A Two-Dimensional Approach to Evaluating Commercial Real Estate Markets

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About NAIOP

NAIOP, the Commercial Real Estate Development Association, is the leading organization for developers, owners and related professionals in office, industrial, retail and mixed-use real estate. NAIOP comprises some 20,000 members in North America. NAIOP advances responsible commercial real estate development and advocates for effective public policy. For more information, visit naiop.org.

The NAIOP Research Foundation was established in 2000 as a 501(c)(3) organization to support the work of individuals and organizations engaged in real estate development, investment and operations. The Foundation's core purpose is to provide information about how real properties, especially office, industrial and mixed-use properties, impact and benefit communities throughout North America. The initial funding for the Research Foundation was underwritten by NAIOP and its Founding Governors with an endowment established to support future research. For more information, visit naiop.org/foundation.

About the Authors

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Executive Summary

In 2020, the NAIOP Research Foundation published "A New Look at Market Tier and Ranking Systems," which evaluated current methodologies for commercial real estate market ranking and tiering and concluded that they are limited by their one-dimensionality. Although researchers often use a wide range of variables and data to construct their rankings, the process of distilling these into a single score results in rankings that do not tell end-users much about markets beyond their rank. In addition, how a researcher prioritizes a range of market characteristics substantially affects how markets perform in a ranking, making it less valuable to end-users with different priorities.

The NAIOP Research Foundation commissioned this follow-up report to develop an alternative approach to evaluating office and industrial real estate markets for investment or development by applying a two-dimensional analysis to the largest metropolitan markets in the United States. This analysis sorts markets into two-dimensional grids that are similar to Morningstar's "Style Box," a tool developed by the investment research firm to evaluate and compare the characteristics of stocks, bonds and mutual funds. A two-dimensional grid analysis simultaneously evaluates multiple market characteristics such as size and risk, avoiding some of the limitations of one-dimensional tier and ranking methodologies. Large, less-risky markets can be classified differently than large but volatile markets. Similarly, smaller but less-risky markets can be clearly identified as such without becoming mired in a debate about whether they should be labeled as primary or secondary.

To test this new methodology, the authors developed several variations of a two-dimensional grid that compared different market characteristics such as size, volatility in transaction prices and volatility in transaction volumes. They then used real estate market data to sort industrial and office markets according to these grids and compared the results of different grids to each other. A select advisory group of approximately 20 commercial real estate market practitioners provided feedback on the potential usefulness, risks and efficacy of the two-dimensional grid analysis. Group members also provided input on market characteristics that the grids should measure and how best to measure them.

This report reveals several advantages of using a two-dimensional analysis over traditional ranking methods, and it challenges some commonly held assumptions about the relationship between the size of markets and their risk. Findings from the research include:

- **A two-dimensional grid analysis improves on market ranking methodologies** by allowing users to simultaneously analyze and compare markets across multiple characteristics such as size, price risk (the risk of a decline in asset value) and liquidity risk (the risk of being unable to locate a buyer).
- **Market size and average transaction prices do not reliably predict price or liquidity risk.** Several comparisons of market size and price to measurements of volatility reveal similar levels of price and liquidity risk for large, medium and small markets. Larger and higher-priced markets are not necessarily less volatile than smaller or lower-priced markets.
- **A grid analysis can differentiate between high-volatility and low-volatility markets, whether they are large, mid-sized or small.** This information can help both risk-averse and opportunistic investors prioritize markets they would not otherwise consider and better align their investments with their risk tolerance and objectives.
- **Like market rankings, a grid analysis is best used as a starting point for additional research.** Although two-dimensional analysis provides more information about markets than ranking methodologies, it does not provide a complete picture of a market's risk/reward characteristics or its prospects.

Introduction

Analytical reports that group, rate and categorize metropolitan real estate markets are useful to a wide spectrum of commercial real estate brokers, researchers and investors. These reports are created for all uses and asset classes, ranging from simplified rankings for the public to technical analyses for practitioners and investors. In March 2020, the NAIOP Research Foundation published a report authored by Maria Sicola, Charles Warren and Megan Weiner titled "A New Look at Market Tier and Ranking Systems." It provided an understanding of the origins, popularity, methods and applications of defining tiers to rank and compare commercial real estate markets in the United States. The authors reviewed how popular ranking and tiering reports define each of their groupings, checked if current data supported these groupings, and solicited input from commercial real estate industry practitioners on the usefulness and shortcomings of those reports.

The authors concluded that although the current practice of assigning major metropolitan regional markets to such tiers has some benefits, varying approaches tailored to varying audiences has generated a wide range of results, sometimes creating inconsistency and confusion. There is no agreed-upon standard for what the tiers are named or how they are ranked. Tiers may have different labels from report to report, such as Tier 1, 2 and 3; primary, secondary and tertiary markets; 24-hour, 18-hour and 8-hour cities; and so on.

Yet all these reports do have one thing in common: they rank markets in a one-dimensional framework, boiling down many different market characteristics (size, price, volatility, liquidity, risk and resilience) into an ordinal ranking of primary, secondary and tertiary. The resulting tiers provide only limited information about the characteristics of different markets.

Based on these conclusions, the report suggested that a two-dimensional approach may be better suited to evaluating and comparing commercial real estate markets. A new two-dimensional framework could become a widely recognized tool for organizing and communicating analytical results. The NAIOP Research Foundation re-engaged Sicola, Warren and Weiner to conceive an alternative approach for evaluating markets for investment or development.

Two-dimensional analysis has long been a popular way to evaluate stocks and bonds. The investment research firm Morningstar created its Style Box as a tool to evaluate stocks, bonds and the investment funds that hold them. Morningstar's Style Box for stocks compares a company's size (market capitalization, from small to large) to metrics related to its market valuation and growth, resulting in nine squares (see Figure 1 on page 3). The location of a stock within this nine-square grid gives potential investors a great deal of information about whether it fits into their specific investment strategy.

