INVESTMENT STRATEGY, VACANCY AND CAP RATES [†]

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Abstract

In this paper we examine whether and to what extent the vacancy of a commercial real estate property is related to its valuation and investment performance. Using data on individual properties, we find that high-vacancy properties are associated with lower cap rates, which suggests the expectation for higher future NOI growth from the potential occupancy of vacant space. Consistent with these expectations, we also find that, on average, high-vacancy properties are associated with higher future NOI growth compared with low-vacancy properties. On the other hand, we find evidence that the investment performance of high-vacancy properties is inferior to the performance of low-vacancy properties, on average. Overall, these results suggest an overvaluation of vacant space.

This version: February 22, 2019

[†] We thank the *Real Estate Research Institute* for a research grant. We also thank the *National Council of Real Estate Investment Fiduciaries* and *CoStar* for providing their commercial real estate data.

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Introduction:

The vacant space associated with commercial real estate (CRE) properties can be viewed by investors as an option for additional revenue in the event the vacant space is occupied. All other things equal, filling vacant space will result in faster growth of net operating income (NOI) in high-vacancy properties compared with the NOI growth of low-vacancy properties. This should result in high-vacancy properties having higher current valuations relative to current NOI, i.e., a lower cap rate. We refer to this as the "growth hypothesis." On the other hand, high-vacancy properties may be viewed as riskier investments as the potential for future rent growth is less certain than rent-in-place. Further, the fact that a particular property suffers from a higher vacancy rate compared with the market vacancy rate may serve as an indicator that the demand for its space is lower, and hence its ability to charge higher rent in the future is constrained, perhaps due to idiosyncratic weaknesses in that property. Additional investment into such properties (i.e., capital expenditures) might alleviate such weaknesses but these investments would themselves entail a degree of risk. In this case, high-vacancy properties should be valued at a lower level (higher cap rate) than low-vacancy properties, something we refer to as the "risk hypothesis."

In this paper we attempt to distinguish between the growth and risk hypotheses by examining whether, and to what extent, the vacancy rate of CRE properties is related to their current valuation, future NOI growth, and future investment performance. Our analysis of nearly 20,000 properties over a 35-year period shows that vacancy rates are negatively related to cap rates. This suggests that investors expect vacancy to fuel NOI growth and are willing to pay for this potential growth. Consistent with these expectations, our analysis provides evidence that, on average, higher vacancy properties are associated with higher future NOI growth compared with lower vacancy properties. However, additional results indicate that higher vacancy properties are associated with lower future overall returns compared with lower vacancy properties. These results suggest that, on average, vacancy is overvalued because the potential for higher NOI growth embedded in high vacancy properties is insufficient to compensate for the price paid for the vacant space.

The negative relation between vacancy and cap rates holds for all four major property types and is found to be weaker during periods where overall rent market conditions are strong. The negative relation between vacancy and cap rates is also robust to an analysis that differentiates between major and smaller markets. Finally, a closer look at vacancy and total return reveals an inverted U-shape relation such that the benefit of lower vacancy diminishes at the margin as vacancy rates decreases. Therefore, there seems to be a "sweet spot" for vacancy rate that is associated with the highest level of future returns.

This paper makes a significant contribution to the literature by being the first to provide a detailed investigation of the relation between CRE vacancy and valuation, and investment performance at the property level. The finding that the growth hypothesis dominates the risk hypothesis provides a significant empirical insight into the theory of CRE pricing. Further, as vacancy rate is often a key consideration by CRE investors when analyzing potential property investments, the results of our analysis are valuable not only for academics, but also for professional investors.

Data and Methodology:

The initial data set for the study consists of quarterly, property-level data on all properties in the NCREIF Property Index (NPI) from Q1 1978 to Q1 2018, supplied by the National Council of Real Estate Investment Fiduciaries (NCREIF). The NPI is composed of institutionally owned commercial real estate and is the oldest and most widely followed commercial real estate investment index. The properties contained in the index vary over time as assets are purchased or sold (and, especially in the earlier years, as new contributors join the index). Over the full time period, the data set contains quarterly data on 26,257 different properties and a total of 547,001 observations, where an observation is a property-quarter.

From the initial data set we exclude hotel properties to concentrate on the four main commercial property sectors: office, apartment, retail, and industrial. We then apply a series of filters to the data to control for missing data, potential data errors, stale appraisals of property value, and to ensure robustness of our calculated statistics. We drop observations with missing vacancy data, with vacancy reported as less than zero, where the CBSA in which the property is located is not reported, and where the market value of the property is reported as zero.[1] After omitting hotels and applying these missing data filters the data set contains 474,769 property-quarter observations.

