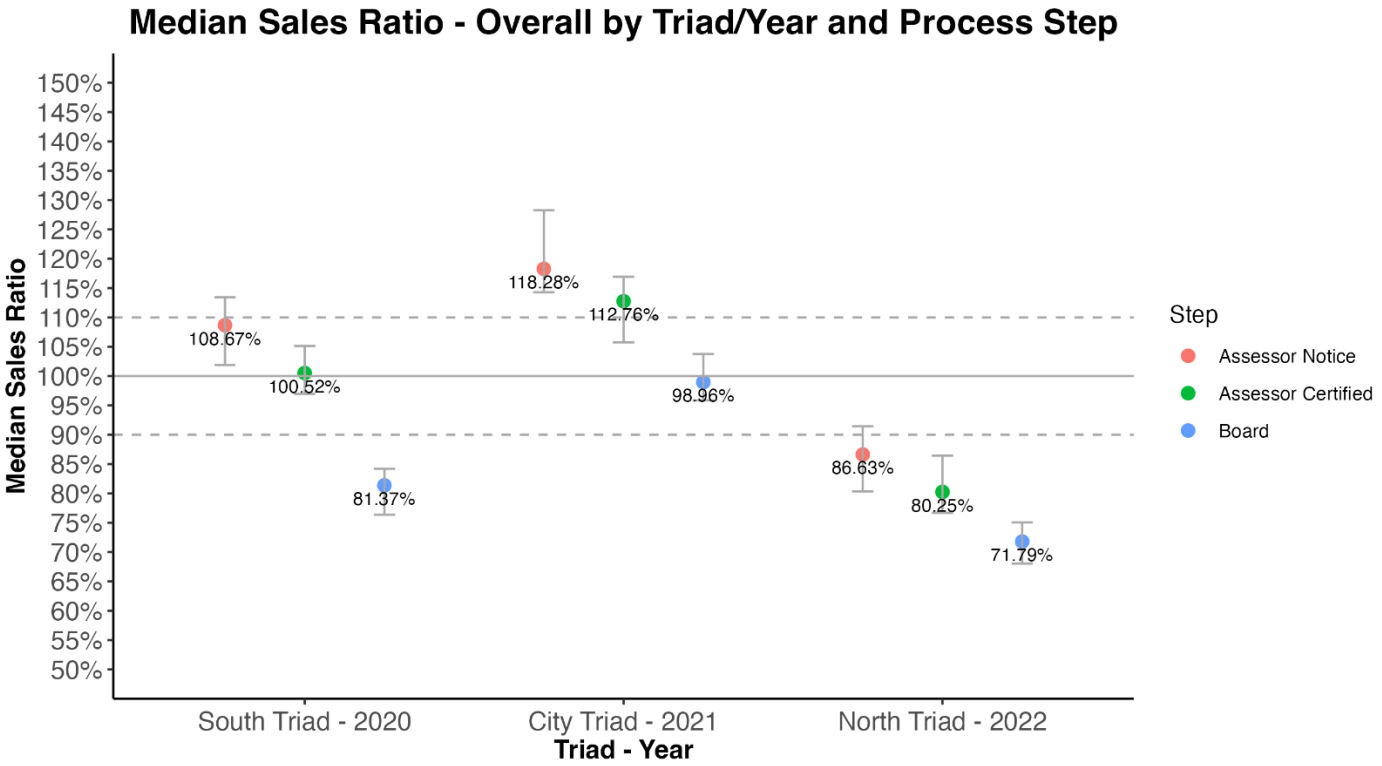

Figure 33. Median Sales Ratio - Overall by Triad/Year and Process Step

Key Findings:

- The Assessor Notice values in the City Triad (2021) did not meet the IAAO standard for the appraisal level of 90% to 110%, with a median sales ratio of 118.28%. The Assessor Notice values meet the IAAO industry standard of 90% to 110% for the South Triad (2020) and the North Triad (2022).

- In the South Triad (2020) and the City Triad (2021), the median sales ratios from the Assessor Certified step were an improvement over the Assessor Notice step (108.67% to 100.52% and 118.28% to 112.76%, respectively). However, the median sales ratio for the North Triad (2022) no longer meets

the IAAO industry standard during the Assessor Certified step when considering the confidence interval (86.63% to 80.25%).

- The median sales ratios for the Assessor Notice step for each triad (108.67%, 118.28%, and 86.63%, respectively) are statistically significantly different from each other. The same is true for the Assessor Certified step for each triad (100.52%, 112.76%, and 80.25%, respectively). The same is also true for the Board step for each triad (81.37%, 98.96%, and 71.79%, respectively). This results in non-uniformity based solely on the triad/year of reassessment. This stacks on top of the general non-uniformity that we see present within the same Triad at various levels.

- In each Triad, the CCAO appeals process and the CCBOR appeals process both result in a noticeable change to the median sales ratio in their respective steps. The change in the appraisal level from the Assessor Certified step to the Board step is greater than that of the Assessor Notice step to the Assessor Certified step. This is not surprising given the results of the appeals analysis.

- The CCBOR appeals process results in a set of commercial property values that have undergone a dramatic and statistically significant reduction in the appraisal level over the Assessor Certified values.

- In the South Triad (2020), this caused the median sales ratio to move from meeting IAAO industry standards (100.52%) to not meeting them (81.37%).

- In the City Triad (2021), although the median sales ratio using the Assessor Certified values did meet the IAAO industry standard when considering its confidence interval (112.76%), the median sales ratio noticeably improved after the CCBOR step (98.96%).

- In the North Triad (2022), the median sales ratio drops from 80.25% in the Assessor Certified step (already not meeting the IAAO industry standard) to 71.79% in the Board of Review step (still not meeting the standard but even farther outside the range).

- Given the facts that higher-valued properties tend to be appealed more often than lower-valued properties to the CCBOR and that appeals for higher-valued properties tend to be granted a value change more often, it is important to compare the weighted mean sales ratios to see how much the CCBOR appeal period impacts an estimate of the total percentage of the tax base that is being appraised. In each Triad, the weighted mean sales ratio gets worse when moving from the Assessor Certified to the Board of Review step. These results are found in the Appendix A table entitled, “Table of Sales Ratio Statistics.”

- For the South Triad (2020), the weighted mean drops from 100.74% in the Assessor Certified step to 75.92% in the Board step. For the City Triad (2021), the weighted mean drops from 108.01% in the Assessor Certified step to 90.19% in the Board step. For the North Triad (2022), the weighted mean drops from 97.59% in the Assessor Certified step to 73.59% in the Board step.

--Appraisal Uniformity

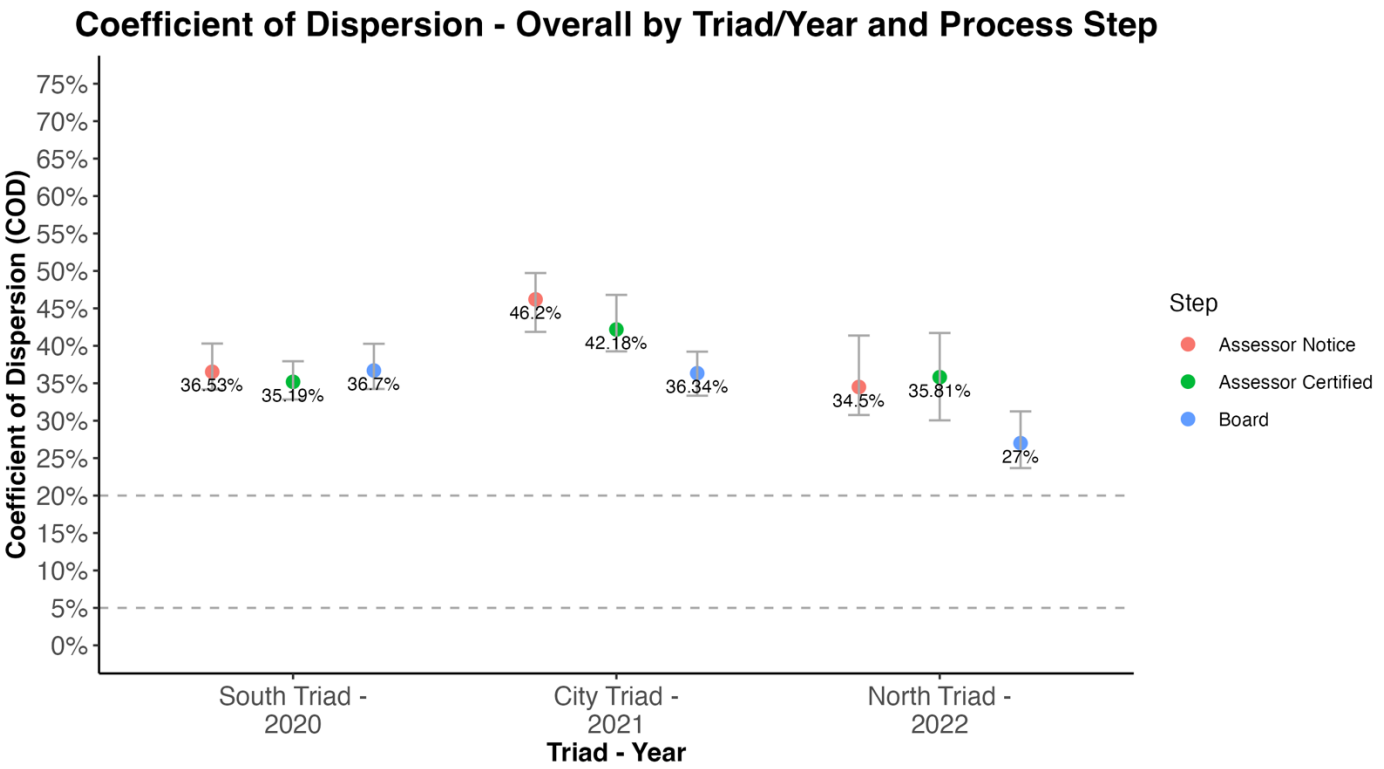

Figure 34. Coefficient of Dispersion - Overall by Triad/Year and Process Step

Key Findings:

- The overall level of general appraisal uniformity, as measured by the Coefficient of Dispersion (COD), is out of range for each step inside of each Triad. The IAAO standard range of 5% to 20% is not met by any of the valuation steps inside any of the triads investigated.
- It is this degree of non-uniformity, not the sample size, which is the primary driver of the wide confidence intervals seen throughout this report. In many instances, this lack of uniformity negatively affects our ability to draw statistical conclusions. Specific issues could be masked by this degree of non-uniformity and rendered undetectable. This lack of uniformity also adds more uncertainty into the process of deriving time (market condition) adjustments.
- The COD for the Assessor Certified step is lower than in the Assessor Notice step in two of the three triads (South and City Triads), but these differences are not statistically significant (p-values of 0.2875 and 0.1013, respectively).
- The COD for the Board of Review step is lower than in the Assessor Certified step in two of the three triads (City and North Triads), and these differences are statistically significant (p-values of 0.0209 and 0.0204, respectively).

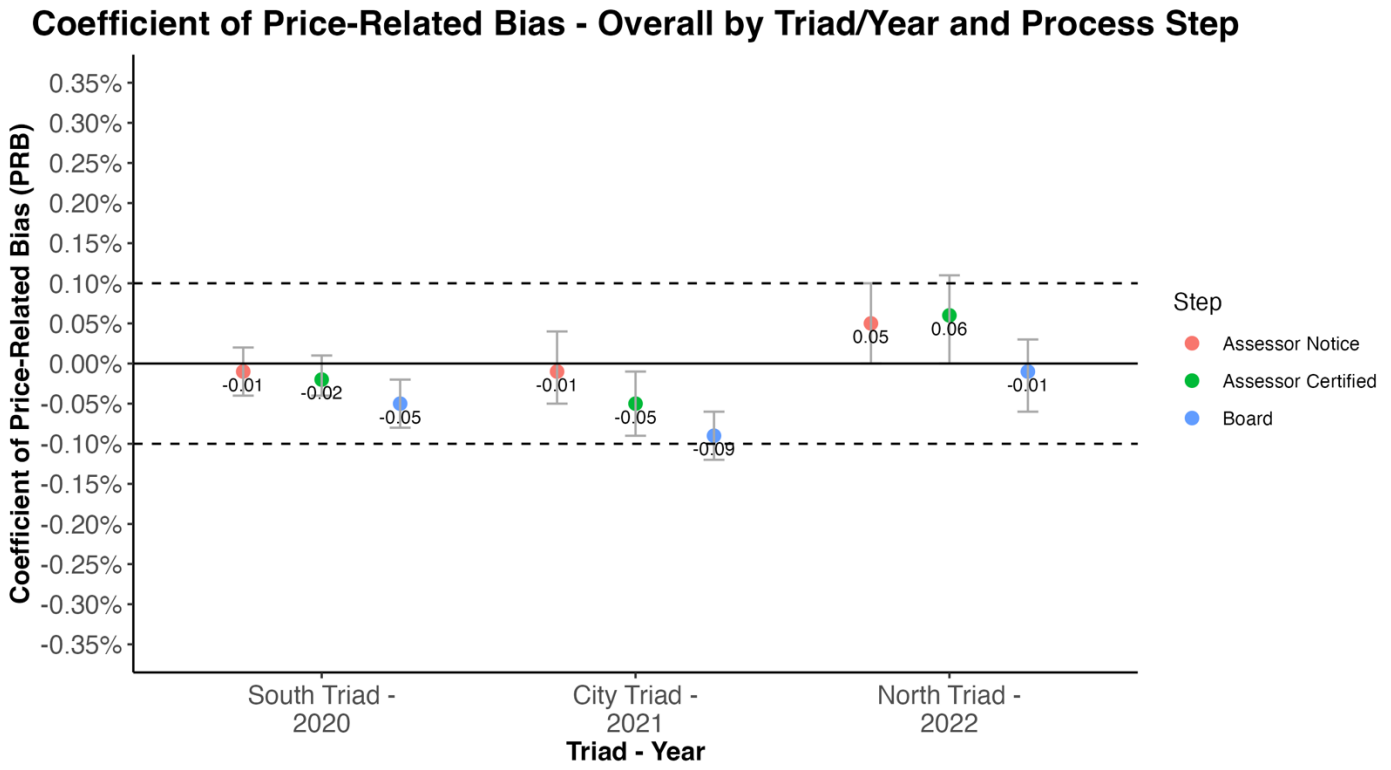

Figure 35. Coefficient of Price-Related Bias - Overall by Triad/Year and Process Step

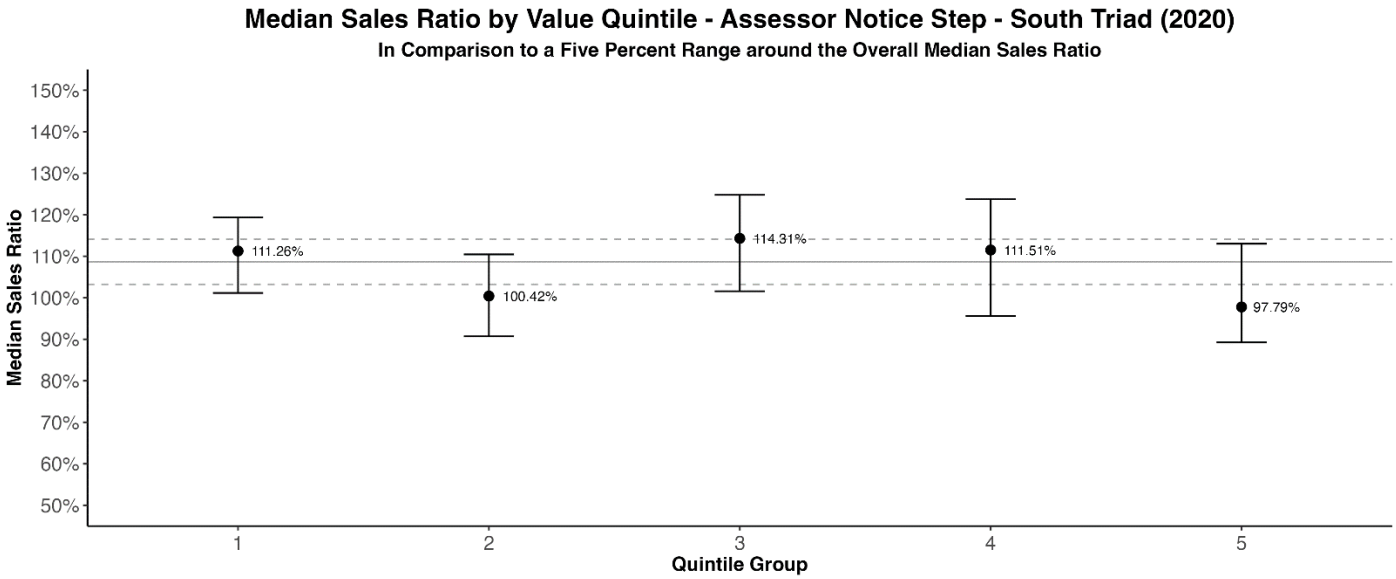

Figure 36. Median Sales Ratio by Value Quintile - Assessor Notice Step - South Triad (2020)

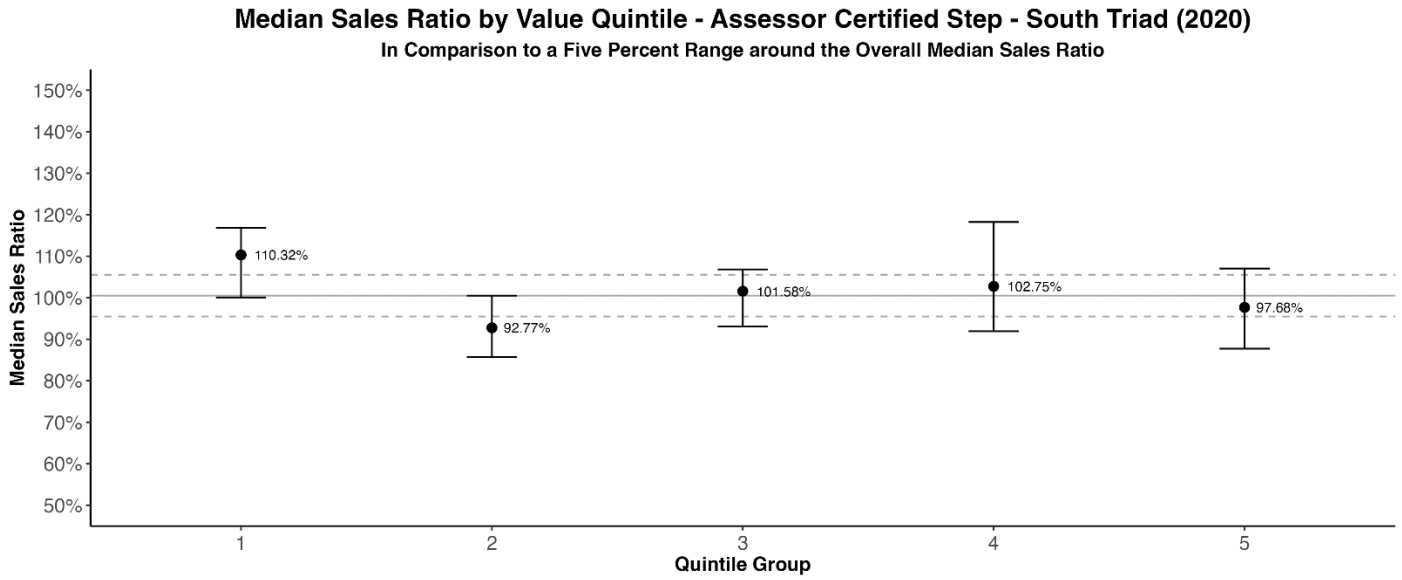

Figure 37. Median Sales Ratio by Value Quintile - Assessor Certified Step - South Triad (2020)

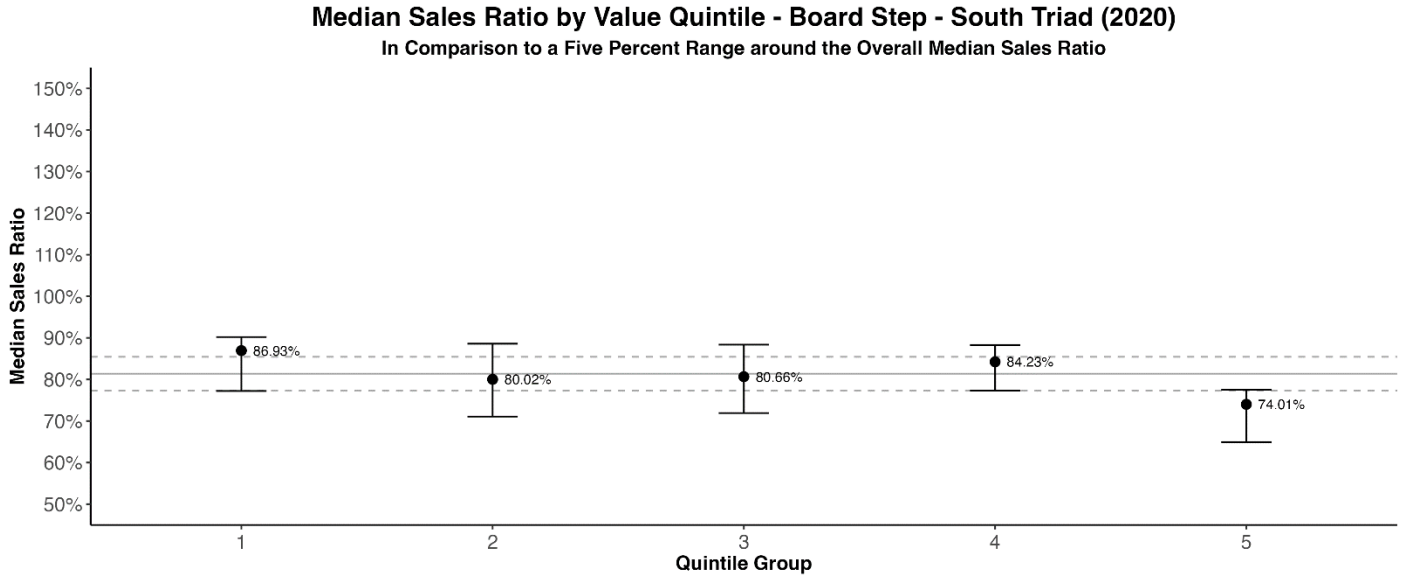

Figure 38. Median Sales Ratio by Value Quintile - Board Step - South Triad (2020)