Figure 1: Example of the Morningstar Style Box for Stocks

	Value	Core	Growth
Large			
Medium			
Small			

This report examines whether a similarly efficient presentation of information can be developed to evaluate commercial real estate markets. The report also tests possible definitions, criteria and breakpoints for organizing markets into groups based on two dimensions. The first dimension (Y-axis) focuses on evaluating measures of market size, recognition and/or resilience. The second dimension (X-axis) focuses on measures of price risk and liquidity risk. The authors applied several different two-dimensional grids to the 50 largest metropolitan areas (MSAs) in the United States by population, comparing the results obtained when defining each analytical axis in slightly different ways.

The report demonstrates the feasibility of the two-dimensional analysis with some proof-of-concept examples. It does not maintain that the variables presented here are necessarily the best ones to evaluate commercial real estate markets across two dimensions.

The authors asked a group of industry professionals to voluntarily provide assessments of the pros and cons of two-dimensional analysis. Before conducting the analysis, group members were asked for their input on how to define what each axis would measure, the specific variables to consider, the numerical breakpoints appropriate for each row or column, and the clearest terms to label the axes and cells in each grid.

The report uses recent market data from three providers (CoStar, Moody's Analytics and Real Capital Analytics [RCA]) to assemble three sample two-dimensional analyses (each deployed on industrial and office product categories, for a total of six) to demonstrate how such analysis might work and be presented. Finally, a seventh analysis of office market data utilizes an index of variables to examine size, price risk and liquidity risk simultaneously, providing the highest-potential example of a two-dimensional analysis. While this analysis is not exhaustive, it does challenge some long-held conventional wisdom about the relationship between size and risk.

Methodology

The authors began by surveying brokers, researchers, academics, analysts, consultants and investors, including some participants who advised them on the previous report. After completion of the surveys, a smaller group volunteered to continue to lend their expertise in an advisory capacity.

The authors then developed a two-dimensional grid analysis in a process that was broken into three phases. First, advisory group members provided suggestions and input on different variables and dimensions to include in the grid. Second, the authors used the group's comments to develop several working models of a two-dimensional grid and apply these to commercial real estate market data. They then shared early versions of the grids with NAIOP's research director, receiving further notes to check and adjust variable selections. Third, the advisory group provided feedback on the revised grids.

In the first phase, advisory group members made several recommendations regarding the development of two-dimensional grids, including:

- Consider different variables to measure market size, such as number of trades as a percent of inventory.
- Transform the raw data into log scaling to smooth out the extremes in pricing between very large markets and very small markets.
- Assign weights to the various data variables.

Working together with NAIOP's research director and building on the recommendations of the advisory group, the authors identified and selected variables (or combinations of variables) from an initial list of more than 150 possibilities. The authors selected variables based on how well they captured key market characteristics (such as size, price risk or liquidity risk) and whether they could be effectively measured using available data. Not all the advisory group's feedback yielded usable results. For example, logarithmic scaling was not an effective way to adjust the raw data for differences in scale between larger and smaller markets. Leasing variables, including vacancy rates and asking rental rates, were tested but did not produce meaningful results. In consultation with the advisory group, the authors chose to focus on measures of size, price, price risk and liquidity risk.

After choosing the variables and dimensions to include in a two-dimensional grid analysis, the authors performed sample analyses using several combinations of inputs, including market data from 2005 to the second quarter of 2020 (noting that 2020 was an atypical year). Data used in sample analyses came from several sources, including publicly available data from the US Census Bureau and other government sources, and real estate market data provided by CoStar, Moody's and RCA. The availability of data on appreciation, asset value and returns was inconsistent across sources. Results varied slightly among the

various sources due to differing geographical boundaries. Smaller markets were not included in the preliminary analysis because less data are available for these markets, though this does not change their appeal to local developers.

Each of the analyses tested one identified variable for the X-axis and one for the Y-axis and were applied to data for office and industrial properties, totaling six different two-dimensional grids. Once the initial analyses were completed, advisory group members were asked to review the results and discuss them over video conference calls. Respondent feedback was assembled to gauge whether the resulting grouping of markets made sense, to highlight any unexpected or surprising results that made group members rethink a market, to question the efficacy of the model and/or to make suggested improvements.

With this guidance from the advisory group, the authors finalized the two-dimensional model, sorting markets into nine boxes on a 3x3 grid, based on their scores on two axes. A seventh analysis using an index approach is presented at the end of the Analysis section, synthesizing the lessons learned from the six preliminary analyses and feedback from the advisory group and NAIOP's research director.

Development of the Two-Dimensional Grid

The authors considered many combinations of variables for the X and Y axes. They decided that the Y-axis should describe either size or transaction prices, and that the X-axis should describe either price risk or liquidity risk. The authors evaluated various measures of size and price, including quarterly transaction volume, average price per square foot or total inventory. They also evaluated multiple measures of liquidity risk and price risk, including volatility in the number or value of transactions, volatility in capitalization (cap) rates and volatility in average transaction prices per square foot.

Measuring a market's size along a grid's Y-axis and categorizing these markets as large, medium or small maps neatly over traditional tier and ranking methodologies. Traditional rankings tend to favor larger markets in part because they are perceived to be more liquid. Larger markets generally have more transactions than smaller markets. The authors chose to use average quarterly volume of sales transactions (total dollars, averaged across available data from 2005 to 2020) to measure market size.