Some properties in the NCREIF data may not have their appraised market value updated every quarter. The previous quarter's value may simply be carried forward, or an automatic adjustment (such as adding capital expenditures to the previous quarter's value) may be used in some instances. To guard against stale appraisals and ensure we are using valid market value data, we retain only observations that meet at least one of the following criteria: (1) the property is sold during that quarter, as the transaction price is then used as market value, (2) the appraisal that quarter is indicated to be provided by an external source, (3) the appraisal that quarter is internal but the market value does not equal the previous quarter's market value plus capital expenditures,

[1] Throughout the paper, we calculate the market value of a property as the sum of the variables "market value" and "partial sales" from the NCREIF data.

and (4) the property is held by an open-end fund, which have an incentive to keep market values up to date as capital flows in and out of the fund occur at net asset value. All other observations are discarded. After omitting potentially stale appraisals our sample includes 367,202 property-quarter observations.

Finally, as detailed below, our analysis of cap rate rates and vacancy is based on measuring each property's cap rate and vacancy rate in each quarter relative to those of similar properties in that same quarter. To ensure that enough comparable properties exist to make this relative measurement robust, we drop observations where there are fewer than 10 other properties of the same property type, in the same CBSA, in that quarter. Our final sample consists of 293,003 property-quarter observations across 19,667 unique properties.

For each property i in quarter t, we calculate the cap rate as:

$$CapRate_{it} = \frac{4(NOI_{it})}{MV_{it}} \quad (1)$$

where NOI is net operating income and MV is market value.

Our sample of properties includes different property types, in different markets, and at different times. This makes direct comparison of cap rates problematic. What is considered a high or low cap rate varies considerably with property type sector. As well, different geographic markets have different norms in terms of property valuation – average cap rates in a major market such as New York are often much lower than in smaller markets with less institutional investor interest such as St. Louis (Ghent, 2019). Further, average cap rates vary with market conditions (with cap rates being lower in strong markets and higher during weak markets) and, therefore, cap rates vary over time. To control for these factors, our analysis is based on the adjusted cap rate for each property ($AdjCapRate_{it}$). This approach is like the methodology used by Beracha, Downs and

MacKinnon (2018). The adjusted cap rate measures cap rate relative to the average cap rate of other properties of the same type, in the same CBSA, in the same quarter:

$$AdjCapRate_{it} = CapRate_{it} - \overline{CompCapRate_{it}} \qquad (2)$$

where:

$$\overline{CompCapRate_{it}} = \frac{\sum_{j \neq i}^{N_{it}} CapRate_{jt}}{N_{it}}$$

The properties, j≠i, used to calculate the average comparable cap rate are those that are of the same property type and located in the same CBSA as property i. The number of comparable properties for property i, N_{it}, varies by property as well as over time. However, recall that our data filters require that $N_{it} \geq 10$ ∀ i and t.

As with cap rate, average vacancy rates also vary across property types, geography, and time. Hence, we also use an adjusted vacancy rate in our analysis which is calculated analogously to the adjusted cap rate;

$$AdjVac_{it} = Vacancy_{it} - \overline{CompVacancy_{it}} \qquad (3)$$

Calculation of the adjusted cap rate and adjusted vacancy rate reveals some extreme outliers in the data such as an adjusted cap rate of 899% (i.e., a cap rate 899% higher than the comparable properties' average) or an adjusted vacancy of 96% (i.e., vacancy 96% greater than comparable average). We attribute these outliers to either data errors not picked up by our initial filters or to very unusual circumstances with the properties in question that are not common to properties in general. To control for these extreme values, we winsorize adjusted cap rate and adjusted vacancy rate at the 1% and 99% percentiles.

As well as cap rates and vacancy levels, part of our analysis also examines returns to the properties. We use appraisal-based returns as calculated by NCREIF (income, appreciation and total returns) and examine them over a five-year investment horizon going forward from the quarter in question. Five-year returns are calculated by compounding the quarterly returns over the window. As the length of the time series of quarterly returns for individual properties varies in the NCREIF database (as properties are held by an investor, and therefore part of the database, for differing periods) some property-quarters do not have the requisite five years of data going forward to calculate returns. We also examine NOI growth over a five-year horizon and again some properties in some quarters do not have the needed five years of data going forward to calculate the growth rate. Consequently, our analysis including returns or NOI growth is based on fewer observations than analysis of cap rate and vacancy alone.

To examine whether the relationship between cap rates and vacancy differs over the real estate cycle, we control for rent conditions in the market. We use data from CoStar on average rent per square foot each quarter, by property type and CBSA, for 4- and 5-star properties. Star categories are assigned by CoStar and are meant to reflect building quality; 4- and 5-star properties are generally considered institutional grade and therefore most closely match the NCREIF data. To measure rent conditions, we first calculate a time series of real rent per square foot for each property type in each CBSA by discounting the CoStar average rent data by the CPI. For each property type in each CBSA, we then follow Chervachidze, Costello, and Wheaton (2009) and calculate a real rent index as real rent per square foot that quarter divided by the mean real rent per square foot over the entire sample period. A “High Rent” dichotomous variable is constructed that equals 1 if the real rent index for that property type and CBSA is greater than 1 (i.e., above its long-term average) and equal to 0 otherwise. Note that the CoStar data does not cover all the CBSAs represented in the NCREIF sample and, in most markets, covers a shorter time period; therefore, analyses using the High Rent variable to measure market conditions are based on fewer observations than our overall sample.