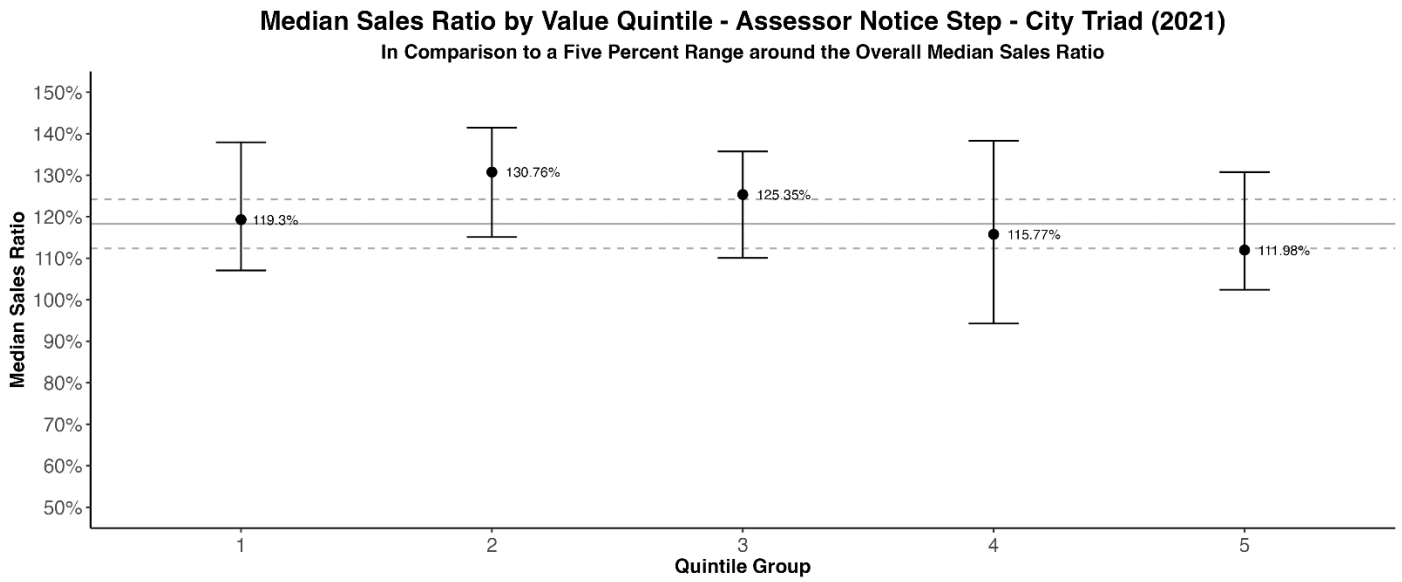

Figure 39. Median Sales Ratio by Value Quintile - Assessor Notice Step - City Triad (2021)

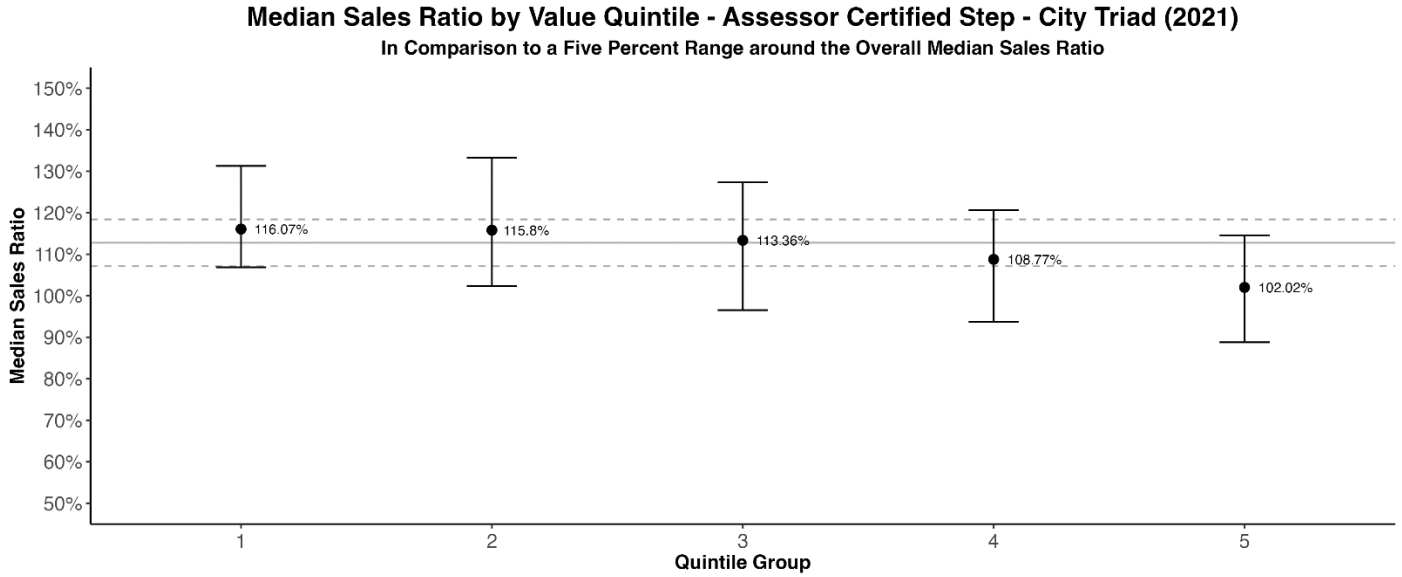

Figure 40. Median Sales Ratio by Value Quintile - Assessor Certified Step - City Triad (2021)

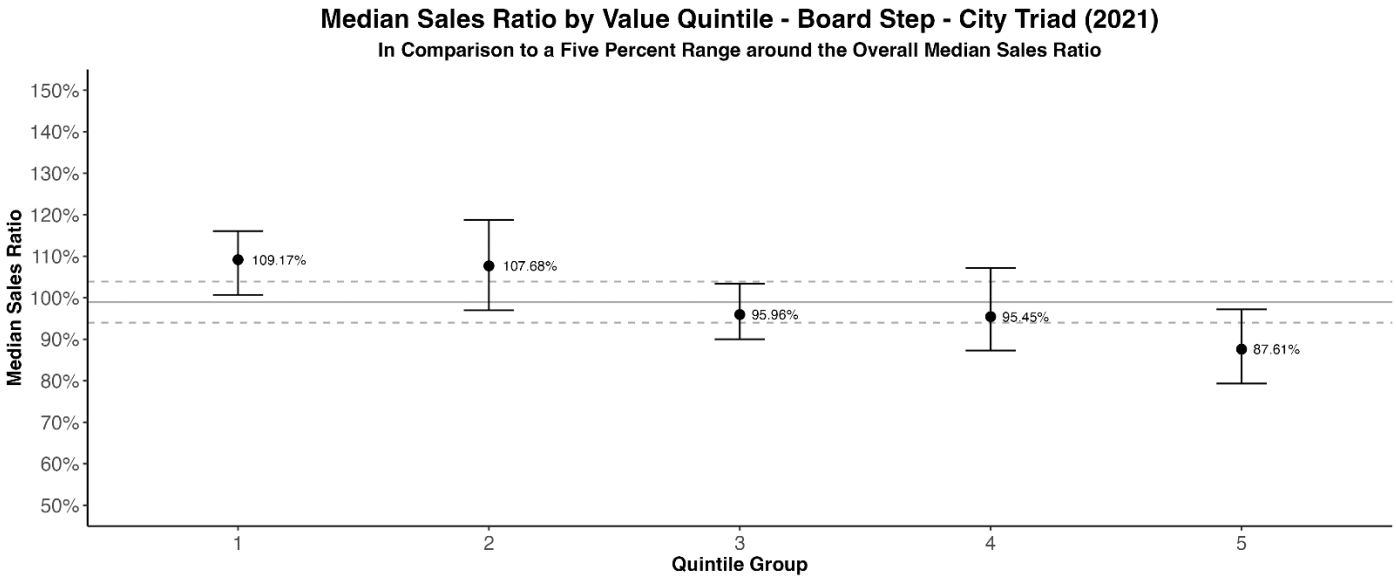

Figure 41. Median Sales Ratio by Value Quintile - Board Step - City Triad (2021)

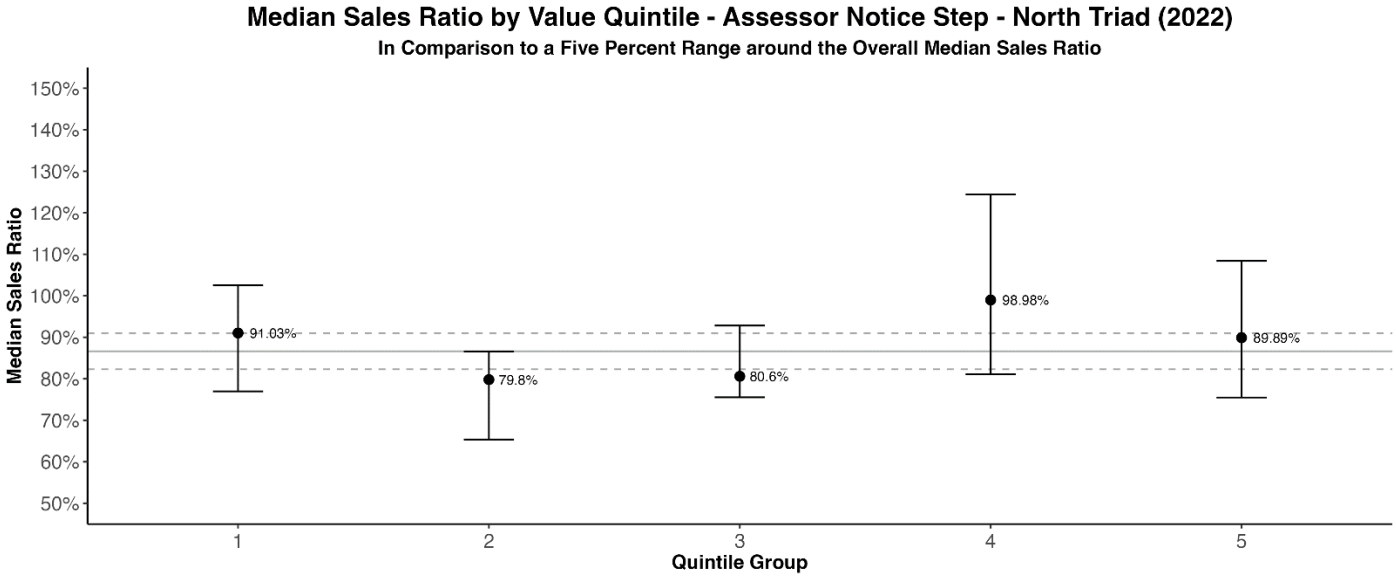

Figure 42. Median Sales Ratio by Value Quintile - Assessor Notice Step - North Triad (2022)

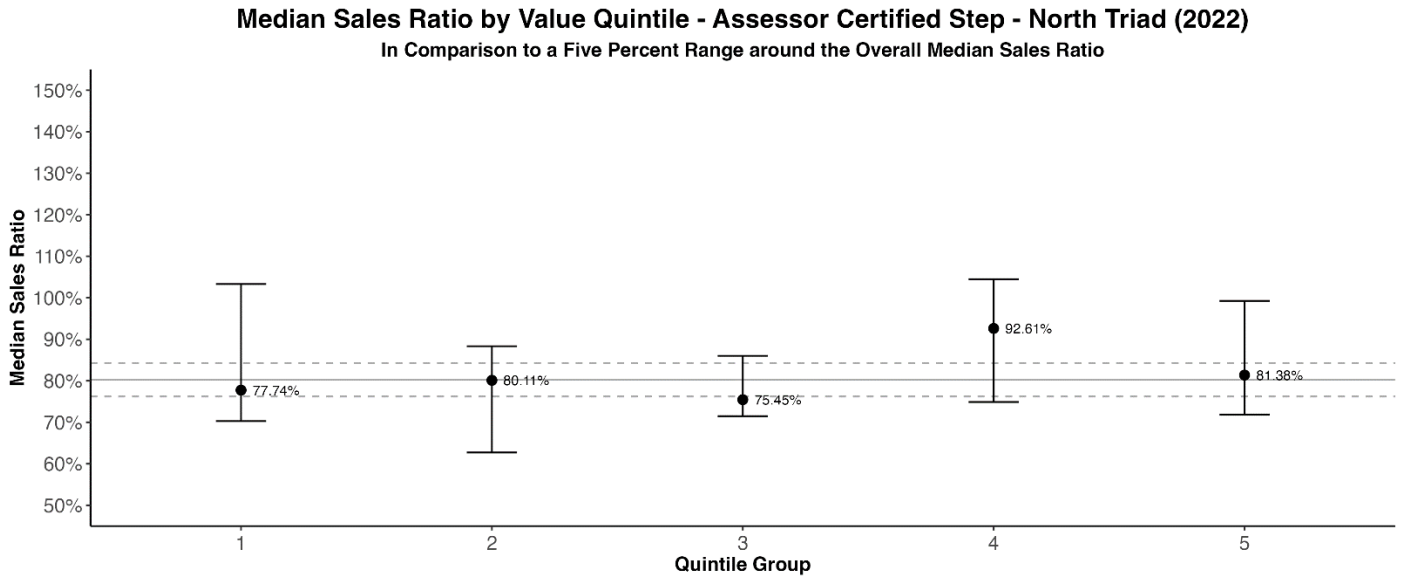

Figure 43. Median Sales Ratio by Value Quintile - Assessor Certified Step - North Triad (2022)

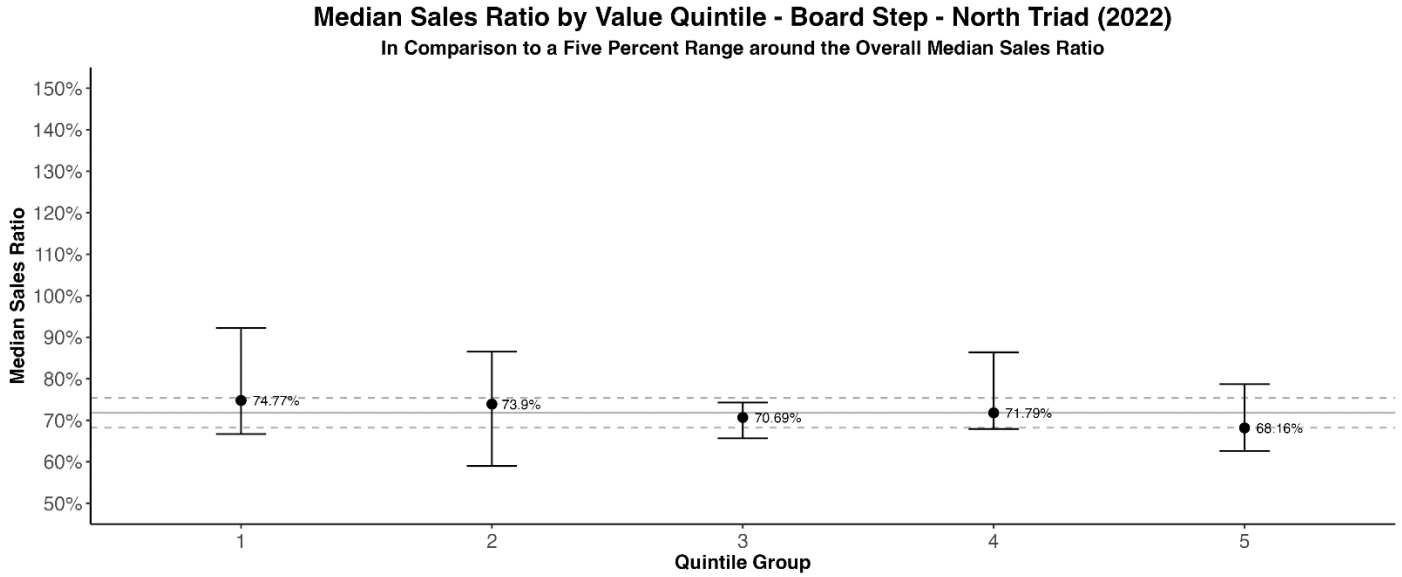

Figure 44. Median Sales Ratio by Value Quintile - Board Step - North Triad (2022)

Key Findings:

- In investigating the presence of vertical inequity using the Coefficient of Price-Related Bias (PRB) and Quintile Median Test, we find that the IAAO industry standards are met and that the degree of regressivity present is within range for all steps in each triad. The values after the Board of Review step in the City Triad (2021) do not meet the IAAO recommended range for the PRB (-0.09).

- The values from the Board step tend to be more regressive than the previous steps in each Triad year (although maybe not by a statistically significant amount), even though they still meet IAAO industry standards.

Results for South Triad by Property Use

This section analyzes appraisal level and appraisal uniformity for the South Triad (2020) by property use group.

--Appraisal Level

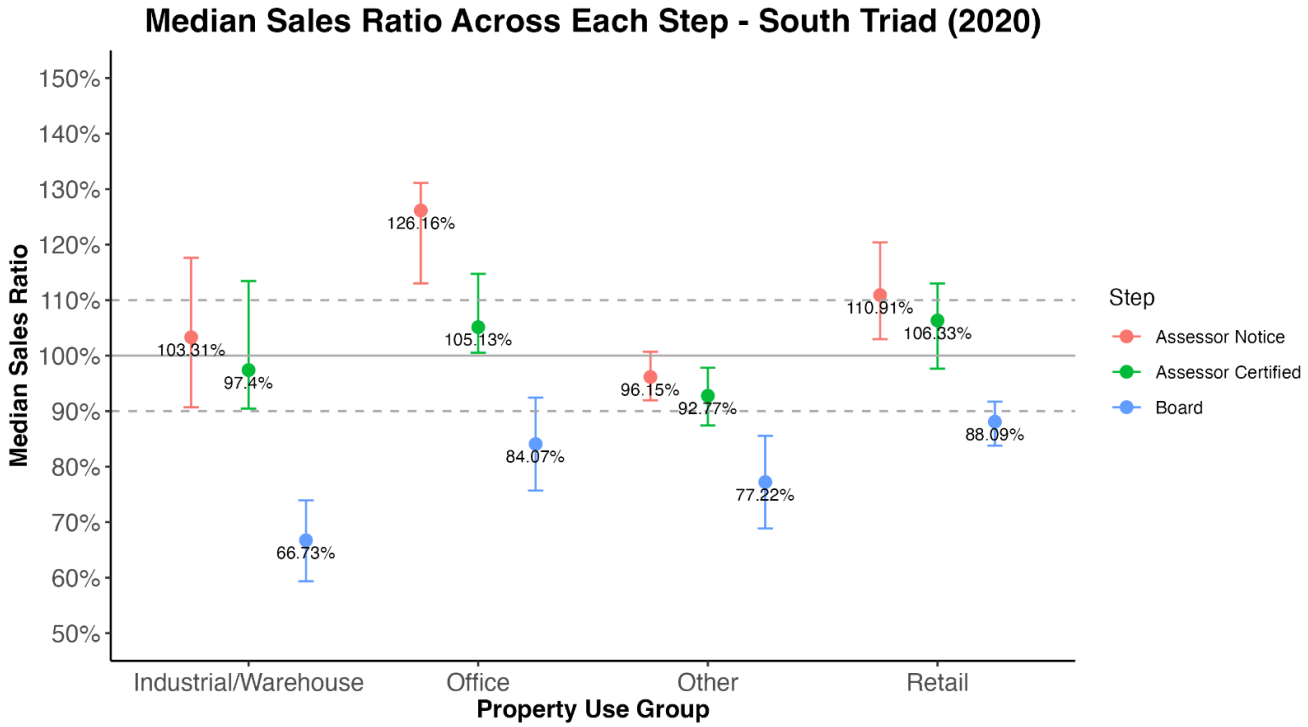

Figure 45. Median Sales Ratio Across Each Step - South Triad (2020)

--Appraisal Uniformity

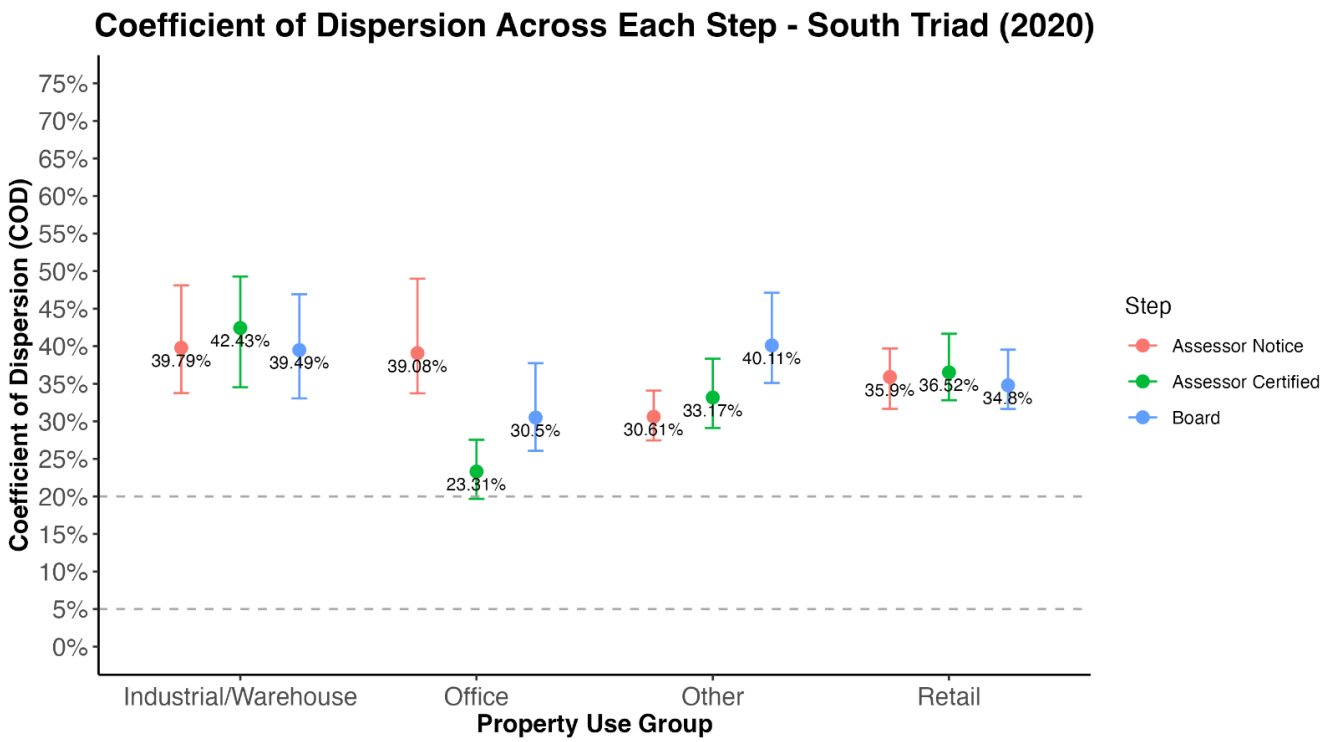

Figure 46. Coefficient of Dispersion Across Each Step - South Triad (2020)

Table of Sales Ratio Statistics for the South Triad (2020)

By Process Step and Property Use Group - Sales are from 01/01/2021 through 12/31/2023

Group	Step	Uniformity Test
Ind/Ware	Assessor Notice	Passed
Office	Assessor Notice	Passed
Other	Assessor Notice	Failed
Retail	Assessor Notice	Passed
Ind/Ware	Assessor Certified	Passed
Office	Assessor Certified	Passed
Other	Assessor Certified	Passed
Retail	Assessor Certified	Passed
Ind/Ware	Board	Failed
Office	Board	Passed
Other	Board	Passed
Retail	Board	Passed

Table 7. Table of Sales Ratio Statistics for the South Triad (2020)

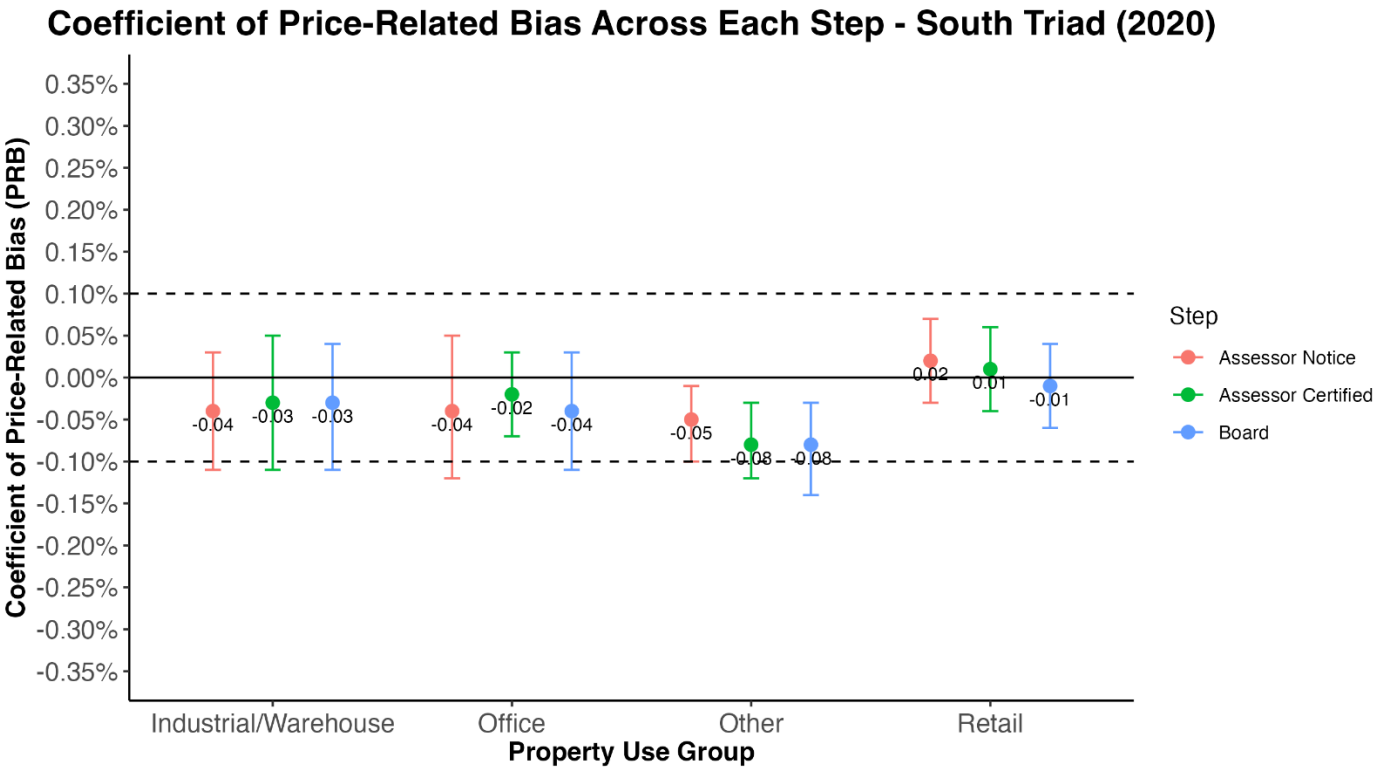

Figure 47. Coefficient of Price-Related Bias Across Each Step - South Triad (2020)

Key Findings:

- The median sales ratios decline for each property use group as they move across the three steps. The median sales ratio in the Board step is statistically significantly less than that of the Assessor Certified step for each property use group.
- The median sales ratio for Office properties in the Assessor Notice step is statistically significantly above the IAAO standard range (126.16%) and the median sales ratios for Industrial / Warehouse properties and Other Commercial properties are statistically significantly below the IAAO standard range (66.73% and 77.22%, respectively).
- The Coefficient of Dispersion does not meet the IAAO industry standard for all property use groups across all valuation steps, except for Office properties in the Assessor Certified step (23.31%).
- The Assessor Notice and Board steps have at least one property use group that does not pass the Median Uniformity Test, providing another indication of extensive appraisal non-uniformity.
- There is no statistically significant evidence that the level of vertical inequity present does not meet the IAAO industry standards across any of the property use groups in any of the valuation steps. The PRB coefficients are also not statistically significantly outside of the IAAO recommended range.