As an alternative to market size, advisory group members recommended that grids evaluate markets based on transaction prices, which serve as a proxy for characteristics such as reputation and demand. Simply knowing about pricing is a valuable insight, and many one-dimensional tier systems report on price. To account for differences in scale between larger and smaller markets, the authors evaluated market pricing by measuring average transaction prices on a per-square-foot basis.

Risk is more difficult to model than factors related to size or price, as evidenced by the notable lack of one-dimensional tier or ranking systems that measure some form of risk.

The decision to evaluate market size and pricing along a grid's Y-axis was easier than settling on which variables to measure along a grid's X-axis. Size and price are both major components of traditional market ranking methodologies, and they are analogous to the categories that Morningstar uses for its Style Box for stocks and mutual funds (large-cap, mid-cap and small-cap). By contrast, the addition of a second dimension of analysis is new to evaluations of commercial real estate markets, and Morningstar's categories based on a company's valuation and growth characteristics are not easily translated to commercial real estate markets.

The authors and advisory committee discussed a range of possible variables to measure along the X-axis such as population change, employment growth, new construction, expanding inventory or rising average asset values. However, feedback from group members revealed that it would be most useful for the X-axis to measure risk.

Risk is more difficult to model than factors related to size or price, as evidenced by the notable lack of one-dimensional tier or ranking systems that measure some form of risk. The advisory group recommended a focus on two kinds of risk: price risk and liquidity risk. Price risk is the uncertainty that properties may lose value, whether because the regional economy starts to shrink and overall demand declines, the neighborhood becomes unfashionable, or prices have risen in a bubble and may come crashing back to earth. Liquidity risk is easy to conceptualize but harder to define. Investors worry that they may be caught with an unprofitable asset in a market with no buyers. If vacancies increase and push an asset into unprofitability, being unable to find a buyer means that losses mount each month instead of taking a one-time loss of selling for less than the purchase price.

One observation of particular interest that survey respondents and subsequent advisory group members made in the first and third phases of research was that exit risk (which may include price risk and liquidity risk) is a primary concern in making investment decisions. Ideally, the X-axis would represent a continuum of risk, from markets that have held up through multiple recessions toward markets that are more cyclical, with the potential for strong growth but also major contractions.

Some group members predicted that the methodology may be more applicable to office markets than industrial markets. The industrial sector is undergoing rapid transition as e-commerce and physical store retail distribution networks (themselves in a period of major transformation) generate unprecedented demand for warehouse space. This transformation predates the COVID-19 pandemic but was strongly accelerated during it. Historical data about market volatility may be less predictive of future risk or could otherwise be misleading given these rapid changes.

The authors selected three measurements to evaluate price risk and liquidity risk along the X-axis of different grids. Grids use beta in quarterly average market capitalization rates and variance in quarterly average sale price per square foot to measure price risk. To measure liquidity risk, grids use the relative standard deviation in quarterly sales volume.

Variance, beta and relative standard deviation are three statistical methods to measure volatility, or the range and rapidity of change over time. Variance measures the spread of data from the mean and is a common measurement for volatility. The authors chose to measure transaction prices per square foot using variance because prices per square foot already control for differences in scale. Capitalization rate is also a relative measure that controls for differences in scale. The authors chose to use beta, which compares variation within one dataset to variation in a broader dataset, to measure the extent to which individual markets respond to nationwide volatility in cap rates.

In contrast to variables that control for scale, differences between markets are much more pronounced in quarterly sales volumes. For example, the volume of office property transactions in New York City is several orders of magnitude greater than in Salt Lake City or Las Vegas. For this reason, the authors used relative standard deviation, which controls for differences in scale, to measure volatility in quarterly sales volume.[1]

Analysis

The authors created a proof-of-concept set of examples for how two-dimensional analysis can work in the real world. Each of these examples have pros and cons, but they collectively present a strong case for using a two-dimensional grid analysis over one-dimensional ranking and tiering methods.

This report uses three pairings of Y-axis and X-axis variables (one from each data provider) to create two-dimensional grids for industrial and office properties. Each uses data for 62 quarters from the first quarter of 2005 to the second quarter of 2020. The Y-axis dimension in each grid measures either size or price. The two measurements used in the Y-axis are: (1) average quarterly sales volume as a measurement of market size; and (2) average transaction price per square foot (PSF) as a measurement of price. The X-axis measures either price risk or liquidity risk. The three measurements of risk used in the X-axis are: (1) beta in quarterly average market capitalization rate (referred to in the figures as beta in market cap rate); (2) variance of quarterly average price PSF as a measurement of price risk; and (3) relative standard deviation in quarterly sales volume as a measurement of liquidity risk.

The report also includes an additional analysis that compares average quarterly sales volume (Y-axis) with a hybrid score that combines each market's relative standard deviation in quarterly sales volume and its variance in market cap rates (X-axis). This allows for a simultaneous examination of size in conjunction with price risk and liquidity risk.

[1] Relative standard deviation divides the standard deviation for a given dataset by its mean value, allowing for comparisons of differently sized markets. For example, a standard deviation of billions of dollars in New York City, compared to a standard deviation of millions in Norfolk, Virginia, would suggest that New York is more volatile. However, when normalized by New York's very high average sales volume each quarter, it becomes apparent that some of the smaller markets are much more volatile than New York relative to their size.

Markets are listed in each figure as they appear in the source data and market names vary slightly between data providers. Since this report only examines commercial real estate markets that align with the 50 largest metropolitan areas within the United States, it should be noted that two-dimensional analyses that include smaller markets could reveal that they perform differently than the smallest markets evaluated here. However, the following analysis is sufficient to demonstrate that size is not always a reliable predictor of a market's price or liquidity risk.

Figure 2 is a two-dimensional grid comparing average quarterly sales volume to beta in market cap rates for each market. It reveals that larger industrial markets are not necessarily better insulated than smaller markets against the broader business cycle.

Figure 2: Industrial Markets, Average Quarterly Sales Volume, Beta in Market Cap Rate, Q1/2005 to Q2/2020

	Low Volatility	Medium Volatility	High Volatility
Large	Philadelphia, PA Phoenix, AZ	Atlanta, GA Boston, MA Chicago, IL Dallas-Ft. Worth, TX Inland Empire, CA Los Angeles, CA Orange County, CA San Diego, CA Seattle, WA	Denver, CO East Bay, CA Miami, FL New York, NY San Jose, CA Washington, DC
Medium	Baltimore, MD Las Vegas, NV Memphis, TN Minneapolis, MN Sacramento, CA Tampa, FL	Cincinnati, OH Columbus, OH Houston, TX Indianapolis, IN San Francisco, CA	Charlotte, NC Detroit, MI Ft. Lauderdale, FL Long Island, NY Nashville, TN Northern New Jersey, NJ Portland, OR
Small	Hartford, CT Honolulu, HI Jacksonville, FL Milwaukee, WI New Orleans, LA Norfolk, VA Orlando, FL Palm Beach, FL Raleigh, NC St. Louis, MO Stamford, CT	Cleveland, OH Kansas City, MO Richmond, VA San Antonio, TX	Austin, TX Oklahoma City, OK Pittsburgh, PA Salt Lake City, UT

Source: Data provided by CoStar

Capitalization rates rose swiftly in all markets in 2008 and 2009, as systematic risk came to the forefront. Since the depths of the Great Recession (and peak cap rates), cap rates in most major metro markets have come back down, at least through the first quarter of 2020. Some markets, however, have been notable exceptions, such as Las Vegas and Baltimore, where cap rates rose in the Great Recession and have stayed high. Since beta compares variance within each market against the variance of the national market, these markets appear to have lower volatility. While this may be counterintuitive, lower cap rate volatility in these cases is because the markets' reputation for risk has remained priced into their cap rates. These markets have avoided a speculative boom, which may keep asset value appreciation low but also makes these markets less volatile and therefore less vulnerable to price risk. Factors other than price risk (e.g., liquidity risk or stagnant growth) may make these markets less attractive.

Cap rate volatility may also be an indicator of price appreciation and strong demand in some markets. Several markets that currently have low cap rates register as having high cap rate volatility because cap rates have declined at an above-average rate. Several of the markets that fit these criteria have experienced a rapid increase in demand for last-mile distribution space in recent years, a trend that has continued during the COVID-19 pandemic.

Figure 3 compares the same set of variables for the office product type, revealing some interesting similarities and differences.

Figure 3: Office Markets, Average Quarterly Sales Volume, Beta in Market Cap Rate, Q1/2005 to Q2/2020

	Low Volatility	Medium Volatility	High Volatility
Large	Orange County, CA Phoenix, AZ San Diego, CA Washington, DC	Atlanta, GA Chicago, IL Los Angeles, CA New York, NY Philadelphia, PA Seattle, WA	Boston, MA Dallas-Ft. Worth, TX Denver, CO Houston, TX San Jose, CA
Medium	Baltimore, MD Detroit, MI Inland Empire, CA Las Vegas, NV Long Island, NY Northern New Jersey, NJ Orlando, FL Sacramento, CA	Ft. Lauderdale, FL Miami, FL Minneapolis, MN Tampa, FL	Charlotte, NC East Bay, CA Nashville, TN Portland, OR
Small	Cleveland, OH Jacksonville, FL Memphis, TN St. Louis, MO	Cincinnati, OH Columbus, OH Milwaukee, WI Norfolk, VA Richmond, VA Salt Lake City, UT	Hartford, CT Indianapolis, IN Kansas City, MO Oklahoma City, OK Pittsburgh, PA San Antonio, TX

Source: Data provided by CoStar

Figure 3 does not show a clear correlation between market size and pricing volatility in the office sector, suggesting that investors who stay within "primary" markets are not insulated against the risk of falling prices (and rising cap rates). Denver, Houston, Dallas and San Jose (Silicon Valley) each experienced a strong decline in cap rates in the 2010-2019 growth cycle, above and beyond the average decline in cap rates across the nation during this period. This shows up on the grid as a higher beta, which suggests such pricing optimism comes with a local risk that these markets have become overpriced and could experience a correction. Markets that become highly favored at certain points in the economic cycle can see larger swings in cap rates when compared to the national average, possibly due to their specific economic engines and single-industry dependencies (e.g., energy or technology).

A low beta indicates below-average volatility in cap rates. In some cases, as with the Detroit office market, lower volatility may be due to persistently high cap rates that remain high because of a market's perceived risk (often due to factors other than price risk). In others, lower volatility in cap rates is also associated with below-average cap rates. These markets could command lower cap rates in part because they are subject to less price risk.

While these two figures are thought-provoking, members of the advisory group suggested that price risk is not necessarily the risk they are most focused on. Liquidity risk – the inability to find a buyer – is more worrisome. This focus in part reflects the composition of the advisory group, which was comprised of advisors to institutional investors. Other investors or developers may have a different perspective.

To evaluate liquidity risk, Figure 4 compares transaction price (on a square-foot basis) to liquidity risk by measuring relative standard deviation in quarterly sales volume in the industrial sector. This measures volatility in quarterly transaction volumes through the peaks and valleys of business cycles, indexed to each market's average transaction volume to control for differences of scale between larger and smaller markets.