City Triad

This section analyzes appraisal level and appraisal uniformity for the City Triad (2021).

--Appraisal Level

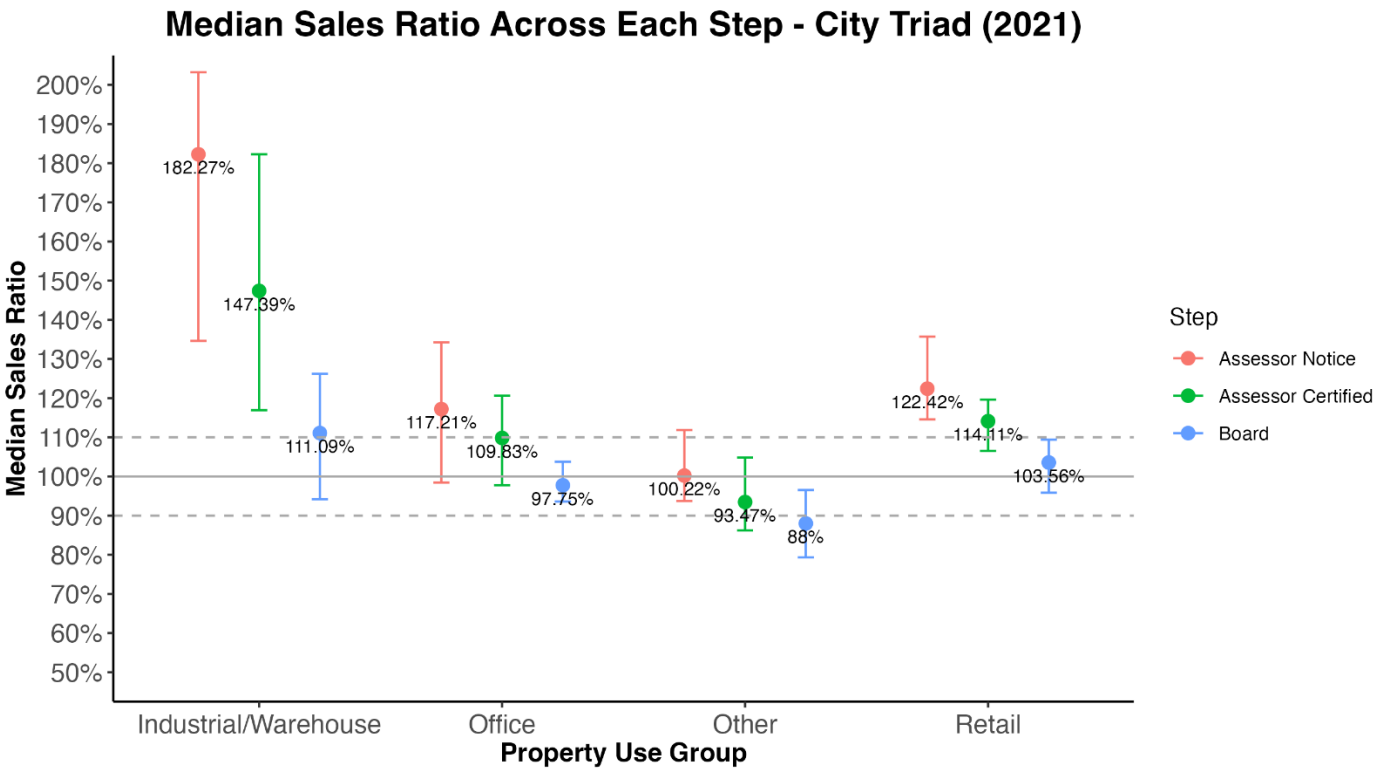

Figure 48. Median Sales Ratio Across Each Step - City Triad (2021)

--Appraisal Uniformity

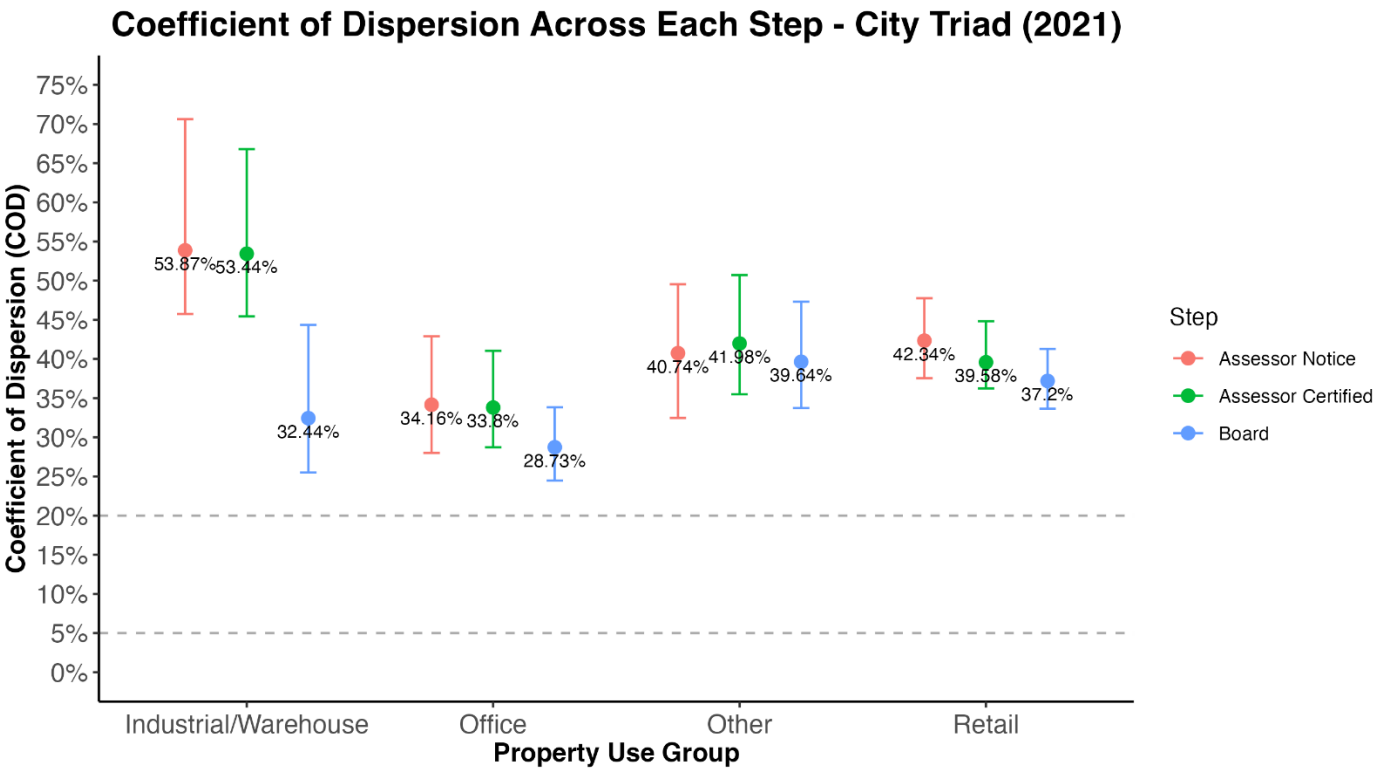

Figure 49. Coefficient of Dispersion Across Each Step - City Triad (2021)

Table of Sales Ratio Statistics for the City Triad (2021) By Process Step and Property Use Group - Sales are from 01/01/2022 through 12/31/2023		
Group	**Step**	**Uniformity Test**
Ind/Ware	Assessor Notice	Failed
Office	Assessor Notice	Passed
Other	Assessor Notice	Failed
Retail	Assessor Notice	Passed
Ind/Ware	Assessor Certified	Passed
Office	Assessor Certified	Passed
Other	Assessor Certified	Failed
Retail	Assessor Certified	Passed
Ind/Ware	Board	Passed
Office	Board	Passed
Other	Board	Passed
Retail	Board	Passed

Table 8. Table of Sales Ratio Statistics for the City Triad (2021)

Figure 50. Coefficient of Price-Related Bias Across Each Step - City Triad (2021)

Key Findings:

- The median sales ratios decline for each property use group as they move across the three valuation steps. The median sales ratios tend to improve in the second and third valuation steps for all property use groups except Other Commercial properties. In this Triad, the appeals periods improved the overall appraisal level for each property use group.

- The median sales ratio for Industrial / Warehouse properties in the Assessor Notice and Assessor Certified steps is statistically significantly above the IAAO standard range (182.27% and 147.39%, respectively), as is the median sales ratio for Retail properties in the Assessor Notice step (122.42%).

- The Coefficient of Dispersion (COD) is outside of the IAAO standard range for all property use groups across all valuation steps. The Board step did statistically significantly improve the COD for Industrial / Warehouse properties where the COD in the two Assessor steps was higher than any of the other property use groups.

- The Assessor Notice and Assessor Certified steps have at least one property use group that does not pass the Median Uniformity Test, providing another indication of extensive appraisal non-uniformity.

- There is no statistically significant evidence that the level of vertical inequity present does not meet the IAAO industry standards across any of the property use groups in any of the valuation steps. Retail properties in the Assessor Certified and Board steps have a Coefficient of Price-Related Bias (PRB) that is outside of the IAAO recommended range.

North Triad
This section analyzes appraisal level and appraisal uniformity for the North Triad (2022).

--Appraisal Level

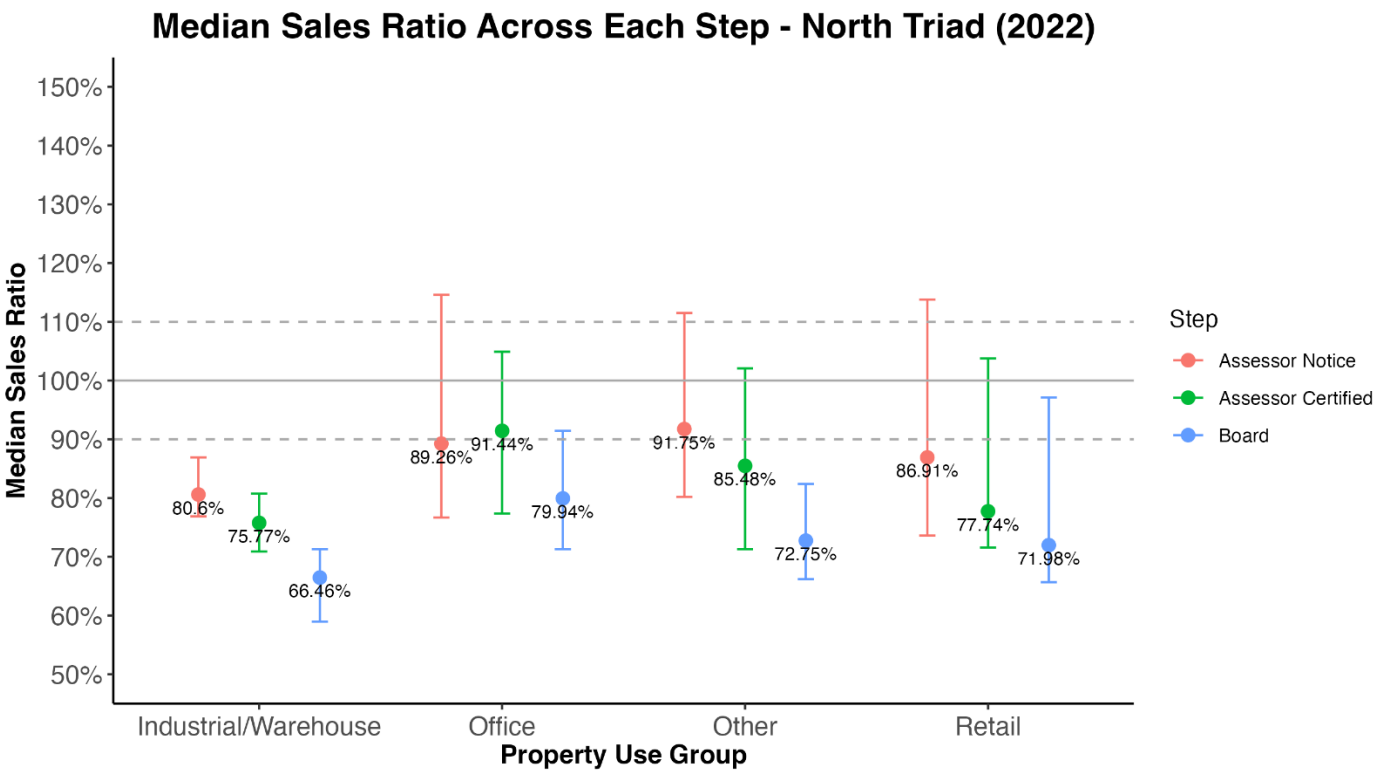

Figure 51. Median Sales Ratio Across Each Step - North Triad (2022)

--Appraisal Uniformity

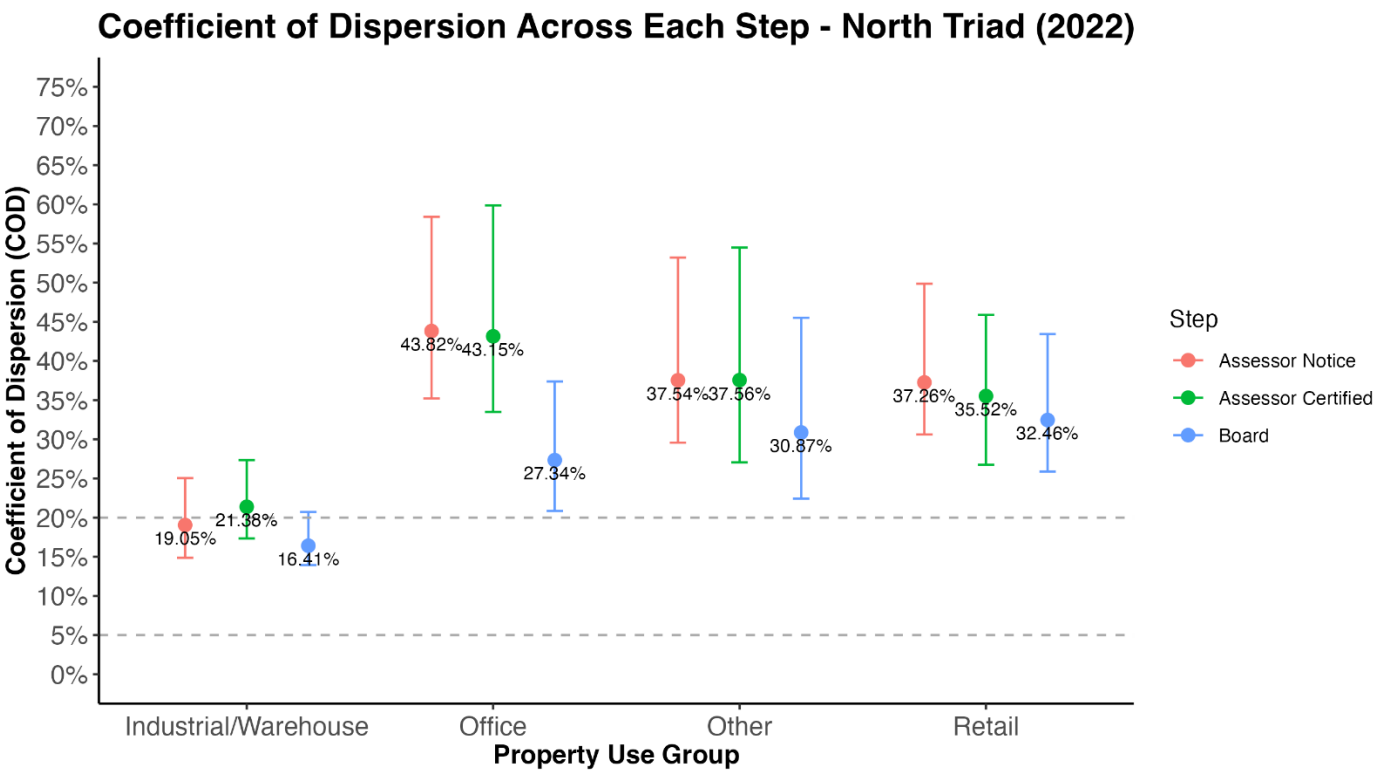

Figure 52. Coefficient of Dispersion Across Each Step - North Triad (2022)

Table of Sales Ratio Statistics for the North Triad (2022)

By Process Step and Property Use Group - Sales are from 01/01/2023 through 12/31/2023

Group	Step	Uniformity Test
Ind/Ware	Assessor Notice	Failed
Office	Assessor Notice	Passed
Other	Assessor Notice	Failed
Retail	Assessor Notice	Passed
Ind/Ware	Assessor Certified	Failed
Office	Assessor Certified	Failed
Other	Assessor Certified	Failed
Retail	Assessor Certified	Failed
Ind/Ware	Board	Failed
Office	Board	Failed
Other	Board	Failed
Retail	Board	Passed

Table 9. Table of Sales Ratio Statistics for the North Triad (2022)

Figure 53. Coefficient of Price-Related Bias Across Each Step - North Triad (2022)

Key Findings:

- The median sales ratios tend to decline for each property use group as they move across the three valuation steps. The median sales ratios tend to move farther out of range, per IAAO industry standards, in the second and third valuation steps for all property use groups, although the difference may not be statistically significant.
- The median sales ratio for Industrial / Warehouse properties in all three valuation steps is statistically significantly below the IAAO standard range (80.60%, 75.77%%, and 66.46%, respectively), as is the median sales ratio for Other Commercial properties in the Board step (72.75%).
- The Coefficient of Dispersion (COD) does not meet the IAAO industry standard for all property use groups across all valuation steps, except Industrial / Warehouse properties. The Board step does tend to improve the COD for all property use groups over the Assessor Certified step, however these differences are slight and may not be statistically significant.
- All three valuation steps have at least one property use group that does not pass the Median Uniformity Test, providing another indication of extensive appraisal non-uniformity.
- There is no statistically significant evidence that the level of vertical inequity present does not meet the IAAO industry standards across any of the property use groups in any of the valuation steps. The PRB coefficients are also not statistically significantly outside of the IAAO recommended range.

Sales Ratio Analysis of the Appeals Process

The previous sales ratio analysis compares the commercial valuation roll, regardless of appeal status, to industry standards. In contrast, this analysis seeks to ascertain the effect that the appeals process has on the

group of properties that were appealed. Recall that our previous analysis found that a large number of properties file an appeal with the Assessor and an even larger number file an appeal with the CCBOR. With this many properties appealing, it is important to analyze the appeal properties separately from the non-appeal properties to differentiate the effect of the appeal process from that of the standard assessment process.