Figure 4: Industrial Markets, Average Transaction Price PSF, Relative Standard Deviation in Quarterly Sales Volume, Q1/2005 to Q2/2020

	Low Volatility	Medium Volatility	High Volatility
High Price	Los Angeles, CA Miami, FL Oakland-East Bay, CA Orange County, CA San Diego, CA San Jose, CA	Boston, MA Palm Beach, FL San Francisco, CA Seattle, WA Virginia Suburbs of DC	Austin, TX San Antonio, TX Maryland Suburbs of DC
Medium Price	Baltimore, MD Denver, CO Phoenix, AZ Inland Empire, CA	Ft. Lauderdale, FL Kansas City, MO Orlando, FL Portland, OR Tampa-St. Petersburg, FL	Dallas, TX Ft. Worth, TX Houston, TX Jacksonville, FL Raleigh-Durham, NC Sacramento, CA
Low Price	Atlanta, GA Chicago, IL Cleveland, OH Minneapolis, MN Philadelphia, PA	Cincinnati, OH Columbus, OH Detroit, MI Nashville, TN St. Louis, MO	Charlotte, NC Indianapolis, IN Memphis, TN Pittsburgh, PA Richmond, VA

Source: Data provided by Moody's Analytics

Figure 4 shows no correlation between price and liquidity risk. The grid reveals where investors may seek lower liquidity risk for a lower price (Atlanta, Chicago, Minneapolis). However, the grid does not provide insight into whether markets that experience substantial variation in liquidity also experience comparable price swings. Without information on whether prices are likely to increase significantly during an economic expansion, it is difficult to ascertain whether investors would be compensated for taking additional liquidity risk.

This analysis of industrial property markets again argues against the rule-of-thumb explanation that investors frequently offer up: that avoiding lower-priced markets insulates them from volatility. The "primary" markets experience similar levels of volatility in transaction volumes as "secondary" markets.

Figure 5 compares the same variables, but for office properties.

The grid reveals a weak correlation between office transaction prices and liquidity risk. More high-priced office markets have low liquidity risk than high liquidity risk, and the opposite is true for low-priced markets. This suggests a potential price premium for office markets that have lower liquidity risk.

However, the grid reveals several outliers such as Minneapolis and Philadelphia that have low transaction prices and low volatility as well as high-price, high-volatility markets like Seattle and Austin. This reflects the limitations of selecting price per square foot as a measurement of a market's valuation.

Figure 5: Office Markets, Average Transaction Price PSF, Relative Standard Deviation in Quarterly Sales Volume, Q1/2005 to Q2/2020

	Low Volatility	Medium Volatility	High Volatility
High Price	Boston, MA Los Angeles, CA New York Metro, NY Orange County, CA San Diego, CA Virginia Suburbs of DC Washington, DC	Miami, FL Oakland-East Bay, CA Palm Beach, FL Portland, OR San Francisco, CA San Jose, CA	Austin, TX Fairfield County, CT Seattle, WA
Medium Price	Atlanta, GA Chicago, IL Denver, CO Ft. Lauderdale, FL Orlando, FL Phoenix, AZ Inland Empire, CA	Dallas, TX Houston, TX Kansas City, MO Nashville, TN Raleigh-Durham, NC Maryland Suburbs of DC	Birmingham, AL Charlotte, NC Sacramento, CA
Low Price	Columbus, OH Minneapolis, MN Philadelphia, PA	Cincinnati, OH San Antonio, TX St. Louis, MO Tampa-St. Petersburg, FL	Cleveland, OH Detroit, MI Fort Worth, TX Indianapolis, IN Jacksonville, FL Memphis, TN Milwaukee, WI Norfolk/Hampton Roads, VA Pittsburgh, PA Richmond, VA

Source: Data provided by Moody's Analytics

Current prices per square foot do not themselves reveal whether prices have grown or declined in recent years, and they may reflect a range of factors beyond liquidity risk. Higher prices may reflect supply constraints due to land scarcity or restrictive zoning. They may also indicate that investors' interest in long-term growth potential is greater than their concerns about potential liquidity fluctuations (despite their reputations, both Seattle and Austin are still smaller markets in terms of square footage and population). A comparison of transaction price per square foot to liquidity risk presents an incomplete picture of the markets.

With this in mind, Figure 6 (page 13) compares average transaction price to price risk instead of liquidity risk for industrial properties.[1] Figure 6 reveals a weak but positive correlation between average transaction price and transaction price volatility: the more expensive industrial markets experience bigger price swings across business cycles. This is not because these markets tend to have a larger portfolio of larger buildings, as everything is normalized on a per-square-foot basis. When the economy is in the expansion phase, demand for industrial assets swells quickly in markets that enjoy higher pricing due to their logistical advantages, proximity to large population bases and limited existing supply. Greater competition in these markets leads to higher pricing peaks during boom cycles. Conversely, demand tapers off sharply during recessions. It is possible that investors have not fully discounted properties in high-volatility markets for price risk. Investors may also be willing to pay a premium with the expectation that they will hold an asset through any downturn. Higher future returns may compensate investors for the added risk associated with additional volatility in these markets.

[1] This figure and the accompanying analysis have been corrected since the report was first published. The corrected figure reveals a weaker correlation than in the uncorrected figure.

Figure 6: Industrial Markets, Average Transaction Price PSF, Variance of Average Price PSF, Q1/2005 to Q2/2020

	Low Volatility	Medium Volatility	High Volatility
High Price	Long Island, NY	Orange County, CA San Diego, CA	Austin, TX Boston, MA Las Vegas, NV Los Angeles, CA Miami, FL NYC Manhattan, NY NYC Outer Boroughs, NY Oakland, CA San Francisco, CA San Jose, CA Seattle, WA Washington, DC Maryland Suburbs of DC Virginia Suburbs of DC
Medium Price	Baltimore, MD Dallas, TX Houston, CT Northern New Jersey, NJ Phoenix, AZ	Broward County, FL Charlotte, NC Denver, CO Inland Empire, CA Nashville, TN Orlando, FL Portland, OR Raleigh-Durham, NC Sacramento, CA Salt Lake City, UT San Antonio, TX	Stamford, CT Westchester County, NY
Low Price	Atlanta, GA Chicago, IL Cincinnati, OH Columbus, OH Detroit, MI Indianapolis, IN Memphis, TN Minneapolis, MN Philadelphia, PA Richmond-Norfolk, VA St Louis, MO Tampa, FL	Cleveland, OH Hartford, CT Jacksonville, FL Kansas City, MO Pittsburgh, PA	Birmingham, AL

Source: Data provided by Real Capital Analytics

The relationship between price and price volatility is also visible in Figure 7, which measures the same variables for office markets.[2]

Figure 7: Office Markets, Average Transaction Price PSF, Variance of Average Price PSF, Q1/2005 to Q2/2020

	Low Volatility	Medium Volatility	High Volatility
High Price	Orange County, CA San Diego, CA Virginia Suburbs of DC	Long Island, NY Oakland, CA Maryland Suburbs of DC	Austin, TX Boston, MA Los Angeles, CA Miami, FL NYC Manhattan, NY NYC Outer Boroughs, NY San Francisco, CA San Jose, CA Seattle, WA Stamford, CT Washington, DC
Medium Price	Broward County, FL Chicago, IL Northern New Jersey, NJ Orlando, FL Phoenix, AZ Sacramento, CA	Charlotte, NC Dallas, TX Denver, CO Houston, CT Inland Empire, CA Las Vegas, NV Portland, OR Raleigh-Durham, NC	Birmingham, AL Nashville, TN San Antonio, TX Westchester County, NY
Low Price	Atlanta, GA Baltimore, MD Cincinnati, OH Cleveland, OH Detroit, MI Minneapolis, MN Philadelphia, PA St Louis, MO Tampa, FL	Columbus, OH Indianapolis, IN Jacksonville, FL Kansas City, MO Pittsburgh, PA Richmond-Norfolk, VA Salt Lake City, UT	Hartford, CT Memphis, TN

Source: Data provided by Real Capital Analytics

[2] This figure and the accompanying analysis have been corrected since the report was first published. The corrected figure reveals a weaker correlation than in the uncorrected figure.

Some of the more volatile markets are volatile because of their ability to attract significant investment during market expansions.

This preliminary analysis suggests that some of the more volatile markets are volatile because of their ability to attract significant investment during market expansions. Investors can be attracted to higher-priced markets because of their perceived quality, further bidding up the prices of assets in those markets. As a result, these markets become vulnerable to larger price corrections in subsequent downturns. Conversely, lower-priced markets may experience less price volatility in part because they do not attract as much investment, resulting in prices that fluctuate less over the course of a business cycle.

The preceding three pairs of industrial and office market grid analyses demonstrate that significantly more information can be communicated using a two-dimensional analysis. However, some limitations present in one-dimensional analyses carry over into the grid. As with tier and ranking methodologies, variable selection has a great influence on how a two-dimensional grid categorizes markets. As the variables are, in the end, a judgment call of the analyst making the grid, even two-dimensional models can produce different results, depending on the variables they measure. Markets can jump from box to box in different models, which may confuse less sophisticated investors and general audiences.

However, one answer to this problem may be in combining two or three variables per axis, which can reduce the need to conduct separate analyses to measure different types of risk. To conclude, Figure 8 (on page 16) uses a hybrid measure of risk by combining two risk variables on the X-axis: relative standard deviation in sales volume (to represent liquidity risk) and variance in market cap rates (to represent price risk). This grid suggests that market size does not always predict risk for office markets.

Figure 8: Office Markets, Average Quarterly Sales Volume, Index Combining Relative Standard Deviation in Quarterly Sales Volume and Variance in Market Cap Rates, Q1/2005 to Q2/2020

	Low Volatility	Medium Volatility	High Volatility
Large	Los Angeles, CA New York, NY Orange County, CA Philadelphia, PA Phoenix, AZ San Diego, CA Washington, DC	Atlanta, GA Boston, MA Chicago, IL Dallas-Fort Worth, TX Denver, CO	Houston, TX San Jose, CA Seattle, WA
Medium	Baltimore, MD Ft. Lauderdale, FL Inland Empire, CA Las Vegas, NV Long Island, NY Miami, FL Northern New Jersey, NJ Orlando, FL	Detroit, MI East Bay, CA Minneapolis, MN Sacramento, CA Tampa, FL	Charlotte, NC Nashville, TN Portland, OR
Small	St. Louis, MO	Cincinnati, OH Columbus, OH Jacksonville, FL Memphis, TN Milwaukee, WI Norfolk, VA	Cleveland, OH Hartford, CT Indianapolis, IN Kansas City, MO Oklahoma City, OK Pittsburgh, PA Richmond, VA Salt Lake City, UT San Antonio, TX

Source: Data provided by CoStar

With this combination of variables, it becomes clear that larger markets are not necessarily a haven from price and liquidity risk. This grid shows a very weak correlation, with large and medium markets weighted toward low volatility, and smaller markets weighted toward high volatility. But this method also shows that "first tier" markets do not all behave alike. San Jose and Seattle, at the heart of the tech sector, have seen above-average declines in cap rates and increasing investment volumes, resulting in apparent volatility that is largely due to increased investor demand for these markets. Should the tech sector experience a sharp downturn, these markets could experience volatility in the other direction. By contrast, demand for office space in Houston has been affected by volatility in the petroleum industry and office properties that face rising flood risks, a combination that has increased volatility in quarterly transaction volume.

The smallest markets do tend to cluster on the higher volatility side of the grid. Among these markets, only St. Louis has seen low volatility, as pricing has remained consistently low and transaction volumes have held steady even through periods of economic growth.