South Triad

--Appraisal Level

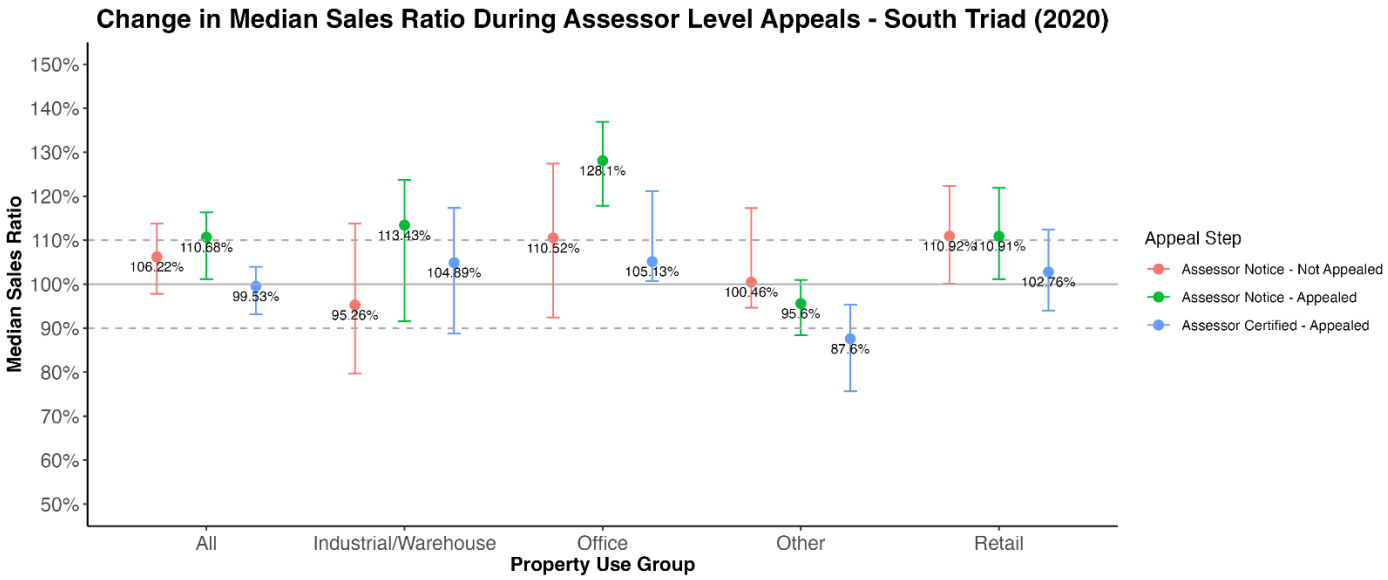

Figure 54. Change in Median Sales Ratio During Assessor Level Appeals - South Triad (2020)

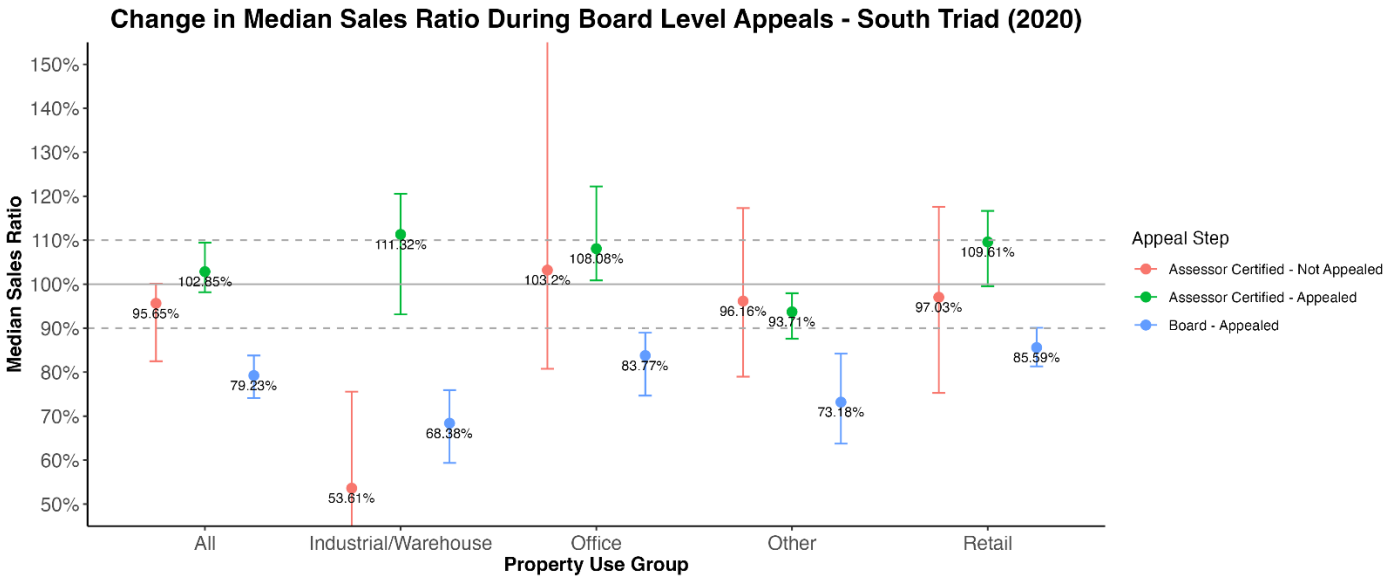

Figure 55. Change in Median Sales Ratio During Board Level Appeals - South Triad (2020)

--Appraisal Uniformity

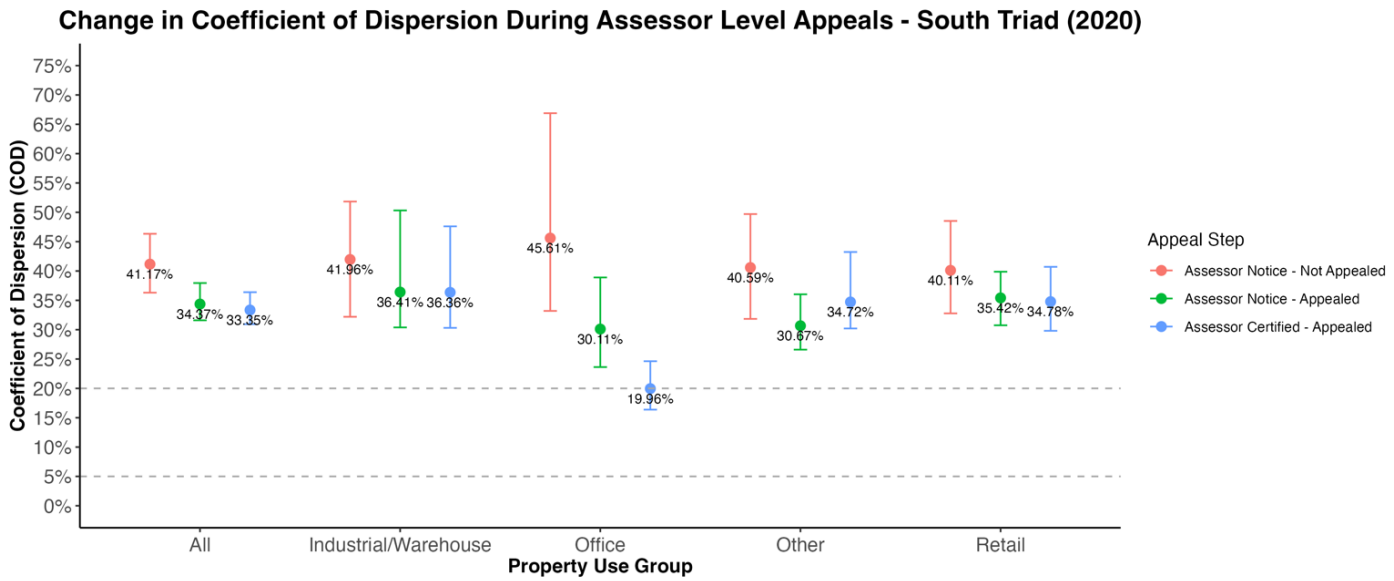

Figure 56. Change in Coefficient of Dispersion During Assessor Level Appeals - South Triad (2020)

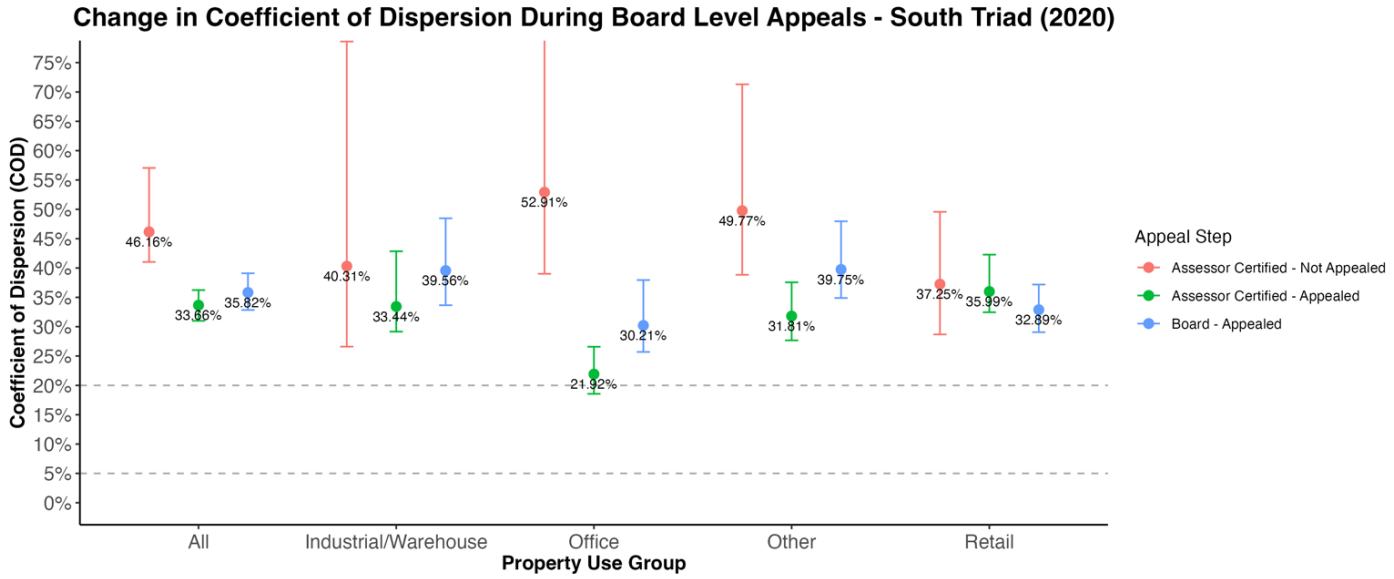

Figure 57. Change in Coefficient of Dispersion During Board Level Appeals - South Triad (2020)

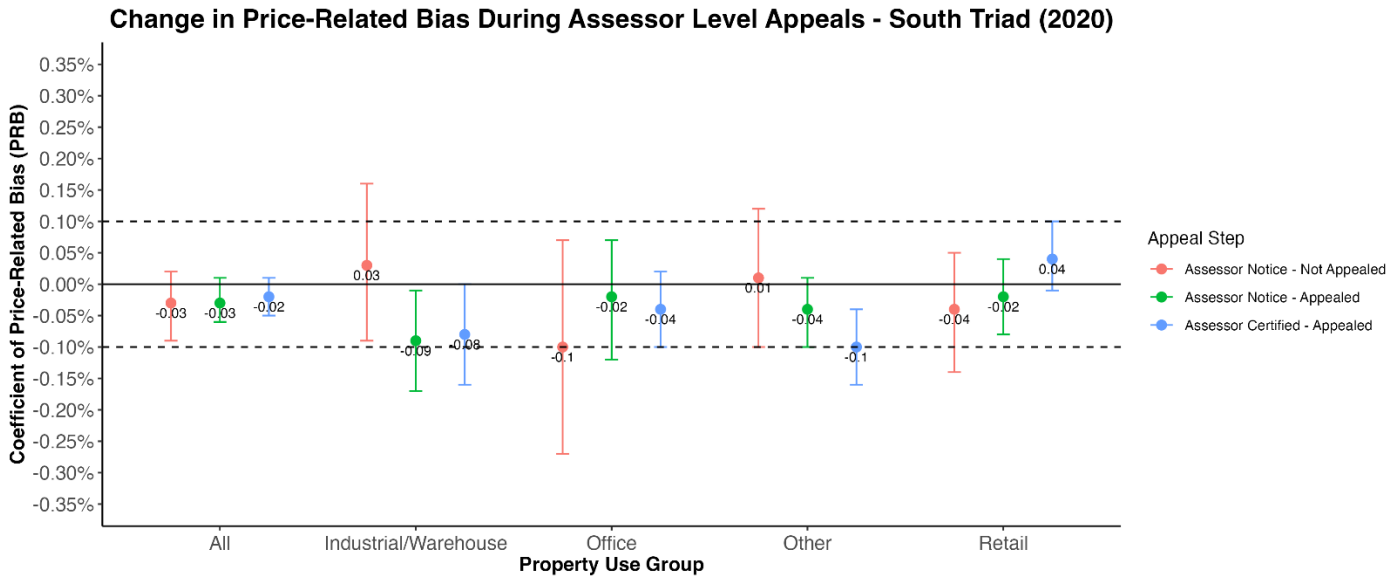

Figure 58. Change in Price-Related Bias During Assessor Level Appeals - South Triad (2020)

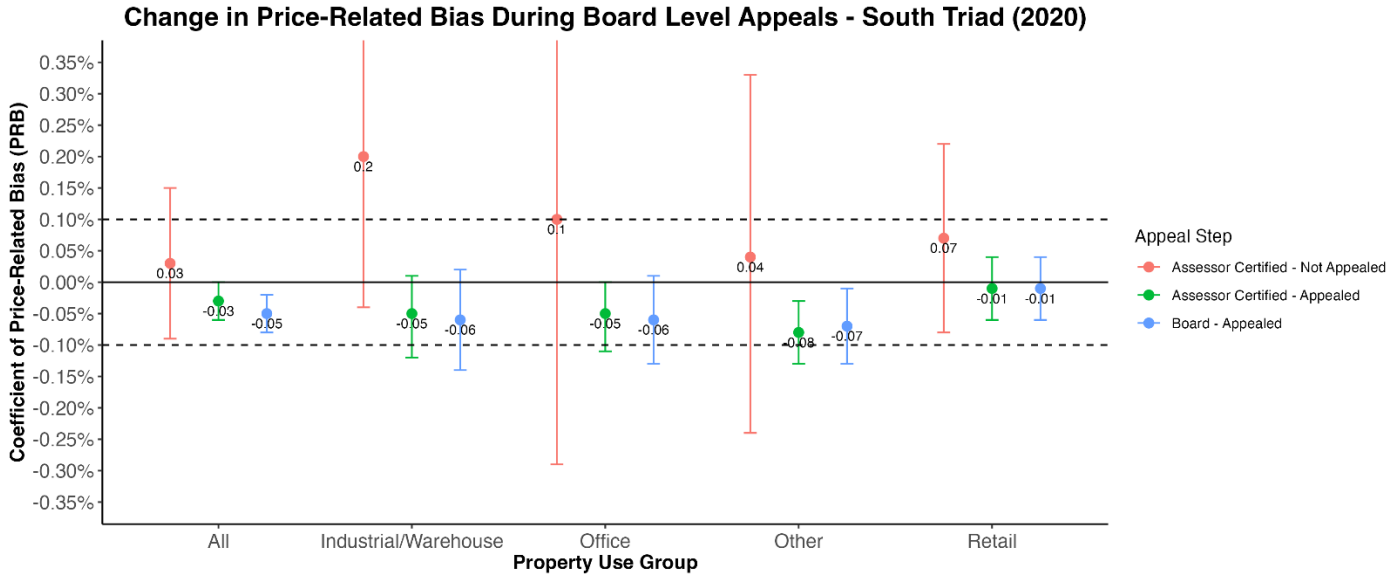

Figure 59. Change in Price-Related Bias During Board Level Appeals - South Triad (2020)

--Tests of Hypotheses

P-Values for Tests of Hypothesis During Assessor Appeals in the South Triad (2020) By Property Use Group - Sales are from 01/01/2021 through 12/31/2023			
Group	**Notice Appraisal Level Greater for Appeals than Non-Appeals?**	**Appraisal Level Reduced for Appeals?**	**Uniformity Improved for Appeals?**
Ind/Ware	0.212	0.3561	0.5015
Office	0.0558	***0.0089***	0.0551
Other	0.7964	0.0751	0.8172
Retail	0.4888	0.1806	0.4423
All	0.2583	***0.0268***	0.3629

Table 10. P-Values for Tests of Hypothesis During Assessor Appeals in the South Triad (2020)

P-Values for Tests of Hypothesis During Board Appeals in the South Triad (2020) By Property Use Group - Sales are from 01/01/2021 through 12/31/2023			
Group	**Certified Appraisal Level Greater for Appeals than Non-Appeals?**	**Appraisal Level Reduced for Appeals?**	**Uniformity Improved for Appeals?**
Ind/Ware	***0.0004***	***0***	0.8568
Office	0.3249	***0.0002***	0.9749
Other	0.5939	***0.0014***	0.946
Retail	0.1416	***0***	0.2246
All	0.0814	***0***	0.8264

Table 11. P-Values for Tests of Hypothesis During Board Appeals in the South Triad (2020)

Key Findings:

- The median sales ratio for the Assessor Notice values in the South Triad (2020) that were appealed to the Assessor is 110.68% vs. 106.22% for those that were not appealed. This difference, however, is not statistically significant (p = 0.2583). Therefore, we cannot conclude that the CCAO appeal properties are over-appraised with respect to non-appeal properties overall. This test was also not statistically significant in each of the property use group strata.

- The median sales ratio for the Assessor Certified values in the South Triad (2020) that were appealed to the Board is 102.85% vs. 95.65% for those that were not appealed. This difference, however, is not statistically significant (p = 0.0814). Therefore, we cannot conclude that the CCBOR appeal properties are over-appraised with respect to non-appeal properties overall. This test was also not statistically significant in each of the property use group strata except for Industrial / Warehouse properties (111.32% vs. 53.61%; p = 0.0004).

- The median sales ratio for properties appealed to the Assessor in the South Triad (2020) dropped from 110.68% to 99.53%, a statistically significant difference (p = 0.0268). However, this test was not

statistically significant in any of the property use group strata except for Office properties (128.10% vs. 105.13%; p = 0.0089). The Assessor appeals period tended to improve the appraisal level for those properties appealed by moving them closer to the target of 100%.

- The median sales ratio for properties appealed to the Board in the South Triad (2020) dropped from 102.85% to 79.23%, a statistically significant difference (p < 0.0001). This is more than two times the drop that occurred during the CCAO appeals period. This test was also statistically significant for each of the property use group strata. The CCBOR appeals period tended to move the appraisal level farther away from the IAAO standard range.

- Appraisal Uniformity, as measured by the Coefficient of Dispersion (COD), does not statistically improve during the Assessor appeal process overall (34.37% vs. 33.35%; p = 0.3629) or in any of the property use groups.

- Appraisal Uniformity, as measured by the Coefficient of Dispersion (COD), does not statistically improve during the CCBOR appeal process overall (33.66% vs. 35.82%; p = 0.8264) or in any of the property use groups.

- The Coefficient of Price-Related Bias (PRB) overall point estimate slightly improves for Assessor appeal properties (-0.03 to -0.02) and slightly worsens for Board appeal properties (-0.03 to -0.05). Statistical testing, however, is not done for vertical inequity because the variability present in the sales ratios has greatly decreased statistical power. Therefore, formal conclusions are not drawn in this instance.

City Triad

--Appraisal Level

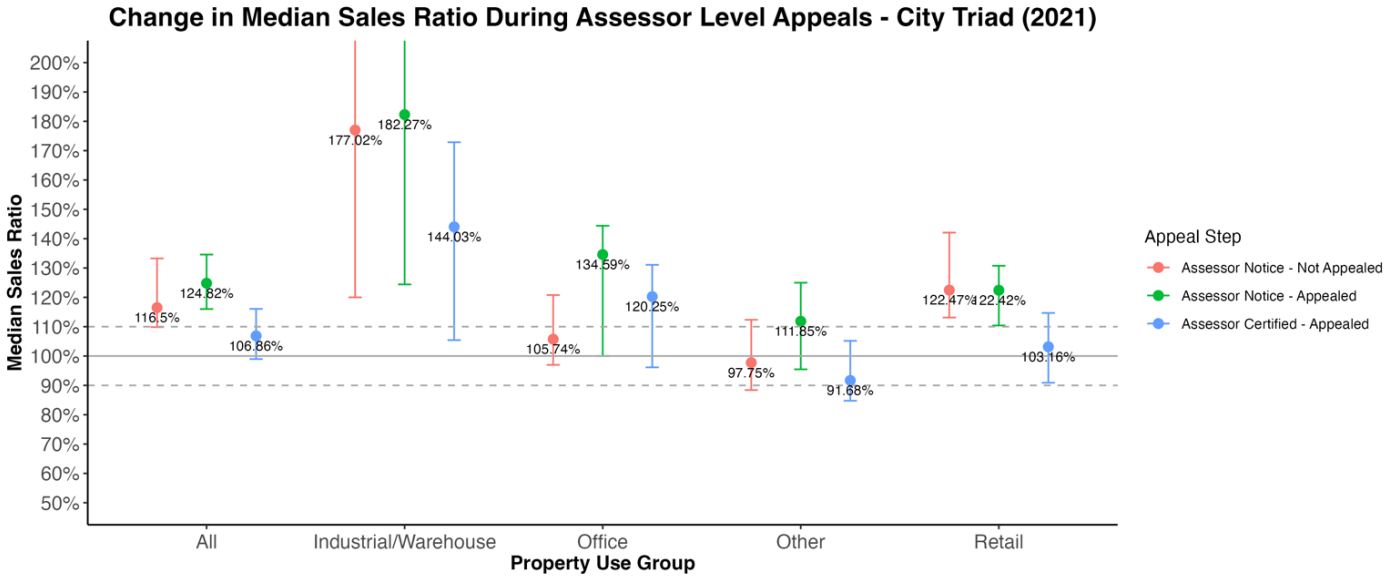

Figure 60. Change in Median Sales Ratio During Assessor Level Appeals - City Triad (2021)

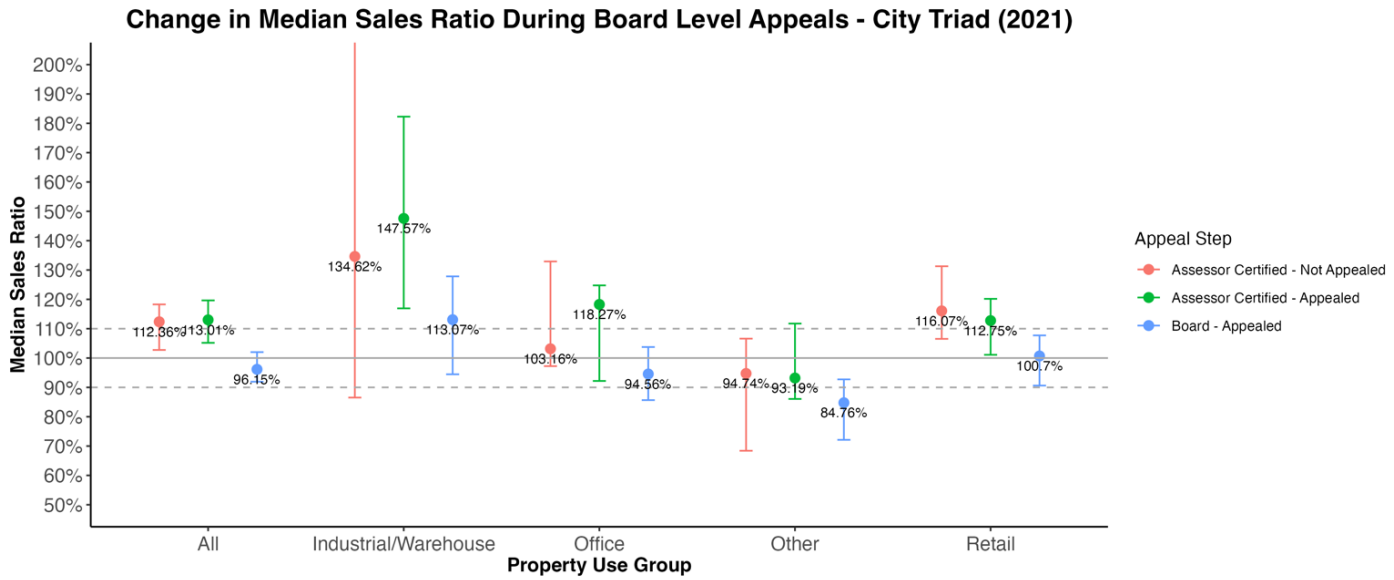

Figure 61. Change in Median Sales Ratio During Board Level Appeals - City Triad (2021)

--Appraisal Uniformity

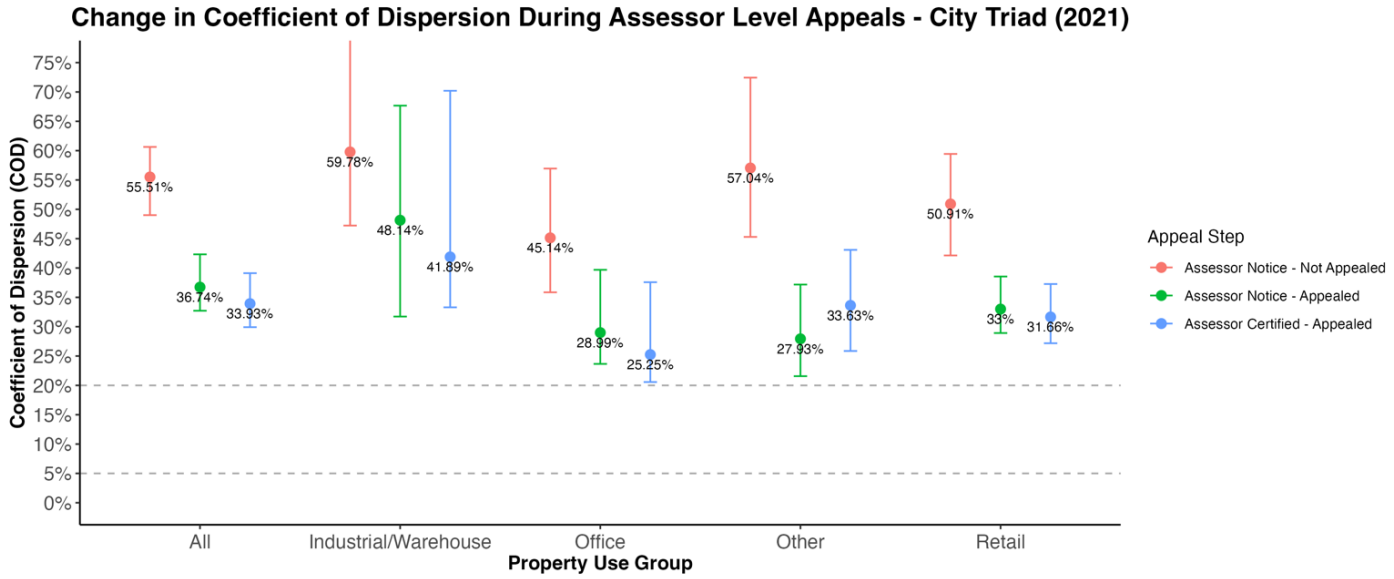

Figure 62. Change in Coefficient Dispersion During Assessor Level Appeals - City Triad (2021)

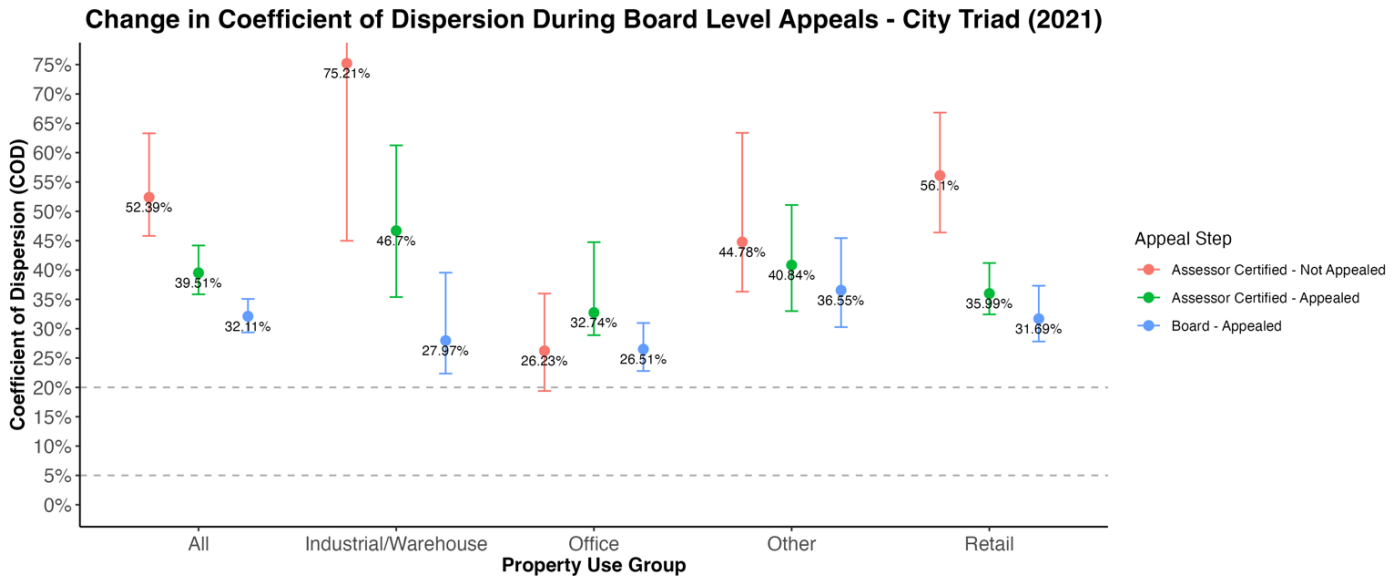

Figure 63. Change in Coefficient Dispersion During Board Level Appeals - City Triad (2021)

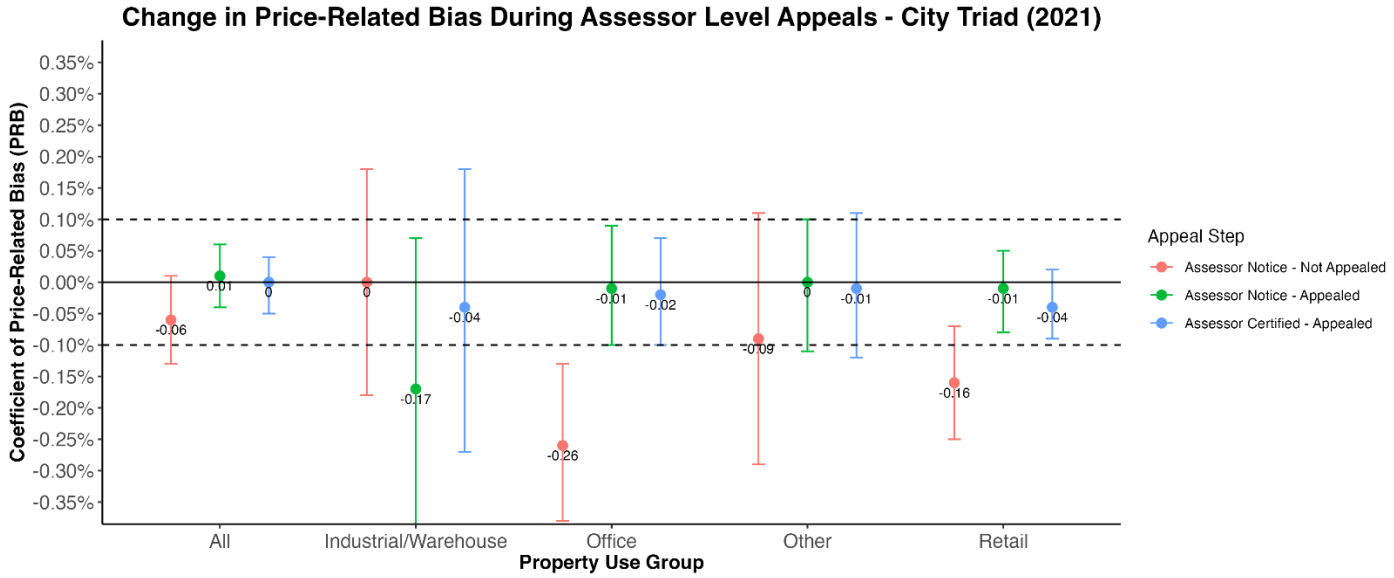

Figure 64. Change in Price-Related Bias During Assessor Level Appeals - City Triad (2021)

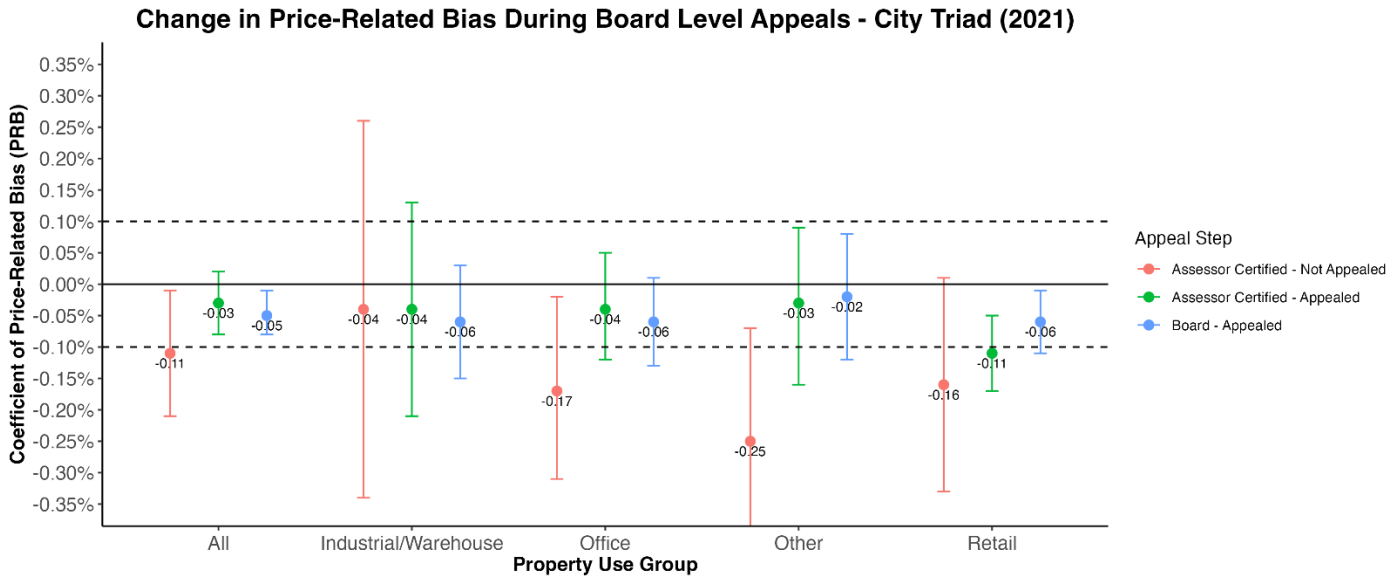

Figure 65. Change in Price-Related Bias During Board Level Appeals - City Triad (2021)

--Tests of Hypotheses

P-Values for Tests of Hypothesis During Assessor Appeals in the City Triad (2021)

By Property Use Group - Sales are from 01/01/2022 through 12/31/2023

Group	Notice Appraisal Level Greater for Appeals than Non-Appeals?	Appraisal Level Reduced for Appeals?	Uniformity Improved for Appeals?
Ind/Ware	0.4647	0.1196	0.3018
Office	0.1514	0.1509	0.2906
Other	0.1436	***0.0481***	0.804
Retail	0.5101	***0.0196***	0.3748
All	0.214	***0.005***	0.2265

Table 12. P-Values for Tests of Hypothesis During Assessor Appeals in the City Triad (2021)

P-Values for Tests of Hypothesis During Board Appeals in the City Triad (2021)

By Property Use Group - Sales are from 01/01/2022 through 12/31/2023

Group	Certified Appraisal Level Greater for Appeals than Non-Appeals?	Appraisal Level Reduced for Appeals?	Uniformity Improved for Appeals?
Ind/Ware	0.2818	***0.0293***	0.051
Office	0.2578	***0.0204***	0.1271
Other	0.5335	0.1042	0.2783
Retail	0.7297	***0.0322***	0.1214
All	0.4338	***0.0008***	***0.0125***

Table 13. P-Values for Tests of Hypothesis During Board Appeals in the City Triad (2021)

Key Findings:

- The median sales ratio for the Assessor Notice values in the City Triad (2021) that were appealed to the Assessor is 124.82% vs. 116.50% for those that were not appealed. This difference, however, is not statistically significant (p = 0.2140). Therefore, we cannot conclude that the CCAO appeal properties are over-appraised with respect to non-appeal properties overall. This test was also not statistically significant in each of the property use group strata.

- The median sales ratio for the Assessor Certified values in the City Triad (2021) that were appealed to the Board is 113.01% vs. 112.36% for those that were not appealed. This difference, however, is not statistically significant (p = 0.4338). Therefore, we cannot conclude that the CCBOR appeal properties are over-appraised with respect to non-appeal properties overall. This test was also not statistically significant in each of the property use group strata.

- The median sales ratio for properties appealed to the Assessor in the City Triad (2021) dropped from 124.82% to 106.86%, a statistically significant difference (p = 0.0050). This test was also statistically significant for Other Commercial properties (111.85% vs. 91.68%; p = 0.0481) and Retail Properties (122.42% vs. 103.16%; p = 0.0196). The Assessor appeals period tended to improve the appraisal level for those properties appealed by moving them closer to the target of 100%.

- The median sales ratio for properties appealed to the Board in the City Triad (2021) dropped from 113.01% to 96.15%, a statistically significant difference (p = 0.0008). This test was also statistically significant for each of the property use group strata, except for Other Commercial properties. In this case, the CCBOR appeals period tended to improve the appraisal level for those properties appealed by moving them closer to the target of 100%.

- Appraisal Uniformity, as measured by the Coefficient of Dispersion (COD), does not statistically improve during the Assessor appeal process overall (36.74% vs. 33.93%; p = 0.2265) or in any of the property use groups.

- Appraisal Uniformity, as measured by the Coefficient of Dispersion (COD), does statistically improve during the CCBOR appeal process overall (39.51% vs. 32.11%; p = 0.0125) but this test is not statistically significant in any of the property use groups individually.

- The Coefficient of Price-Related Bias (PRB) overall point estimate very slightly improves for Assessor appeal properties (-0.01 to 0.00) and slightly worsens for Board appeal properties (-0.03 to -0.05). Statistical testing, however, is not done for vertical inequity because of the variability present in the sales ratios.

North Triad

--Appraisal Level

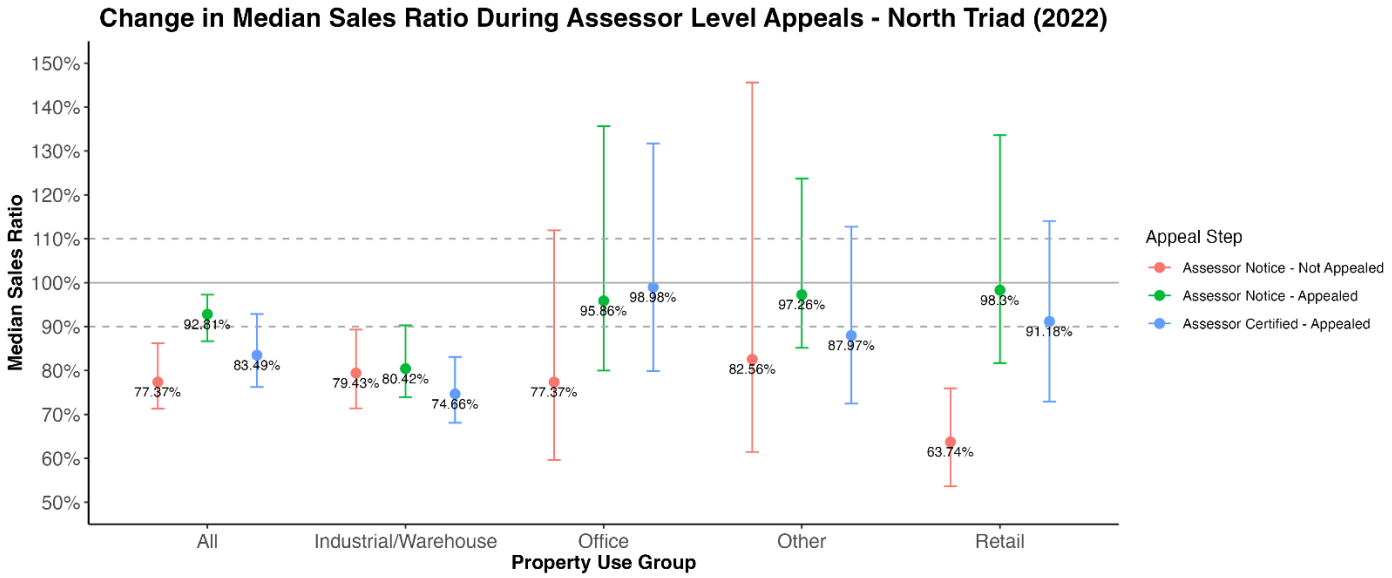

Figure 66. Change in Median Sales Ratio During Assessor Level Appeals - North Triad (2022)

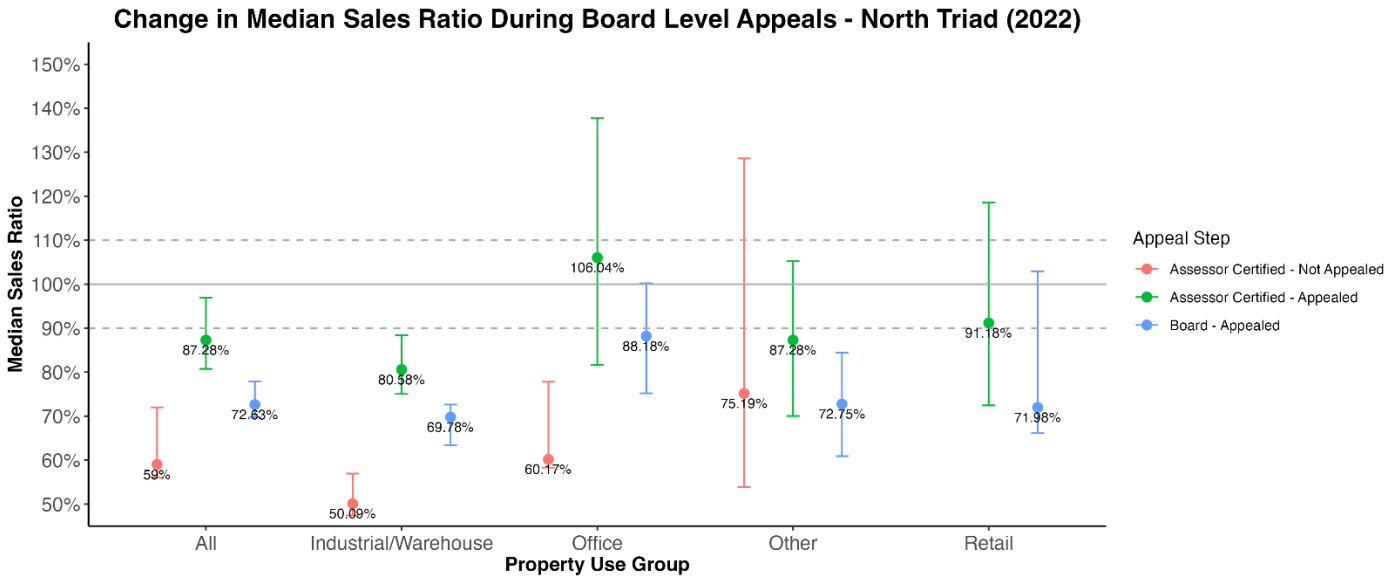

Figure 67. Change in Median Sales Ratio During Board Level Appeals - North Triad (2022)

--Appraisal Uniformity

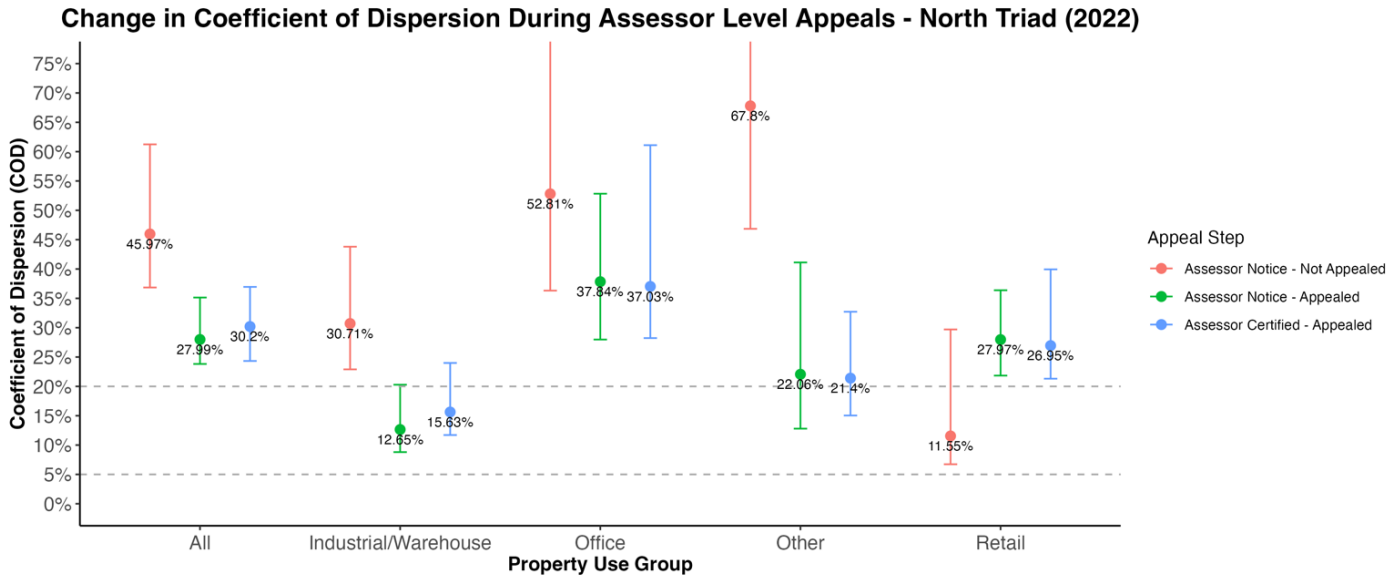

Figure 68. Change in Coefficient of Dispersion During Assessor Level Appeals - North Triad (2022)

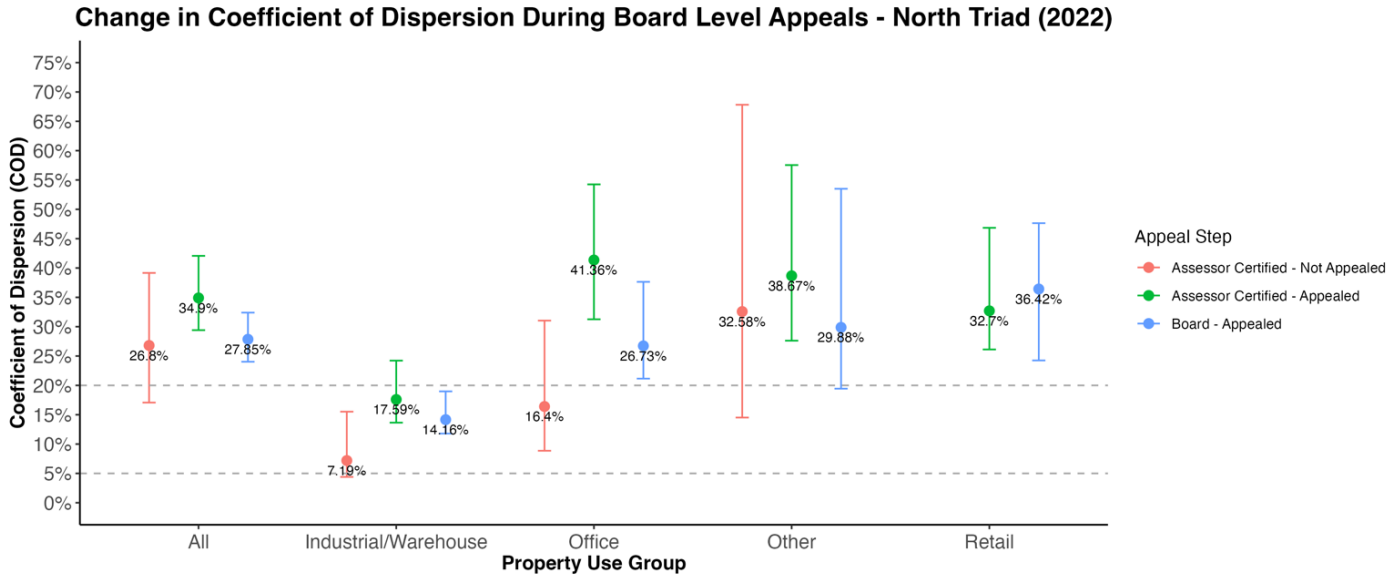

Figure 69. Change in Coefficient of Dispersion During Board Level Appeals - North Triad (2022)