However, for mid-sized markets, the two-dimensional grid brings forward new information, revealing a distribution of risk that mirrors the largest markets. The higher-volatility markets in this group may reflect investment opportunities, particularly for investors willing to take risks. Much has been made about growth in Charlotte and Nashville. Perhaps Portland, with its proximity to both Seattle and San Francisco/Silicon Valley, is the next new growth market.

Compare this to a simple table of capitalization rates (Figure 9), a snapshot-in-time measurement of how prices reflect expectations for risk and future growth. In theory, investors should extract a price discount (or conversely, a higher cap rate) to compensate for the interrelated risks of price volatility and market liquidity.

In the second quarter of 2020, the world was in mid-emergency, office space was empty as stay-at-home orders spread, and no one could be certain of the pandemic's future course. At this snapshot in time, average market cap rates do show that "first tier" markets seem to be clustered in the lowest group, which would suggest the highest confidence in those markets. However, there are several smaller markets, such as Portland and Salt Lake City, that had low cap rates in mid-2020 (suggesting confidence in their long-term futures) but have had higher cap rate volatility from 2005 to 2020. In isolation, these low cap rates (especially during an emergency) suggest that Portland and Salt Lake City might be considered first-tier markets. But the grid analysis shows that historically there is more volatility and risk in these markets than would be indicated by their current cap rates alone.

A comparison of current cap rates to the two-dimensional grid can also be read in the other direction. Investors interested in identifying higher-yielding assets in markets that have experienced low levels of volatility could consider investing in several mid-sized markets that they might otherwise overlook as "second tier" markets. Baltimore, Las Vegas, Long Island, Northern New Jersey and Orlando have all experienced below-average price and liquidity risk, but office properties in these markets traded at higher cap rates than most larger markets. This approach could also apply to the smaller market of St. Louis, which has experienced low volatility but is priced at a higher market cap rate.

Presentation of information in this two-dimensional grid conveys significantly more information than one-dimensional ranking and tiering. Not only does it provide two pieces of information, but the *relationship between the two* enables a third level of reporting. The two-dimensional method surfaces opportunities in what would otherwise be considered secondary or tertiary markets, depending on an investor's unique combination of capital, risk tolerance and goals for investment return.

Figure 9: Recent Office Market Average Cap Rates, Q2/2020

Low Cap Rates	Medium Cap Rates	High Cap Rates
Boston, MA	Atlanta, GA	Cincinnati, OH
Charlotte, NC	Baltimore, MD	Cleveland, OH
Dallas-Ft. Worth, TX	Chicago, IL	Columbus, OH
Denver, CO	Houston, TX	Detroit, MI
East Bay, CA	Inland Empire, CA	Hartford, CT
Ft. Lauderdale, FL	Kansas City, MO	Indianapolis, IN
Los Angeles, CA	Las Vegas, NV	Jacksonville, FL
Miami, FL	Long Island, NY	Memphis, TN
New York, NY	Minneapolis, MN	Milwaukee, WI
Orange County, CA	Nashville, TN	Norfolk, VA
Portland, OR	Northern New Jersey, NJ	Oklahoma City, OK
Salt Lake City, UT	Orlando, FL	Pittsburgh, PA
San Diego, CA	Philadelphia, PA	Richmond, VA
San Jose, CA	Phoenix, AZ	St. Louis, MO
Seattle, WA	Sacramento, CA	San Antonio, TX
Washington, DC	Tampa, FL	

Source: Data provided by CoStar

Conclusion

Two-dimensional analyses provide an understanding of the relationship between key market characteristics such as price, size and risk that make the grid framework a step forward from market tier and ranking methodologies. As this report has demonstrated, size and transaction pricing do not reliably predict a market's risk. A two-dimensional grid can reveal that some "primary" markets are riskier than suggested by traditional tier and ranking methodologies. Conversely, some smaller, lower-priced markets may be less risky than is assumed.

The information contained in two-dimensional grids will mean different things to different investors. Depending on budget, risk tolerance and strategy, one investor may gravitate toward low-priced assets in high-volatility markets that offer more potential upside from declining cap rates. Others may be looking for less volatility, preferring reliable growth in net operating income over potential gains from fluctuating cap rates. Yet other investors might hope to profit from smaller markets that appear to be inefficiently priced, with higher cap rates than would seem justified given their historical volatility. Whatever an investor's risk tolerance and objectives, it is much easier to identify suitable markets within a nine-box grid than in a traditional rank-and-tier system.

While a two-dimensional grid analysis is a viable framework for commercial real estate with many potential uses, it is still not a one-size-fits-all solution. Just as the previous report on market tiers concluded that ranking and tiering markets is most effective when the methodology is tailored to specific goals, the same is true of two-dimensional grids. Deciding how to build the right grid analysis depends on both purpose and audience. Grids developed for a specific investor (or type of investor) should select and weight variables to match the investor's strategies, risk tolerances and objectives. Grids developed for a more general audience should select variables that will be of interest to that broader audience (such as all commercial real estate investors and developers). These grids should be relatively transparent in how this information is incorporated into the analysis so that end-users can easily compare the characteristics of different markets and make their own evaluations about which markets merit additional research. The example grid analyses in this report incorporated variables that can be used to evaluate and compare market size, price, liquidity risk and price risk. These were identified by the advisory group as being significant to both investors and developers.

A two-dimensional grid that focuses on describing market characteristics instead of ranking markets along a single dimension avoids a common pitfall of traditional tier and ranking systems: offending the economic development agents that object to their region's ranking. It is harder for a representative of Kansas City or Sacramento or Portland to object to where their market is placed on a two-dimensional grid that objectively describes quantitative data.