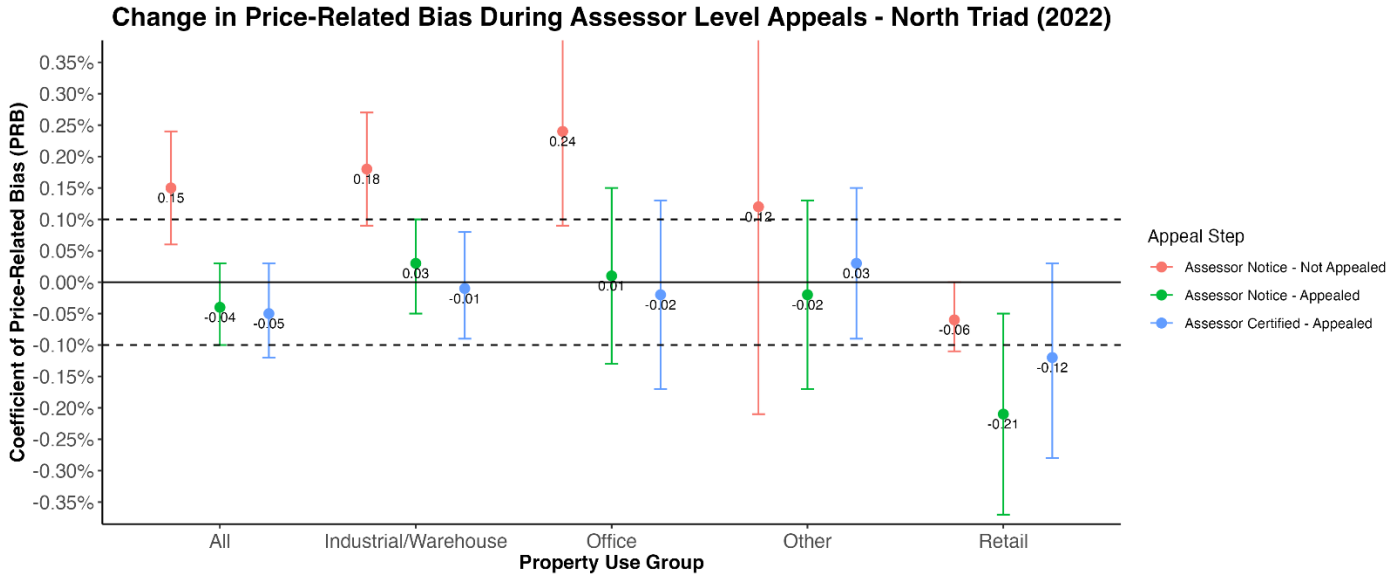

Figure 70. Change in Price-Related Bias During Assessor Level Appeals - North Triad (2022)

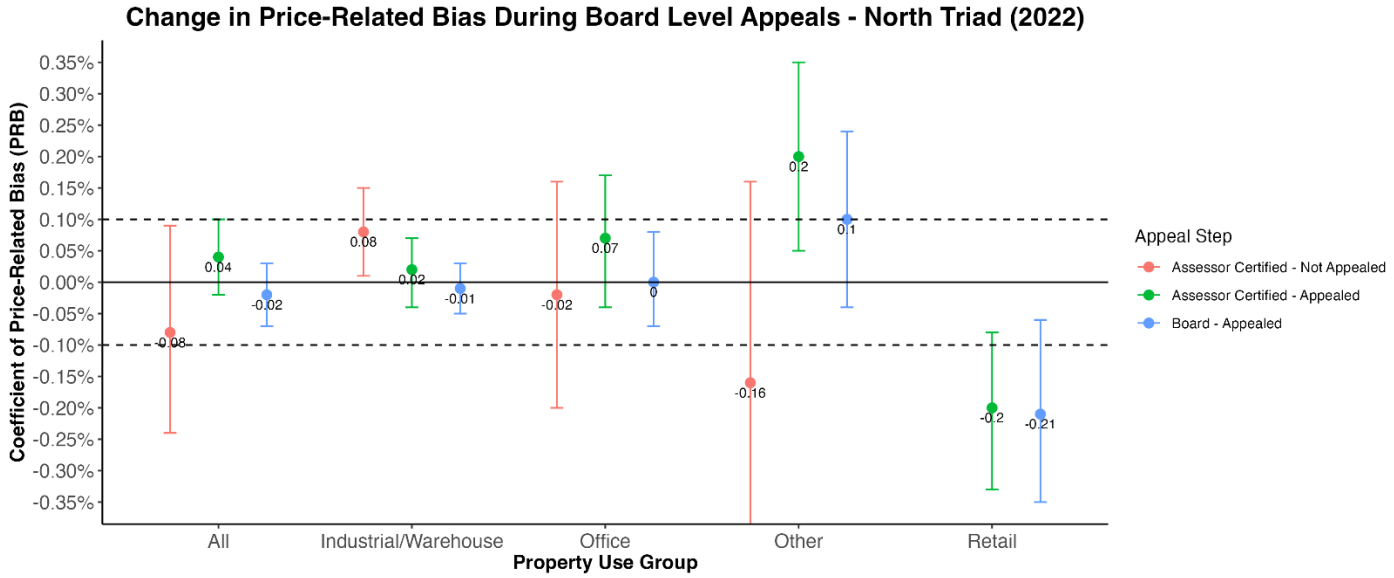

Figure 71. Change in Price-Related Bias During Board Level Appeals - North Triad (2022)

--Tests of Hypotheses

P-Values for Tests of Hypothesis During Assessor Appeals in the North Triad (2022) By Property Use Group - Sales are from 01/01/2023 through 12/31/2023			
Group	**Notice Appraisal Level Greater for Appeals than Non-Appeals?**	**Appraisal Level Reduced for Appeals?**	**Uniformity Improved for Appeals?**
Ind/Ware	0.4162	0.1429	0.7499
Office	0.1598	0.4836	0.4635
Other	0.1233	0.2046	0.4658
Retail	***0***	0.303	0.4357
All	***0.0075***	0.0858	0.6648

Table 14. P-Values for Tests of Hypothesis During Assessor Appeals in the North Triad (2022)

P-Values for Tests of Hypothesis During Board Appeals in the North Triad (2022) By Property Use Group - Sales are from 01/01/2023 through 12/31/2023			
Group	**Certified Appraisal Level Greater for Appeals than Non-Appeals?**	**Appraisal Level Reduced for Appeals?**	**Uniformity Improved for Appeals?**
Ind/Ware	***0***	***0.0021***	0.1978
Office	***0***	0.106	0.0595
Other	0.2252	0.1258	0.2676
Retail	1	0.2418	0.6801
All	***0***	***0.0018***	0.0736

Table 15. P-Values for Tests of Hypothesis During Board Appeals in the North Triad (2022)

Key Findings:

- The median sales ratio for the Assessor Notice values in the North Triad (2022) that were appealed to the Assessor is 92.81% vs. 77.37% for those that were not appealed. This difference is statistically significant ($p = 0.0075$). Therefore, we can conclude that the CCAO appeal properties are over-appraised with respect to non-appeal properties overall. In terms of property use group, however, this test was only statistically significant for Retail properties (98.30% vs. 63.74%; $p < 0.0001$).

- The median sales ratio for the Assessor Certified values in the North Triad (2022) that were appealed to the Board is 87.28% vs. 59.00% for those that were not appealed. This difference is statistically significant ($p < 0.0001$). Therefore, we can conclude that the CCBOR appeal properties are over-appraised with respect to non-appeal properties overall. This test was also statistically significant in Industrial / Warehouse (80.58% vs. 50.09%; $p < 0.0001$) and Office (106.04% vs. 60.17%; $p < 0.0001$) property use group strata.

- The median sales ratio for properties appealed to the Assessor in the North Triad (2022) dropped from 92.81% to 83.49%, but this is not a statistically significant difference ($p = 0.0858$). This test was not

statistically significant for the four property use group strata either. The Assessor appeals period tended to move the appraisal level point estimates farther away from the IAAO standard range.

- The median sales ratio for properties appealed to the Board in the North Triad (2022) dropped from 87.28% to 72.63%, a statistically significant difference (p = 0.0018). This test was also statistically significant for Industrial / Warehouse properties (80.58% vs. 69.78%; p = 0.0021) but not the other property use group strata. The CCBOR appeals period tended to move the appraisal level farther away from the IAAO standard range.

- Appraisal Uniformity, as measured by the Coefficient of Dispersion (COD), does not statistically improve during the Assessor appeal process overall (27.99% vs. 30.20%; p = 0.6648) or in any of the property use groups.

- Appraisal Uniformity, as measured by the Coefficient of Dispersion (COD), also does not statistically improve during the CCBOR appeal process overall (34.90% vs. 27.85%; p = 0.0736) or in any of the property use groups.

- The Coefficient of Price-Related Bias (PRB) overall point estimate is made very slightly worse for Assessor appeal properties (-0.04 to -0.05) and slightly better for Board appeal properties (0.04 to -0.02). Both point estimates became more regressive. Statistical testing, however, is not done for vertical inequity because the variability present in the sales ratios has greatly decreased statistical power. Therefore, formal conclusions are not drawn in this instance.

Step 7: Evaluation and Use of Result

The key findings of the statistical analysis are summarized in the main body of the report (see “Statistical Analysis Summary”) rather than here, and they are organized according to the key project questions for the statistical phase. This is done to improve the flow of the report for the reader.

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APPENDIX A

Supporting Statistical Tables

Table of Sales Ratio Statistics

Overall by Triad/Year and Process Step

Group	Step	Count Before Trim	Count After Trim	Median LCL	Median	Median UCL	Wtd. Mean LCL	Wtd. Mean	Wtd. Mean UCL	COD LCL	COD	COD UCL	PRB LCL	PRB	PRB UCL
South Triad - 2020	Assessor Notice	503	451	101.9	108.67	113.43	97.48	110.78	127.89	34.17	36.53	40.3	-0.04	-0.01	0.02
South Triad - 2020	Assessor Certified	503	447	96.95	100.52	105.13	88.84	100.74	116.57	32.84	35.19	37.94	-0.04	-0.02	0.01
South Triad - 2020	Board	503	457	76.36	81.37	84.2	69.37	75.92	83.46	34.24	36.7	40.27	-0.08	-0.05	-0.02
City Triad - 2021	Assessor Notice	426	393	114.28	118.28	128.26	113.35	120.62	128.36	41.86	46.2	49.72	-0.05	-0.01	0.04
City Triad - 2021	Assessor Certified	426	392	105.74	112.76	116.93	101.65	108.01	114.79	39.26	42.18	46.8	-0.09	-0.05	-0.01
City Triad - 2021	Board	426	388	95.85	98.96	103.75	85.74	90.19	94.89	33.34	36.34	39.22	-0.12	-0.09	-0.06
North Triad - 2022	Assessor Notice	133	118	80.32	86.63	91.44	90.88	101.38	112.85	30.76	34.5	41.37	0	0.05	0.1
North Triad - 2022	Assessor Certified	133	122	76.69	80.25	86.43	86.82	97.65	109.35	30.05	35.81	41.71	0	0.06	0.11
North Triad - 2022	Board	133	120	68.03	71.79	75.05	68.5	73.59	80.06	23.67	27	31.24	-0.06	-0.01	0.03

Table 16. Table of Sales Ratio Statistics

Table of Sales Ratio Statistics for the South Triad (2020)

By Process Step and Property Use Group - Sales are from 01/01/2021 through 12/31/2023

Step	Group	Count Before Trim	Count After Trim	Median LCL	Median	Median UCL	Wtd. Mean LCL	Wtd. Mean	Wtd. Mean UCL	COD LCL	COD	COD UCL	PRB LCL	PRB	PRB UCL
Assessor Notice	Ind/Ware	101	91	90.71	103.31	117.64	83.39	93.66	105.96	33.75	39.79	48.11	-0.11	-0.04	0.03
Assessor Certified	Ind/Ware	101	93	90.46	97.4	113.43	78.54	89.11	101.68	34.53	42.43	49.29	-0.11	-0.03	0.05
Board	Ind/Ware	101	91	59.35	66.73	73.92	54.84	61.19	68.8	33.05	39.49	46.91	-0.11	-0.03	0.04
Assessor Notice	Office	81	75	113.01	126.16	131.11	109.55	125.49	143.19	33.72	39.08	48.99	-0.12	-0.04	0.05
Assessor Certified	Office	81	63	100.52	105.13	114.73	94.36	105.67	117.38	19.68	23.31	27.55	-0.07	-0.02	0.03
Board	Office	81	70	75.68	84.07	92.44	74.14	81.74	90.23	26.09	30.5	37.75	-0.11	-0.04	0.03
Assessor Notice	Other	147	126	91.94	96.15	100.69	80.44	88.18	96.54	27.46	30.61	34.08	-0.1	-0.05	-0.01
Assessor Certified	Other	147	129	87.43	92.77	97.81	71.72	78.89	87.31	29.11	33.17	38.33	-0.12	-0.08	-0.03
Board	Other	147	135	68.86	77.22	85.55	59.49	65.79	73.46	35.11	40.11	47.13	-0.14	-0.08	-0.03
Assessor Notice	Retail	174	159	102.97	110.91	120.39	100.06	132.17	168.93	31.67	35.9	39.7	-0.03	0.02	0.07
Assessor Certified	Retail	174	162	97.65	106.33	112.99	94.02	121.86	152.92	32.81	36.52	41.66	-0.04	0.01	0.06
Board	Retail	174	161	83.78	88.09	91.7	78.62	92.58	107.11	31.65	34.8	39.55	-0.06	-0.01	0.04

Table 17. Table of Sales Ratio Statistics for the South Triad (2020)

Table of Sales Ratio Statistics for the City Triad (2021)

By Process Step and Property Use Group - Sales are from 01/01/2022 through 12/31/2023

Step	Group	Count Before Trim	Count After Trim	Median LCL	Median	Median UCL	Wtd. Mean LCL	Wtd. Mean	Wtd. Mean UCL	COD LCL	COD	COD UCL	PRB LCL	PRB	PRB UCL
Assessor Notice	Ind/Ware	45	45	134.62	182.27	203.22	132.38	159.35	192.93	45.74	53.87	70.63	-0.18	-0.04	0.09
Assessor Certified	Ind/Ware	45	44	116.93	147.39	182.27	120.3	142.77	170.68	45.44	53.44	66.79	-0.18	-0.05	0.09
Board	Ind/Ware	45	38	94.17	111.09	126.23	88.83	103.3	120.76	25.5	32.44	44.36	-0.11	-0.03	0.06
Assessor Notice	Office	86	78	98.43	117.21	134.23	103.31	115.59	129.12	28	34.16	42.9	-0.12	-0.04	0.03
Assessor Certified	Office	86	78	97.75	109.83	120.64	96.74	107.9	120.47	28.73	33.8	41.05	-0.14	-0.07	0.01
Board	Office	86	77	93.6	97.75	103.75	82.4	89.72	97.51	24.48	28.73	33.84	-0.18	-0.11	-0.05
Assessor Notice	Other	80	69	93.74	100.22	111.85	86.82	99.3	113.83	32.47	40.74	49.54	-0.15	-0.05	0.05
Assessor Certified	Other	80	72	86.22	93.47	104.85	76.38	88.17	102.35	35.5	41.98	50.72	-0.18	-0.08	0.02
Board	Other	80	74	79.33	88	96.54	69.65	78.59	89.15	33.73	39.64	47.32	-0.18	-0.09	0
Assessor Notice	Retail	215	201	114.57	122.42	135.72	107.63	115.96	125.33	37.54	42.34	47.76	-0.13	-0.07	-0.02
Assessor Certified	Retail	215	198	106.53	114.11	119.64	96.53	103.36	110.8	36.23	39.58	44.83	-0.16	-0.11	-0.06
Board	Retail	215	199	95.85	103.56	109.41	84.97	90.9	97.26	33.66	37.2	41.28	-0.16	-0.11	-0.06

Table 18. Table of Sales Ratio Statistics for the City Triad (2021)

Table of Sales Ratio Statistics for the North Triad (2022)

By Process Step and Property Use Group - Sales are from 01/01/2023 through 12/31/2023

Step	Group	Count Before Trim	Count After Trim	Median LCL	Median	Median UCL	Wtd. Mean LCL	Wtd. Mean	Wtd. Mean UCL	COD LCL	COD	COD UCL	PRB LCL	PRB
Assessor Notice	Industrial/Warehouse	43	35	76.89	80.6	86.91	80.17	87.92	94.39	14.87	19.05	25.04	-0.02	0.04
Assessor Certified	Industrial/Warehouse	43	38	70.89	75.77	80.74	74.61	83.7	90.92	17.34	21.38	27.34	0.01	0.06
Board	Industrial/Warehouse	43	38	58.97	66.46	71.29	61.59	64.77	69.84	13.95	16.41	20.72	-0.03	0.01
Assessor Notice	Office	36	34	76.69	89.26	114.61	96.32	131.58	159.76	35.21	43.82	58.4	0.03	0.13
Assessor Certified	Office	36	35	77.37	91.44	104.91	93.72	129.64	157.84	33.5	43.15	59.86	0.01	0.11
Board	Office	36	34	71.29	79.94	91.44	71.79	88.62	103.52	20.86	27.34	37.38	-0.05	0.02
Assessor Notice	Other	28	24	80.21	91.75	111.52	89.75	112.16	129.55	29.58	37.54	53.21	-0.02	0.11
Assessor Certified	Other	28	24	71.29	85.48	102.08	82.57	107.25	126.58	27.06	37.56	54.48	0.01	0.14
Board	Other	28	23	66.2	72.75	82.41	68.88	77.22	88.86	22.41	30.87	45.52	-0.09	0.03
Assessor Notice	Retail	26	25	73.63	86.91	113.79	72.49	81.42	94.53	30.61	37.26	49.86	-0.27	-0.14
Assessor Certified	Retail	26	25	71.55	77.74	103.76	70.38	78.02	89.13	26.76	35.52	45.88	-0.26	-0.13
Board	Retail	26	25	65.67	71.98	97.12	64.78	70.99	80.28	25.87	32.46	43.43	-0.26	-0.13

Table 19. Table of Sales Ratio Statistics for the North Triad (2022)

Table of Quintile Median Sales Ratio Statistics By Process Step for the South Triad (2020)				
Sales are from 01/01/2021 through 12/31/2023				
Step	**Quintile Group**	**Median LCL**	**Median**	**Median UCL**
Assessor Notice	1	101.16	111.26	119.34
Assessor Certified	1	100.08	110.32	116.84
Board	1	77.22	86.93	90.2
Assessor Notice	2	90.71	100.42	110.45
Assessor Certified	2	85.71	92.77	100.51
Board	2	71.07	80.02	88.59
Assessor Notice	3	101.58	114.31	124.79
Assessor Certified	3	93.12	101.58	106.83
Board	3	71.92	80.66	88.36
Assessor Notice	4	95.6	111.51	123.74
Assessor Certified	4	91.94	102.75	118.25
Board	4	77.31	84.23	88.26
Assessor Notice	5	89.25	97.79	113.01
Assessor Certified	5	87.73	97.68	107.05
Board	5	64.9	74.01	77.54

Table 20. Table of Quintile Median Sales Ratio Statistics By Process Step for the South Triad (2020)

Table of Quintile Median Sales Ratio Statistics By Process Step for the City Triad (2021)

Sales are from 01/01/2022 through 12/31/2023

Step	Quintile Group	Median LCL	Median	Median UCL
Assessor Notice	1	107.07	119.3	137.95
Assessor Certified	1	106.86	116.07	131.28
Board	1	100.7	109.17	116.07
Assessor Notice	2	115.1	130.76	141.46
Assessor Certified	2	102.34	115.8	133.27
Board	2	96.99	107.68	118.76
Assessor Notice	3	110.07	125.35	135.72
Assessor Certified	3	96.54	113.36	127.32
Board	3	90.01	95.96	103.39
Assessor Notice	4	94.27	115.77	138.29
Assessor Certified	4	93.74	108.77	120.64
Board	4	87.29	95.45	107.18
Assessor Notice	5	102.42	111.98	130.76
Assessor Certified	5	88.8	102.02	114.57
Board	5	79.33	87.61	97.21

Table 21. Table of Quintile Median Sales Ratio Statistics By Process Step for the City Triad (2021)

Table of Quintile Median Sales Ratio Statistics By Process Step for the North Triad (2022)

Sales are from 01/01/2023 through 12/31/2023

Step	Quintile Group	Median LCL	Median	Median UCL
Assessor Notice	1	76.97	91.03	102.52
Assessor Certified	1	70.29	77.74	103.31
Board	1	66.69	74.77	92.21
Assessor Notice	2	65.37	79.8	86.57
Assessor Certified	2	62.72	80.11	88.33
Board	2	58.99	73.9	86.52
Assessor Notice	3	75.54	80.6	92.82
Assessor Certified	3	71.48	75.45	86.01
Board	3	65.66	70.69	74.27
Assessor Notice	4	81.1	98.98	124.39
Assessor Certified	4	74.89	92.61	104.48
Board	4	67.92	71.79	86.39
Assessor Notice	5	75.49	89.89	108.42
Assessor Certified	5	71.83	81.38	99.25
Board	5	62.62	68.16	78.7

Table 22. Table of Quintile Median Sales Ratio Statistics By Process Step for the North Triad (2022)

Comparison in Changes in Sales Ratio Statistics During Assessor Appeals for the South Triad (2020)

By Process Step and Property Use Group - Sales are from 01/01/2021 through 12/31/2023

Appeal Step	Group	Count Before Trim	Count After Trim	Median LCL	Median	Median UCL	Wtd. Mean LCL	Wtd. Mean	Wtd. Mean UCL	COD LCL	COD	COD UCL	PRB LCL	PRB	PRB UCL
Assessor Notice - Appealed	All	290	264	101.16	110.68	116.32	92.81	99.96	107.84	31.6	34.37	37.95	-0.06	-0.03	0.01
Assessor Notice - Not Appealed	All	213	192	97.81	106.22	113.76	95.18	102.36	109.94	36.31	41.17	46.34	-0.09	-0.03	0.02
Assessor Certified - Appealed	All	290	265	93.12	99.53	103.95	82.5	99.9	121.57	30.94	33.35	36.39	-0.05	-0.02	0.01
Assessor Notice - Appealed	Ind/Ware	55	51	91.6	113.43	123.74	75.63	87.72	105.18	30.39	36.41	50.32	-0.17	-0.09	-0.01
Assessor Notice - Not Appealed	Ind/Ware	46	40	79.71	95.26	113.76	86.34	100.86	115.26	32.2	41.96	51.84	-0.09	0.03	0.16
Assessor Certified - Appealed	Ind/Ware	55	51	88.78	104.89	117.33	70.61	82.62	100.2	30.31	36.36	47.61	-0.16	-0.08	0
Assessor Notice - Appealed	Office	47	41	117.83	128.1	136.92	111.88	131.68	153.69	23.63	30.11	38.9	-0.12	-0.02	0.07
Assessor Notice - Not Appealed	Office	34	32	92.44	110.52	127.41	88.44	102.47	120.75	33.2	45.61	66.89	-0.27	-0.1	0.07
Assessor Certified - Appealed	Office	47	37	100.72	105.13	121.17	90.61	106.3	121.62	16.38	19.96	24.63	-0.1	-0.04	0.02
Assessor Notice - Appealed	Other	87	77	88.4	95.6	100.97	78.66	87.68	97.82	26.6	30.67	36.03	-0.1	-0.04	0.01
Assessor Notice - Not Appealed	Other	60	54	94.65	100.46	117.3	84.34	101.11	121.36	31.84	40.59	49.7	-0.1	0.01	0.12
Assessor Certified - Appealed	Other	87	81	75.64	87.6	95.33	61.86	69.72	79.48	30.21	34.72	43.24	-0.16	-0.1	-0.04
Assessor Notice - Appealed	Retail	101	95	101.16	110.91	121.91	95.94	106.14	118.71	30.75	35.42	39.88	-0.08	-0.02	0.04
Assessor Notice - Not Appealed	Retail	73	66	100.09	110.92	122.35	94.26	104.45	116.54	32.78	40.11	48.53	-0.14	-0.04	0.05
Assessor Certified - Appealed	Retail	101	96	94.01	102.76	112.43	91.4	131.19	169.6	29.81	34.78	40.71	-0.01	0.04	0.1