The fact that at least 20 years of real estate data including two recessions (2000-2020) are available makes it possible to observe the effects of business cycles, unpredictable external events and transformational change in the industry on different real estate markets. For example, as one respondent noted, e-commerce was in its infancy in 2008 but is now a huge driver of industrial activity, including in markets that previously attracted less investment. This is especially true given the recent surge in occupier and investor demand for warehouse/distribution space that is located closer to consumers as online sales have grown dramatically since 2020.

The two-dimensional grids raise questions about individual markets that could be answered with research using other methods. Certain markets do not occupy their expected positions on the grid. There is more to the relationship between price volatility, liquidity volatility, and the assumed investment reliability of the biggest and most well-known markets. Perhaps Seattle and Austin's volatility reflects a tension in investor perceptions, as they are increasingly recognized as permanently established tech hubs but are still relatively small when compared to Silicon Valley. Inversely, markets that are large but considered "flat," such as Chicago and Philadelphia, show both the low volatility of large markets and the low prices of smaller markets. Perhaps unexpected results represent opportunities for investors, or perhaps they accurately reflect long-term growth prospects.

The availability of granular data makes it possible to take a deeper dive into the findings to investigate apparent mismatches in pricing and risk, or to evaluate the characteristics that have helped some markets attract more investment than others. Detailed investigation could reveal that conventional wisdom as well as widely held assumptions about markets are not entirely accurate.

Further Research

Further research could test out and build on the two-dimensional grids developed for this report. The variables and measurements used in these grids could be supplemented or replaced with others to more reliably or efficiently measure key market characteristics such as size or risk.

The advisory group for this report represented investors and investor service providers, resulting in grids designed to address investor priorities. Other two-dimensional grids designed for a different audience (e.g., occupiers, developers or a specific firm) or different property types (multifamily, single-family, retail, etc.) might select other variables or measure them differently.

Rigorous exploration of the efficiencies and limitations of the two-dimensional grid method would be welcome, testing the idea beyond the proof-of-concept level presented in this report.

Glossary

Beta: A statistical measurement that compares historical price variation in a single investment (such as a stock) to the price variation of the overall group (such as the stock market). Beta is used to measure systematic risk and measures the degree to which an investment tends to move up or down more (high-beta investments) or less (low-beta investments) than the market as a whole in response to broader changes in market valuation.

Capitalization Rate or Cap Rate: Unlevered initial return from the acquisition of a real estate asset calculated by dividing net operating income (NOI) by the property sales price. For example, a property's capitalization rate (cap rate) is 10 percent if it is purchased for $10 million and produces $1 million in NOI per year. The cap rate is typically calculated using the NOI generated in the first year of ownership so investors can normalize and compare potential returns among competing investment properties.

Liquidity Risk: The risk that an asset cannot be bought or sold quickly enough to minimize or prevent a loss. This usually occurs when there is a mismatch between the number of buyers and sellers or between buyer and seller price expectations. For example, in a recession, a seller may not be able to locate a buyer for a building at a price they find acceptable, forcing them to either sell the building at a substantial loss or hold the building longer, despite potential operating losses or further price depreciation.

Market: For the purposes of this report, a market is a metropolitan region in the United States, referring to both the central city and its suburbs. Sometimes very large markets are subdivided if there are multiple downtown cores, such as the Bay Area into San Francisco, San Jose (Silicon Valley) and Oakland (East Bay).

Market Tier and Ranking: The popular method of grouping markets into tiers. They are most popularly described as primary, secondary, tertiary; global, national, regional; or 24-hour, 18-hour, 8-hour markets. All market-tier methods categorize markets using a single score, even if that score is derived from multiple factors (such as market size, reputation, and average cap rate).

Morningstar Style Box: A two-dimensional analysis developed by Morningstar to categorize investments. For example, the Morningstar Equity Style Box categorizes a stock by its market capitalization (total market value of all the company's shares) and measurements of its valuation (e.g., price-to-earnings, price-to-book, price-to-sales and price-to-cash flow ratios) and growth (e.g., historical and projected growth in earnings, sales, cash flow and book value). The resulting analysis sorts stocks into small, medium and large "value," "core" and "growth" stocks.

One-Dimensional Analysis: Methods such as market tiers effectively group markets along a single spectrum from biggest to smallest, most active to least active, or best to worst. Because everything is ranked according to a single score, it is a one-dimensional analysis.

Price (per Square Foot): The total of all sale prices of all transactions in a single quarter, divided by the total square footage of all the buildings sold in those transactions.

Price Risk: The risk that the value of an asset will decrease.

Relative Standard Deviation: Standard deviation is a statistical measure of the dispersion of data. In the context of investments, it is used to measure volatility. Standard deviation is calculated by taking the square root of the variance (also defined below) in a dataset. Using the relative form helps to compare very large cities (like New York) to smaller cities (like Boulder, Colorado). For example, the net migration of 100,000 people into or out of New York City (population 8.3 million) is a regular annual occurrence with a limited effect on the city's economy. But if the same number of people moved out of Boulder, the city would be empty. Relative standard deviation accounts for these types of differences of scale by dividing the standard deviation in a range of data by the range's average value.

Sales Volume: The total value of all sales transactions in a single quarter.

Two-Dimensional Grid Analysis: Methods such as the Morningstar Style Box create grids, and the most popular are 2x2 or 3x3 in size. These enable comparisons of different investments or markets based on how they score across two different metrics (such as small to large and low-price to high-price) by sorting them into corresponding boxes. This enables the comparison of investments or markets across two different qualities, as opposed to a one-dimensional analysis that only evaluates an investment or market according to a single score.

Variance: A statistical measurement of the spread between numbers in a dataset. It can be used to describe fluctuation over time (such as in prices) or across a group (such as the range of people's heights).

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