Table 23. Comparison in Changes in Sales Ratio Statistics During Assessor Appeals for the South Triad (2020)

Comparison in Changes in Sales Ratio Statistics During Board Appeals for the South Triad (2020)

By Process Step and Property Use Group - Sales are from 01/01/2021 through 12/31/2023

Appeal Step	Group	Count Before Trim	Count After Trim	Median LCL	Median	Median UCL	Wtd. Mean LCL	Wtd. Mean	Wtd. Mean UCL	COD LCL	COD	COD UCL	PRB LCL	PRB	PRB UCL
Assessor Certified - Appealed	All	407	362	98.18	102.85	109.46	88.74	101.97	118.53	31	33.66	36.24	-0.06	-0.03	0
Assessor Certified - Not Appealed	All	96	89	82.49	95.65	100.08	78.74	91.21	104.54	41.03	46.16	57.05	-0.09	0.03	0.15
Board - Appealed	All	407	373	74.12	79.23	83.77	67.66	74.82	83.15	32.85	35.82	39.1	-0.08	-0.05	-0.02
Assessor Certified - Appealed	Ind/Ware	90	79	93.12	111.32	120.55	80.97	92.65	107.3	29.16	33.44	42.85	-0.12	-0.05	0.01
Assessor Certified - Not Appealed	Ind/Ware	11	10	32.95	53.61	75.57	34.01	54.06	80.01	26.6	40.31	78.59	-0.04	0.2	0.43
Board - Appealed	Ind/Ware	90	83	59.35	68.38	75.92	53.88	60.38	68.17	33.66	39.56	48.47	-0.14	-0.06	0.02
Assessor Certified - Appealed	Office	67	52	100.85	108.08	122.23	93.94	105.72	118.19	18.56	21.92	26.58	-0.11	-0.05	0
Assessor Certified - Not Appealed	Office	14	14	80.76	103.2	174.33	90.25	120.39	155.47	39.01	52.91	83.27	-0.29	0.1	0.48
Board - Appealed	Office	67	59	74.65	83.77	88.95	71.84	79.41	87.82	25.7	30.21	37.95	-0.13	-0.06	0.01
Assessor Certified - Appealed	Other	111	100	87.6	93.71	97.96	67.96	75.44	84.46	27.67	31.81	37.56	-0.13	-0.08	-0.03
Assessor Certified - Not Appealed	Other	36	33	78.97	96.16	117.3	90.17	104.4	121.38	38.84	49.77	71.3	-0.24	0.04	0.33
Board - Appealed	Other	111	103	63.74	73.18	84.2	57.63	64.27	72.12	34.89	39.75	47.96	-0.13	-0.07	-0.01
Assessor Certified - Appealed	Retail	139	131	99.56	109.61	116.67	93.61	124.16	157.05	32.46	35.99	42.28	-0.06	-0.01	0.04
Assessor Certified - Not Appealed	Retail	35	32	75.27	97.03	117.6	75.51	92.97	112.54	28.69	37.25	49.57	-0.08	0.07	0.22
Board - Appealed	Retail	139	128	81.32	85.59	90.09	76.06	91.98	107.82	29.06	32.89	37.18	-0.06	-0.01	0.04

Table 24. Comparison in Changes in Sales Ratio Statistics During Board Appeals for the South Triad (2020)

Comparison in Changes in Sales Ratio Statistics During Assessor Appeals for the City Triad (2021)

By Process Step and Property Use Group - Sales are from 01/01/2022 through 12/31/2023

Appeal Step	Group	Count Before Trim	Count After Trim	Median LCL	Median	Median UCL	Wtd. Mean LCL	Wtd. Mean	Wtd. Mean UCL	COD LCL	COD	COD UCL	PRB LCL	PRB	PRB UCL
Assessor Notice - Appealed	All	190	172	116.02	124.82	134.59	118.17	126.23	135.01	32.72	36.74	42.33	-0.04	0.01	0.06
Assessor Notice - Not Appealed	All	236	225	109.85	116.5	133.27	105.32	116.59	129.03	49.01	55.51	60.63	-0.13	-0.06	0.01
Assessor Certified - Appealed	All	190	175	98.97	106.86	116.07	96.74	103.68	111.14	29.92	33.93	39.12	-0.05	0	0.04
Assessor Notice - Appealed	Ind/Ware	19	19	124.41	182.27	255.32	135.69	165.7	206.34	31.73	48.14	67.67	-0.4	-0.17	0.07
Assessor Notice - Not Appealed	Ind/Ware	26	26	120	177.02	232.46	120.42	155.84	206.14	47.23	59.78	98.64	-0.18	0	0.18
Assessor Certified - Appealed	Ind/Ware	19	19	105.42	144.03	172.87	116.99	138.08	167.24	33.3	41.89	70.2	-0.27	-0.04	0.18
Assessor Notice - Appealed	Office	32	31	100.03	134.59	144.39	111.36	132.05	152.28	23.66	28.99	39.69	-0.1	-0.01	0.09
Assessor Notice - Not Appealed	Office	54	51	96.99	105.74	120.79	88.61	98.92	111.87	35.86	45.14	56.95	-0.38	-0.26	-0.13
Assessor Certified - Appealed	Office	32	29	96.15	120.25	131.08	94.6	115.84	136.87	20.57	25.25	37.58	-0.1	-0.02	0.07
Assessor Notice - Appealed	Other	40	31	95.47	111.85	124.99	105.05	115.32	127.55	21.57	27.93	37.18	-0.11	0	0.1
Assessor Notice - Not Appealed	Other	40	38	88.4	97.75	112.36	71.47	92.99	124.39	45.3	57.04	72.44	-0.29	-0.09	0.11
Assessor Certified - Appealed	Other	40	35	84.76	91.68	105.18	80.04	92.11	105.41	25.86	33.63	43.09	-0.12	-0.01	0.11
Assessor Notice - Appealed	Retail	99	91	110.41	122.42	130.76	107.86	118.35	129.9	28.92	33	38.55	-0.08	-0.01	0.05
Assessor Notice - Not Appealed	Retail	116	110	113.12	122.47	142.06	101.95	113.19	126.78	42.14	50.91	59.44	-0.25	-0.16	-0.07
Assessor Certified - Appealed	Retail	99	92	90.9	103.16	114.68	88.11	96.64	106.07	27.18	31.66	37.27	-0.09	-0.04	0.02

Table 25. Comparison in Changes in Sales Ratio Statistics During Assessor Appeals for the City Triad (2021)

Comparison in Changes in Sales Ratio Statistics During Board Appeals for the City Triad (2021)

By Process Step and Property Use Group - Sales are from 01/01/2022 through 12/31/2023

Appeal Step	Group	Count Before Trim	Count After Trim	Median LCL	Median	Median UCL	Wtd. Mean LCL	Wtd. Mean	Wtd. Mean UCL	COD LCL	COD	COD UCL	PRB LCL	PRB	PRB UCL
Assessor Certified - Appealed	All	289	263	105.18	113.01	119.64	104.52	111.49	118.91	35.86	39.51	44.18	-0.08	-0.03	0.02
Assessor Certified - Not Appealed	All	137	129	102.75	112.36	118.28	86.02	97.62	112.04	45.81	52.39	63.29	-0.21	-0.11	-0.01
Board - Appealed	All	289	258	91.93	96.15	102.02	87.28	92.09	97.12	29.36	32.11	35.07	-0.08	-0.05	-0.01
Assessor Certified - Appealed	Ind/Ware	32	31	116.93	147.57	182.27	134.08	155.18	179.42	35.39	46.7	61.24	-0.21	-0.04	0.13
Assessor Certified - Not Appealed	Ind/Ware	13	13	86.53	134.62	298.77	83.47	115.08	210.17	44.98	75.21	129.38	-0.34	-0.04	0.26
Board - Appealed	Ind/Ware	32	28	94.46	113.07	127.83	90.75	105.19	119.71	22.35	27.97	39.55	-0.15	-0.06	0.03
Assessor Certified - Appealed	Office	58	52	92.19	118.27	124.76	97.06	111.08	126.84	28.89	32.74	44.74	-0.12	-0.04	0.05
Assessor Certified - Not Appealed	Office	28	23	97.24	103.16	132.92	100.74	108.13	118.67	19.39	26.23	35.99	-0.31	-0.17	-0.02
Board - Appealed	Office	58	50	85.66	94.56	103.75	80.44	88.96	97.52	22.79	26.51	30.97	-0.13	-0.06	0.01
Assessor Certified - Appealed	Other	53	47	86.06	93.19	111.75	79.67	93.8	110.64	33	40.84	51.08	-0.16	-0.03	0.09
Assessor Certified - Not Appealed	Other	27	26	68.4	94.74	106.61	53.42	66.39	88.26	36.31	44.78	63.37	-0.43	-0.25	-0.07
Board - Appealed	Other	53	49	72.12	84.76	92.73	70.07	80.54	93.28	30.27	36.55	45.44	-0.12	-0.02	0.08
Assessor Certified - Appealed	Retail	146	133	101.1	112.75	120.17	97.07	104	111.65	32.44	35.99	41.19	-0.17	-0.11	-0.05
Assessor Certified - Not Appealed	Retail	69	67	106.53	116.07	131.28	91.07	105.82	125.25	46.39	56.1	66.82	-0.33	-0.16	0.01
Board - Appealed	Retail	146	131	90.62	100.7	107.72	87.77	93.99	100.53	27.82	31.69	37.32	-0.11	-0.06	-0.01

Table 26. Comparison in Changes in Sales Ratio Statistics During Board Appeals for the City Triad (2021)

Comparison in Changes in Sales Ratio Statistics During Assessor Appeals for the North Triad (2022)

By Process Step and Property Use Group - Sales are from 01/01/2023 through 12/31/2023

Appeal Step	Group	Count Before Trim	Count After Trim	Median LCL	Median	Median UCL	Wtd. Mean LCL	Wtd. Mean	Wtd. Mean UCL	COD LCL	COD	COD UCL	PRB LCL	PRB	PRB UCL
Assessor Notice - Appealed	All	70	60	86.68	92.81	97.26	87.97	95.4	103.98	23.82	27.99	35.14	-0.1	-0.04	0.03
Assessor Notice - Not Appealed	All	63	59	71.29	77.37	86.2	90.28	112.01	132.25	36.85	45.97	61.24	0.06	0.15	0.24
Assessor Certified - Appealed	All	70	64	76.23	83.49	92.87	79.87	86.82	95.07	24.33	30.2	36.95	-0.12	-0.05	0.03
Assessor Notice - Appealed	Ind/Ware	19	15	73.93	80.42	90.29	76.07	83.18	94.13	8.8	12.65	20.28	-0.05	0.03	0.1
Assessor Notice - Not Appealed	Ind/Ware	24	22	71.39	79.43	89.32	82.03	100.23	122.02	22.9	30.71	43.8	0.09	0.18	0.27
Assessor Certified - Appealed	Ind/Ware	19	17	68.08	74.66	83.1	67.12	73.34	81.63	11.71	15.63	23.99	-0.09	-0.01	0.08
Assessor Notice - Appealed	Office	19	18	79.98	95.86	135.68	84.71	104.51	128.53	27.98	37.84	52.83	-0.13	0.01	0.15
Assessor Notice - Not Appealed	Office	17	17	59.63	77.37	111.93	74.73	156.43	185.9	36.32	52.81	79.59	0.09	0.24	0.4
Assessor Certified - Appealed	Office	19	19	79.9	98.98	131.72	82.79	101.24	124.09	28.23	37.03	61.1	-0.17	-0.02	0.13
Assessor Notice - Appealed	Other	14	11	85.16	97.26	123.71	92.37	102.98	113.04	12.8	22.06	41.12	-0.17	-0.02	0.13
Assessor Notice - Not Appealed	Other	14	14	61.46	82.56	145.61	79.61	121.02	143.51	46.85	67.8	111.43	-0.21	0.12	0.44
Assessor Certified - Appealed	Other	14	11	72.46	87.97	112.74	77.28	91.75	106.95	15.04	21.4	32.72	-0.09	0.03	0.15
Assessor Notice - Appealed	Retail	18	16	81.7	98.3	133.6	86.72	96.38	109.03	21.84	27.97	36.38	-0.37	-0.21	-0.05
Assessor Notice - Not Appealed	Retail	8	6	53.61	63.74	75.95	54.58	59.51	64.96	6.73	11.55	29.7	-0.11	-0.06	0
Assessor Certified - Appealed	Retail	18	17	72.91	91.18	114.06	78.33	87.27	97.25	21.31	26.95	39.94	-0.28	-0.12	0.03

Table 27. Comparison in Changes in Sales Ratio Statistics During Assessor Appeals for the North Triad (2022)

Comparison in Changes in Sales Ratio Statistics During Board Appeals for the North Triad (2022)

By Process Step and Property Use Group - Sales are from 01/01/2023 through 12/31/2023

Appeal Step	Group	Count Before Trim	Count After Trim	Median LCL	Median	Median UCL	Wtd. Mean LCL	Wtd. Mean	Wtd. Mean UCL	COD LCL	COD	COD UCL	PRB LCL	PRB	PRB UCL
Assessor Certified - Appealed	All	105	94	80.74	87.28	96.91	90.22	102.28	114.99	29.41	34.9	42.07	-0.02	0.04	0.1
Assessor Certified - Not Appealed	All	28	21	56	59	71.99	58.97	65	70.69	17.07	26.8	39.16	-0.24	-0.08	0.09
Board - Appealed	All	105	93	69.78	72.63	77.91	68.88	74.69	81.99	24.03	27.85	32.4	-0.07	-0.02	0.03
Assessor Certified - Appealed	Ind/Ware	36	30	75.05	80.58	88.37	77.37	86.57	93.98	13.65	17.59	24.22	-0.04	0.02	0.07
Assessor Certified - Not Appealed	Ind/Ware	7	6	47.43	50.09	56.93	49.14	52.96	55.78	4.4	7.19	15.52	0.01	0.08	0.15
Board - Appealed	Ind/Ware	36	31	63.4	69.78	72.63	61.73	65.11	71.27	11.79	14.16	18.98	-0.05	-0.01	0.03
Assessor Certified - Appealed	Office	26	25	81.63	106.04	137.75	100.12	138.67	169.29	31.26	41.36	54.25	-0.04	0.07	0.17
Assessor Certified - Not Appealed	Office	10	9	58.28	60.17	77.82	60.82	66.39	72.22	8.86	16.4	31.04	-0.2	-0.02	0.16
Board - Appealed	Office	26	24	75.19	88.18	100.21	73.06	91.66	108.54	21.15	26.73	37.64	-0.07	0	0.08
Assessor Certified - Appealed	Other	21	18	70.03	87.28	105.24	85.58	113.6	133.5	27.62	38.67	57.54	0.05	0.2	0.35
Assessor Certified - Not Appealed	Other	7	6	53.86	75.19	128.61	61.2	75.04	90.39	14.52	32.58	67.82	-0.48	-0.16	0.16
Board - Appealed	Other	21	17	60.9	72.75	84.43	68.13	77.67	92.42	19.44	29.88	53.5	-0.04	0.1	0.24
Assessor Certified - Appealed	Retail	22	21	72.44	91.18	118.56	72.05	80.61	93.17	26.12	32.7	46.85	-0.33	-0.2	-0.08
Assessor Certified - Not Appealed	Retail	4	4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Board - Appealed	Retail	22	21	66.14	71.98	102.93	65.96	72.72	82.78	24.25	36.42	47.64	-0.35	-0.21	-0.06

Table 28. Comparison in Changes in Sales Ratio Statistics During Board Appeals for the North Triad (2022)

Curriculum Vitae – Josh Myers

Knowledge and Skills

Statistics
General knowledge of advanced statistics, probability, and mathematics. Expertise in the application of advanced valuation modeling and statistical analysis to real-world housing data.

Valuation of Real Property
Knowledge of mass appraisal valuation standards and best practices. Expertise in the following areas of mass appraisal of real property: automated valuation model (AVM) development and implementation, ratio studies and other performance analyses, business process consulting, valuation model oversight and review, and expert witness testimony.

Work Experience

Statistical Consultant and President, Josh Myers Valuation Solutions - 02/2013 to Present
Josh Myers Valuation Solutions offers a wide-array of consulting services for the mass appraisal and real estate valuation field including valuation model building and implementation, ratio study analysis, other forms of statistical analysis, expert witness testimony, valuation practices review, and general business process analysis. Josh has successfully completed over 50 projects and served dozens of clients, including local governments, mass appraisal software vendors, IAAO (International Association of Assessing Officers), IPTI (International Property Tax Institute), and others.

Business Systems Analyst, Thomson Reuters: Tax and Accounting - Government Division - 12/2011 to 01/2013
Responsibilities included the software design of statistical and modeling functionality.

CAMA Modeler Analyst, City of Norfolk, Va. - 10/2008 to 12/2011
Primary responsibilities included the design of regression modeling methodology, strategy, and implementation.

Education

University of Virginia
Master of Science - 2007
Field: Statistics

University of Virginia
Bachelor of Science - 2005
Double Major: Physics and Mathematics

Publications

Journal of Property Tax Assessment and Administration
"Using Geographic Attribute Weighted Regression for CAMA Modeling"
Applied a modified form of Geographically Weighted Regression to three mass appraisal data-sets. The model achieved the best results when compared to other competing models, including models submitted by other experts and academics from a contemporaneous valuation model development competition. Article was co-authored with J Wayne Moore, PH.D.

"A Review of Vertical Equity Measures in Property Assessments"
Compared various vertical inequity detection approaches using a simulated dataset. The various approaches were compared based on the degree of bias discovered in several different vertical inequity scenarios. Article was co-authored with other members of the IAAO Statistical Tools and Measures Task Force: Carmela Quintos, Kristie Foster, Molly Hayes, Luc Hermans, Michael McCord, Vilma Vielma, and Cory Yemen.

Professional Accomplishments

IAAO Outstanding Technical Essay Award (2011) - "Using Geographic Attribute Weighted Regression for CAMA Modeling"

Member of the IAAO / IPTI Editorial Review Board (2011 - present) - Periodically reviews technical valuation-related papers for publication

Member of IAAO Technical Standards Sub-Committee (2016, 2017) - Prepared technical mass appraisal standards, including the current Standard on Automated Valuation Models

Member of IAAO AVM Global Credentialing Task Force (2018, 2019, 2021) – Worked on a global credential for AVM use.

Member of IAAO Standard on Verification and Adjustment of Sales Task Force (2019) – Worked on a revised Standard.

Member of IAAO Ethics Committee (2022) - Tasked with handling ethics cases for the organization.

Member of the IAAO Statistical Tools and Measures Task Force (2022, 2023) - Tasked with researching statistical techniques.

Member of the IAAO Research and Standards Committee (2023, 2024) - Prepared technical mass appraisal standards, including an upcoming revision to the Standard on Ratio Studies.

Conference Presentations

Aumentum User's Group Conference

2009 - "Improving CAMA Modeling With GIS Location Data" (Along with J. Wayne Moore PhD)

2011 - "GAWR Extended Research: Using GIS X-Y Location Coordinates To Improve Market Value Estimates" (Along with J. Wayne Moore PhD)

2011 - "Handling Sales In ProVal - A Window into the City of Norfolk's Sales Archiving Process"

2014 - "Regression Modeling Using Third Party Tools"

2018 – "California Market Models – Challenges and Solutions" (With Aron Villenueva, Chris Gray, and William Pleake)

GIS Valuation Technologies Conference

2010 - "Using Geographical-Attribute Weighted Regression for CAMA Modeling" (Along with J. Wayne Moore PhD)

2011 - "GAWR Extended Research" (Along with J. Wayne Moore PhD)

2012 - "Comparing Vertical Inequity Detection Methods Using Simulated Data"

2013 - "How to Detect Vertical Inequity More Accurately"

2014 - "The COD: A Misunderstood Measure of Equity"

2014 - "Location: The Great Equalizer"

2015 - "What's So Great about R? - The Skinny on the R Statistical Software"

2016 - "Unique Applications of Geographically Weighted Regression"

2017 - "Vertical Equity Decathlon: PRD vs. PRB"

2019 - "Representative Sales Samples in Mass Appraisal: Tests and Remedial Measures"

2022 - "Amazing Dashboards Using R Shiny"

2023 - "The Most Important Statistical Issues in the Vertical Inequity Debate - Explained"

2024 - "Quantifying Bias in Vertical Inequity Detection Methods"

GIS Valuation Technologies Conference Workshop

2016 - "Basics of the R Statistical Software"

2017 - "Basics of the R Statistical Software"

2021 - "Mass Appraisal Valuation Modeling in R or SPSS Workshop" (Along with a group of others)

2022 - "Mass Appraisal Valuation Modeling in R or SPSS Workshop" (Along with a group of others)

IAAO International Conference on Assessment Administration

2010 - "Using Geographical-Attribute Weighted Regression for CAMA Modeling" (Along with J. Wayne Moore PhD)

2012 - "Evaluating Vertical Inequity Detection Methods Using Simulated Data: Problems and Solutions"

2013 - "Testing Geographic Attribute Weighted Regression (GAWR) and New Cost Models in Jefferson County, Kentucky" (Along with J. Wayne Moore PhD and Tony Lindauer)

2014 - "Impact of Heterogeneity and Age on COD"

2015 - "Improving Data Quality Using Statistical Analysis"

2017 - "Vertical Equity Examined and Options Reviewed" (Panel along with Robert Denne, Alan Dornfest, Carmela Quintos PhD, and Mark Sunderman PhD)

2017 - "Standard on Automated Valuation Models (AVM's)" (Panel along with August Dettbarn, Alan Dornfest, and Patrick O'Connor)

2018 – "California Market Value Models – Challenges and Solutions" (Along with Christopher Gray, Aron Villanueva, and William Pleake)

2020 – "AVM Showdown: A Performance Comparison of Today's Most Popular Modeling Techniques" (Along with Paul Bidanset)

2022 - "Eight Mistakes to Avoid When Building Your Model Development Process"

2023 - "How to Implement Regression Modeling in a Small Jurisdiction" (Along with Stephenie Love)

Virginia Association of Assessing Officers Annual Conference

2016 - "Five Things You Probably Don't Know About Ratio Studies"

2022 - "Assessing at Market Value in a Rapidly Increasing Market"

2023 - "How to Implement Regression Modeling in a Small Jurisdiction" (Along with Stephenie Love)

Virginia Association of Assessing Officers Educational Seminar

2013 - "Statistical Observations on Mass Appraisal"

2024 - "Eight Mistakes to Avoid when Designing your Model Development Process"

IPTI Spatial Analysis Symposium

2011 - "R Software for Analysis in Real Estate Assessment"

2011 - "GAWR Research"

North Carolina Department of Revenue Advanced Real Property Seminar

2014 - "Mass Appraisal Modeling Using GIS"

The Digital Future of Assessing - Vision Government Solutions Web Series

2021 - "Ten Modeling Mistakes You Want to Avoid" (Along with Paul Bidanset and Ruel Williamson)

List of Clients

Direct Clients

- Mecklenburg County, NC - Equity Ratio Study (2024); Calibration of Model Factors for 2023 Reassessment; Calibration of Model Factors for 2019 Reassessment; Ratio Study Analysis of 2011 Reassessment; Expert Witness Testimony in 2015
- Johnston County, NC - 2019 Reassessment Ratio Study Analysis
- Forsyth County, NC - Comparable Sales Analysis for 2017 Reassessment; Comparable Sales Analysis for 2021 Reassessment; Comparable Sales Analysis for 2025 Reassessment; Gross Rent Multiplier Analysis; Ratio Study Analysis; Time Adjustment Determination Tool; Cost Model Analysis for 2017 Reassessment; Cost Model Analysis for 2021 Reassessment; Cost Model Analysis for 2025 Reassessment; Twice-Annual Sales Reports (2014-2024); Annual Reports (2019-2024);
- City of Minneapolis, MN - Residential and Commercial Model Building (2016-2019).
- Hennepin County, MN - Apartment Income Model Building in 2018
- Riverside County, CA - Comparable Sales Model Building and Direct Market Model Building for New Software Implementation (2016-2017)
- St. Louis County, MO - Ratio Study and Expert Witness Testimony (2017-2018); Ratio Study and Expert Witness Testimony (2022-2023); Ratio Study and Expert Witness Testimony (2024-2025);
- Bearing Commercial Appraisal - Development of R Shiny Analysis Tool in 2019

- Bureau of Governmental Research - Orleans Parish Ratio Study in 2019
- Kansas City Hispanic Economic Development Corporation - Jackson County Ratio Study and Litigation Support (2019-2020)
- The Law Offices of Lawrence J. Berger P.C. - New York City Ratio Study (2019-2025)
- City of Elgin, IL - Ratio Study in 2021
- City of Portsmouth, Va. - Residential Valuation Model Development (2021-2022)
- City of Poquoson, Va. - Residential Valuation Model Development in 2022
- Amherst County, Va. - Sales Ratio Study of 2020 Reassessment; Review of Valuation Methodology Employed in 2020 Reassessment; Litigation Support in 2022;
- Amelia County, Va. - Independent Assessment Review and Sales Ratio Study (2023)
- Larimer County, Co. - General Valuation Related Advice (2021)
- GAR Appraisal Group - Statistical Modeling Projects (2022 - 2024); Software Design Project (2024); Market Trend Analyses (2023-2024);
- Vision Government Solutions - New Employee Training in Value Approximation and Statistical Analysis in 2022; Valuation Support for New Customer On-Boarding (2023)
- Allegheny County, PA - Litigation Support Services (2022)
- Cumberland County, NC - Model Development Work (2022-2024)
- Cook County President's Office - Support in Property Tax System Audit (2022-2023); Commercial Valuation Practices Review and Sales Ratio Study (2024);
- Knox Law Firm - Ratio Study in 2022 in Forest County, PA; Ratio Study in 2023 in Crawford County, PA; Ratio Study in 2024 in Franklin County, PA;
- City of Falls Church, VA - Residential Valuation Model Development (2022, 2023)
- Fayette County, KY - Equity Analysis of Valuation Models (2023)
- Palm Beach County, FL - Development of Residential Time Trends (2023, 2024); Valuation Model Improvements (2024)
- Tulsa County, OK - Mentorship on Residential Valuation Model Development (2023)
- Guilford County, NC - Statistical Support for the 2027 Reassessment (2024-2026)
- Community Justice Project - Ratio Study for Northumberland County, PA (2024)

<u>As Sub-Contractor for Bob Finnegan</u>
- Commercial Reassessment Assistance for Nassau County, NY in 2018

<u>As Sub-Contractor for the Civic Consulting Alliance</u>
- Cook County, IL - Completion of Third-Party Ratio Study; Supply of Statistical and Mass Appraisal Consulting Services (2017-2019)

<u>As Sub-Contractor for the International Association of Assessing Officers</u>
- Albemarle County, VA - CAMA System Implementation Audit in 2014
- Northern Ireland - Ratio Study in 2015
- Cook County, IL - Audit of Assessment Practices in 2019
- State of Delaware - Litigation Support (2019); Consulting on the Preparation of a Reassessment Timeline and an RFP for Reassessment Services (2020 - 2021);

- Washington DC - Ratio Study and Business Process Audit in 2022
- Valuation Office Agency (UK) - Sales Ratio Study and Model Review (2023-2024)

As Sub-Contractor for the International Property Tax Institute

- Municipal Property Assessment Corporation (Ontario, CA) - Ratio Studies in 2014 and 2017; Creation of Office Quality Control Valuation Manual in 2014
- Property Value Services Corporation (Nova Scotia, CA) - General Statistical Consulting Services in Mass Appraisal in 2016
- NAACP Legal Defense Fund - Ratio Study in Detroit, MI in 2016
- Cape Town, South Africa - Ratio Study Audit (2022-2023)

As Sub-Contractor for Vision Government Solutions

- Valuation Implementation Projects in the Following Jurisdictions from 2015 to 2018
  - Portsmouth, VA
  - Chesapeake, VA
  - Henry County, VA
  - Martinsville, VA
  - Harrisonburg, VA
  - Hanover County, VA
  - Somerset County, PA
  - Wausau County, WI
  - Madison, WI
  - Maricopa County, AZ
  - Sumter County, FL
- Norfolk, Va - Model Development Project (2022-2023)

As Sub-Contractor for Tyler Technologies

- City of Philadelphia, PA - Valuation Implementation Project from (2018-2022); CAMA Modeling Support (2024);
- Wright County, MN - Valuation Implementation of Commercial Cost Models (2021-2022).
- Stark County, OH - Valuation Training (2022); Modeling Project (2023-2024);

As Sub-Contractor for Timmons Group

- Technical Software Design Work (2019-2021).

As Sub-Contractor for BIS Consulting

- Regression Modeling performed for Williamson Central Appraisal District (2020-2024).

David Cornell, MAI, CAE

100 White Pine Lane, Manchester, NH 03102 ♦ david@cornellconsultants.com ♦ 603-203-5517

Outgoing and results-focused *Appraiser, and former Chairman of the Board of Assessors with proven success in collaborating with all levels of management to provide key leadership skills while planning, developing, and growing key initiatives. Over 20 years of experience as an Appraiser at progressive levels of responsibility. High level of integrity and optimism.*

Areas of Expertise

- Organizational Management
- Team Building
- Commercial Properties
- Utility Properties
- High-Impact Decision Making
- Consultative Expert
- Training & Hiring
- New Employee Development
- Executive Leadership
- Property Assessment
- Statistical Analysis
- Equalization Process

Management Experience

- Directed a staff of 28 employees including hiring team members and ensuring goals and objectives were adhered to.
- Led initiatives in educating municipalities regarding the proper methodology and techniques of appraisal and assessment of real property.
- Trained team members, as needed, on processes and procedures.

Professional Experience

CORNELL CONSULTANTS, LLC Manchester, NH **2016-Present**

President

Summary:

- Helping small businesses and government agencies maximize their potential through technology, professional development, and assessing/appraisal valuation services.

NH DEPARTMENT OF REVENUE ADMINISTRATION, Concord, NH **2010-2016**

Assistant Director, Municipal and Property Division

Summary:

- Lead initiatives in educating municipalities regarding the proper methodology and techniques of appraisal and assessment of real property.
- Oversaw all property assessment practices in New Hampshire.
- Performed statistical tests to determine the level of quality and accuracy for revaluations completed for assessing districts.
- Assisted in the statewide equalization process.
- Managed the valuation of commercial and utility properties.

Management Responsibilities:

- Directed a staff of 28 employees including hiring team members and ensuring goals and objectives were adhered to.
- Trained and evaluated the efficiency and productivity of team members by establishing performance standards and objectives.
- Provided training and development of team members monitoring goals and providing feedback.

CITY OF MANCHESTER, Manchester, NH **2006-2010**

Chairman of the Board of Assessors

Summary:

- Oversaw approximately 32,000 properties in the City of Manchester, equaling $10 billion in market valuation
- Performed statistical analysis of assessments to determine uniformity and equity.

Key Responsibilities:
- Voted on all tax abatement cases.
- Advised the Mayor and the Board of Aldermen on real estate valuation and acquisition issues.
- Awarded "Key to the City" in 2009 by Mayor Frank Guinta for working "honorably and with great distinction."
- Handled public relations including numerous newspaper, radio, and TV interviews.
- Developed a successful internship program.

CITY OF MANCHESTER, Manchester, NH **2003-2006**

Commercial Appraiser

Summary:
- Identified, listed, and appraised commercial property for tax purposes.
- Measured, listed and valued new construction projects.
- Prepared appraisals for tax appeal cases, appearing as an expert witness before the Board of Tax and Land Appeals and Superior Court (residential, commercial, and industrial properties).

Key Responsibilities:
- Developed a process that automated sections of appraisal reports.
- Developed valuation analytic tools using geospatial analysis

NH DEPARTMENT OF REVENUE ADMINISTRATION, Concord, NH **1999-2003**

Real Estate Appraiser/Assistant Utility Appraiser

Summary:
- Planned, organized, and administered the appraisal and taxation of public utility property in the state.
- Researched and analyzed utility industry trends, data and technical reports to determine the value of utility properties (gas, hydro, nuclear, steam, transmission, and water).
- Adjusted utility property appraisal valuation models based on market data.
- Appraised industrial, commercial, and residential property to determine equitable tax assessments.
- Explained the real estate appraisal process to property owners at public hearings.

Key Responsibilities:
- Testified as an expert witness before Superior Court in valuation disputes.

Education & Training

Master of Business Administration, Plymouth State University, Plymouth, NH

Graduate Certificate, Investment & Finance, Plymouth State University, Plymouth, NH

Bachelor of Science, Business Administration, Liberty University, Lynchburg, VA

Microsoft Certification, Microsoft Certified Trainer

Licenses & Affiliations

Appraisal Institute Designated Member - MAI Designation
Appraisal Institute New Hampshire-Vermont Chapter - President (2017 - 2018)
Appraisal Institute New Hampshire-Vermont Chapter - Board of Directors (2014 - present)
International Association of Assessing Officers - Certified Assessment Evaluator (CAE)
International Association of Assessing Officers – Research and Standards Committee (2017- 2018)
International Association of Assessing Officers – Chair (2018) Research and Standards Committee
International Association of Assessing Officers - Senior National Instructor
Maine Board of Real Estate Appraisers- Certified General Appraiser (CG-3764)
Microsoft – Microsoft Certified Trainer (MCT) and Certified Excel Expert
New Hampshire Association of Assessing Officials - Certified New Hampshire Assessor
New Hampshire Office of Professional Licensure (OPLC) - Certified Property Assessor Supervisor
New Hampshire Real Estate Appraiser Board- Certified General Appraiser (NHCG-863)
The Appraisal Foundation- AQB Certified USPAP Instructor

Editorial Review Board

Journal of Property Tax Assessment & Administration- Editorial Review Board (2018 - 2024)
The Journal of Property Tax Assessment & Administration is a joint publication of the International Association of Assessing Officers and the International Property Tax Institute and provides an international forum for the dissemination of theoretical and practice-based research in the fields of property tax assessment and administration.

Publications

Cornell, David. "*Journey to Assessment Excellence: Using the Assessor's Maturity Curve as a Guide*." Fair and Equitable, January 2017, pages 3-10.

Cornell, D., S. Hamilton, L. Kennedy, D. Salzer, and P. Santoso. "*New Hampshire Develops Mosaic System to Achieve Equalization in Property Taxes*." Fair and Equitable, August 2014, pages 3-10.

Seminars and Presentations (Partial Listing)

Top 10 Tips for Creating Dynamic Assessing Power BI Dashboards. International Association of Assessing Officers Annual Conference, August 28, 2024.

Introduction to Power BI. Northeastern Regional Association of Assessing Officers and the Association of Municipal Assessors of New Jersey Joint Conference, May 22, 2024.

Excel for Assessors and Appraisers. Northeastern Regional Association of Assessing Officers and the Association of Municipal Assessors of New Jersey Joint Conference, May 21, 2024.

Employee Engagement in Public Sector Organizations (1st presentation*); Supercharge Your Assessing Analytics with Power BI (2nd presentation);* Florida Department of Revenue, Property Tax Oversight (PTO) Program; 2024 Continuing Education Workshop for Property Appraisers and Tax Collectors, January 31, 2024

Conflict Resolution. New Hampshire Municipal Association's Annual Conference, November 15, 2023.

Supercharge Your Power BI Reports by Using DAX (Data Analysis Expressions). International Association of Assessing Officers Annual Conference, August 29, 2023

The Ultimate Guide to Reviewing Single Property and Mass Appraisals. Massachusetts Association of Assessing Officers 2023 Summer Conference, June 23, 2023.

The Future of Analytics- Power BI. Virginia Association of Assessing Officers (VAAO); 2023 VAAO Education Seminar, June 21, 2023.

Journey to Assessment Excellence: Using the Assessor's Maturity Curve as a Guide. Florida Department of Revenue, Property Tax Oversight (PTO) Program; 2023 Continuing Education Workshop for Property Appraisers and Tax Collectors, February 1, 2023

Supercharge Your Assessing Analytics with Power BI. International Association of Assessing Officers Annual Conference, August 30, 2022

How Lake County FL is Using Power BI to Gain Deep Insights Into Their Data. International Association of Assessing Officers Annual Conference, August 29, 2022

Building a Power BI Dashboard in 60 Minutes. International Association of Assessing Officers Annual Conference, August 31, 2021.

The Ultimate Guide to Reviewing Single Property and Mass Appraisals. Massachusetts Association of Assessing Officers 2021 Summer Conference, June 24, 2021.

Power BI 101 - An Awesome Tool in Understanding Your Assessing Data. Northeastern Regional Association of Assessing Offices Annual Conference, May 26, 2021.

Journey to Assessment Excellence: Using the Assessor's Maturity Curve as a Guide. Northeastern Regional Association of Assessing Offices Annual Conference, May 25, 2021.

Power BI 101 - An Introduction to Power BI. International Association of Assessing Officers Annual Conference, August 31, 2020.

A Guide to Reviewing Single Property and Mass Appraisals, New Hampshire Association of Assessing Officials, January 14, 2020.

What is Power BI? Learn How it Can Radically Change How We Analyze and Visualize Data. New Hampshire Municipal Association's Annual Conference, November 13, 2019.

Creating Assessing Dashboards in Excel. International Association of Assessing Officers Annual Conference, September 11, 2019.

Journey to Assessment Excellence: Using the Assessor's Maturity Curve as a Guide. New Hampshire Municipal Association's Annual Conference, November 15, 2018.

Using Data Visualization Software in Excel. International Association of Assessing Officers Annual Conference, September 26, 2018.

Journey to Assessment Excellence: Using the Assessor's Maturity Curve as a Guide. Massachusetts Association of Assessing Officers 2018 Summer Conference, June 22, 2018.

Excel and Power BI Analytics for Assessors. Northeastern Regional Association of Assessing Officers Annual Conference, May 2, 2018.

PowerPoint for Assessors. Northeastern Regional Association of Assessing Officers 2018 Annual Conference, May 1, 2018.

Excel Can Do That? From 3D Mapping to Using Solver. New Hampshire Municipal Association's Annual Conference, November 16, 2017.

Determining Market Derived Rates…the $64,000 Question. Massachusetts Association of Assessing Officers 2017 Summer Conference, June 23, 2017.

Unleashing the Power of Excel in the Appraisal Process. NH Appraisal Institute Chapter Meeting, January 17, 2017.

Excel Can Do That? Using Pivot Tables and Dashboards. New Hampshire Municipal Association's Annual Conference, November 17, 2016.

Excel Can Do That?! From PivotTables to Dashboards. International Association of Assessing Officers Annual Conference, August 31, 2016.

Appraisal of Retail and Restaurant Properties. Massachusetts Association of Assessing Officers 2016 Summer School, August 1, 2016.

Excel Can Do That?! From PivotTables to Dashboards. Massachusetts Association of Assessing Officers, October 28, 2015.

International Association of Assessing Officers Classes

As a **Senior National Instructor** for the International Association of Assessing Officers:

I teach the following one-week courses:

Course 101 - Fundamentals of Real Property Appraisal
Course 102 - Income Approach to Valuation
Course 112 - Income Approach to Valuation II
Course 300 - Fundamentals of Mass Appraisal
Course 311 - Residential Modeling Concepts
Course 331 - Mass Appraisal Practices and Procedures
Course 332 - Modeling Concepts
Course 333 - Residential Modeling Applications
Course 400 - Assessment Administration

I teach the following workshops (1 to 2 ½ days):

Workshop 100 - Understanding Real Property Appraisal
Workshop 151 - Uniform Standards of Professional Appraisal Practice (National)
Workshop 150 - Mathematics for Assessors
Workshop 155 - Depreciation Analysis
Workshop 171 - IAAO Standards of Professional Practice & Ethics
Workshop 181 - 7-Hour National USPAP Update for Mass Appraisal
Workshop 191 - 7-Hour National USPAP Update
Workshop 354 - Multiple Regression Analysis for Real Property Valuation
Workshop 452 - Fundamentals of Assessment Ratio Studies
Workshop 850 - CAE Case Study Review Workshop
Workshop 851 - RES Case Study Review Workshop
Workshop 852 - AAS Case Study Review Workshop

I teach the following one-day forums:

Forum 909 - The Appraisal of Commercial Properties in a Declining Market

Forum 914 - The Development and Use of the Compound Interest Tables and Apps, Using the HP-12C
Forum 917 - How to Critique an Appraisal
Forum 929 - Preparation of Data for Analysis for Modeling
Forum 931 - Reading and Understanding Leases
Forum 932 - Restructuring Income/Expense Statements

Recognition and Awards

Instructor of Excellence Award (formerly Instructor of the Year Award). Award in 2020**.** Established in 2005 by the International Association of Assessing Officers, the annual award is *"presented to an IAAO instructor who has gone beyond basic textbook instruction and motivated students to learn professional skills that will positively influence their careers. The instructor will have made significant contributions toward promoting the IAAO educational program and demonstrated involvement with IAAO at the state, regional and national levels."*

The Sherry Vermilya Award. Award in 2020. Established in 1992 by the Northeastern Regional Association of Assessing Officers, the annual award is given "*for outstanding service to the assessment profession and in honor and memory of Sherry Vermilya's support of NRAAO principles and his untiring efforts to assist assessors throughout the entire country and in particular the northeast."*

Lawton B. Chandler Award. Award in 2018. Established in 1971 by the New Hampshire Association of Assessing Officials, the annual award "*is presented to an individual who shows outstanding service by contributing through involvement, and encouraging others to follow in Lawton B. Chandler's footsteps*."

Rick Rape, MAI, CAE, CFE
State Certified General Real Estate Appraiser RZ0000572
16306 McGlamery Rd.
Odessa, FL 33556
813 230 0032, cell

Appraiser & Consultant
Commercial & Residential

SUMMARY OF EXPERIENCE AND SKILLS

- 34 years as a private sector fee appraiser specializing in commercial valuations.
- 24 years serving as a special magistrate in various Florida counties, hearing petitions to value adjustment boards and providing recommendations with a view toward factual findings, application of applicable law, administrative code and relevant case law.
- Eight years as senior valuation analyst and ultimately Director of Valuation for the Hillsborough County Property Appraiser's Office (HCPA), Tampa, Florida.

In my capacity as Director of Valuation for the HCPA, I study existing processes and often make fundamental changes to existing processes and/or introduce new methodologies that lead to substantially greater efficiencies. Examples as follows.

- Pivoted the residential and commercial permit process to a desktop paradigm rather than a field inspection-centric process.
- Building permit process now completed several months earlier in the valuation year.
- Developed Power Query-driven analytical tools to allow the real property valuation analysts to apply mass appraisal methodologies, rather than performing "mass appraisal, one parcel at a time".
- Introduced a new Power Query analytical platform to allow mass appraisal methods in the valuation of tangible personal property
- Senior HCPA leadership is now provided Power BI-based reports, showing key metrics of the valuation processes and team members responsibilities.

Much of the improvements in processes stemmed from the realization that the existing CAMA system is focused on keying data into the database and is not a significant analytical platform.

EDUCATION:	**YEAR**
University of Florida, Gainesville, Florida	
B.S.B.A. in Real Estate and Urban Analysis and in Economics	1982
Lake Brantley High School, Altamonte Springs, Florida	1978

REAL ESTATE EDUCATION:

Courses required by American Institute of Real Estate Appraisers/Appraisal Institute for the MAI designation.

Valuation Analysis and Report Writing, Course 2-2	1987
Standards of Professional Practice, Course 2-3, By Exam	1986
Case Studies in Real Estate Valuation, Course 2-1, By Exam	1986
Capitalization Theory and Techniques Part B, Course 1B-B, By Exam	1986
Capitalization Theory and Techniques Part A, Course 1B-A, By Exam	1985
Basic Valuation Procedures, Course 1-A2, By Exam	1985
Principles of Real Estate Appraisal, Course 1-A1, By Exam	1984

Sample of contemporary courses required by the Appraisal Institute for the MAI designation and State Certified General Real Estate Appraiser continuing education:

7-Hour National USPAP
Florida State Law for Real Estate Appraisers

Sample of courses required by the International Association of Assessing Officers for the CAE designation.

IAAO Course 400 Assessment Administration
IAAO Course 311 Real Property Modeling Concepts
Other IAAO courses given credit by virtue of Appraisal Institute MAI designation.

Courses sponsored by other entities:
ME201OL: Introduction to Machinery & Equipment Valuation, American Society of Appraisers.

DESIGNATIONS & EXPERT WITNESS:

MAI - Member, Appraisal Institute Certificate No. 7818
CAE - Certified Assessment Evaluator, IAAO
CFE - Certified Florida Evaluator, Florida Department of Revenue
State Certified General Real Estate Appraiser RZ0000572
Florida Real Estate Broker's License
Qualified Expert Witness in County, Circuit, and Federal Courts

MEMBERSHIPS AND AFFILIATIONS:

Greater Tampa Realtors
Florida Realtors
United States Chess Federation

VALUE ADJUSTMENT BOARDS

Hillsborough County Special Magistrate 1991-2015

Pasco County Special Magistrate	1993-2015
Hernando County Special Magistrate	1996 - 2001, 2003-2015
Pinellas County Special Magistrate	2004-2006+
Polk County Special Magistrate	
Manatee County Special Magistrate	
Sarasota County Special Magistrate	
Sumter County Special Magistrate	
Santa Rosa County Special Magistrate	

EMPLOYMENT HISTORY:

March 2016 to present - Senior Valuation Analyst when hired, now Director of Valuation
Hillsborough County Property Appraiser's Office, Tampa, Florida.

October 1988 to March 2016 - Managing Director/President
Tropical Realty Appraisal Services, Inc. (New Port Richey, Florida and Tampa, Florida)

August 1986 to September 1988 - Associate Appraiser R/E
Marketing Consultants, Inc. (Tampa, Florida)

January 1983 to July 1986 - Senior Appraiser
Pardue, Heid, Church, Smith & Waller, Inc. (Orlando, Florida)