Results:

Descriptive statistics

Table 1 provides descriptive statistics for the adjusted vacancy and adjusted cap rate of the observations included in our dataset. The 50th percentile value of the adjusted vacancy is -2.91% with a 1st and 99th percentile values of -17.31% and 53.92%, respectively. These values indicate that the center of the adjusted vacancy distribution is slightly to the left of 0.00%, but the distribution is skewed to the right. 50% of the observations range within a tight range of less than 9% (-6.86% for the 25th percentile and 1.96% for the 75th percentile). The adjusted cap rate values are centered slightly to the right of 0.00% at 0.12%. Here, however, the distribution is skewed to the left with a 1st and 99th percentile values of -9.02% and 7.48%, respectively. 50% of the distribution values are ranged between within roughly 2% with the 25th percentile at -0.95% and the 75th percentile at 1.12%.

Tables 2 and 3 provide a closer look at the distributions of the adjusted vacancy and adjusted cap rate, respectively, by segmenting the data into the four major property types (apartment, industrial, office and retail). Similar to Table 1, the adjusted vacancy value distributions for each property type is centered to the left of 0.00% but skewed to the right. The distribution is especially wide for industrial and office (-18.22% to 59.29% and -18.40% to 54.19%), while the distribution for apartment is materially narrower (-8.16% to 27.63%). Also, like Table 1, the distribution values of the adjusted cap rate presented in Table 3 are centered slightly to the right of 0.00% for each property type and with some skewness to the left. The adjusted cap rate distribution range is the widest for office and industrial (-10.10% and -9.98% for the 1st percentile and 9.48% and 8.12% for the 99th percentile, respectively) and the narrowest for apartment (-4.88% for the 1st percentile and 3.05% for the 99th percentile).

The relation between vacancy rate and cap rate

Table 4 reports the results of the regression analysis that explores the relation between cap rates and vacancy. Specifically, the five different specifications presented in the table regress the adjusted cap rate of each property on its adjusted vacancy rate for all property types as well as separately for each of the four major real estate property types. When all property types are considered, the coefficient of the adjusted vacancy rate is negative and statistically significant, indicating that properties with higher vacancy are valued at a lower cap rate, on average. These results suggest that the potential rent that can be generated from the vacant space is at least partially capitalized into the value of the property and support the NOI growth hypothesis.[2]

When each of the four major property types are considered independently, the adjusted vacancy rate is also negative and statistically significant for each of the property types. The adjusted vacancy rate coefficients for the office and industrial property types are larger in magnitude (-0.0926 and -0.0933, respectively) while the coefficients for the retail and apartment property types are smaller in magnitude (-0.0525 and -0.0719, respectively). These results may suggest that vacant space for office and industrial properties are capitalized to a larger extent into the value of the property compared with apartments and retail. The narrower distribution of vacant space for apartment and retail provided in Table 2 may serve as a possible explanation for their

[2] To ensure that the negative relationship found between vacancy and property valuation is not merely due to using (adjusted) cap rate as the measure of value, we repeat the analysis using appraised value per square foot. We calculate an "adjusted value per square foot" analogously to adjusted cap rate, and we then regress this on adjusted vacancy. The coefficient on adjusted vacancy is significantly positive indicating that higher vacancy properties have higher values, consistent with the findings using cap rate. This alternative approach addresses the robustness of our results and, again, supports the growth hypothesis. Detailed findings of this analysis are available from the authors on request.

smaller coefficient (in absolute terms) compared with industrial and office. In other words, high deviation from the normal occupancy rate is less common for these property types and, therefore, when high vacancy is present it may reflect a fundamental problem with the specific property.

To determine whether the results vary between large and small real estate markets, Table 5 reports the results based on analysis that regresses the adjusted cap rate of each property on its adjusted vacancy rate while controlling for whether the property is in one of six primary US real estate markets. We define the six primary US real estate markets as New York City, Boston, Chicago, San Francisco, Los Angeles and Washington DC. Like the results we report in Table 4, the coefficients of the adjusted vacancy rate are negative and statistically significant when all property types are pooled together and when each property type is considered independently. The coefficients of the primary market variables are negative and statistically significant for industrial and office properties as well as when all property types are pooled together. This suggests that, at least for those two property types, adjusted cap rates are slightly lower in primary markets. The coefficients of the variable that interacts primary market and adjusted vacancy are positive and statistically significant for all the specifications. These results indicate that the relation between cap rates and vacancy is slightly less negative in primary markets. However, the size of the coefficient on the interaction term is quite small compared to the coefficient on adjusted vacancy rate. Hence, while the value of vacant space may be capitalized into property values to a slightly lesser extent in primary markets, the overall result of a negative relationship between vacancy and cap rate holds in both larger and smaller markets.

Table 6 reports results that explore the possibility of a non-linear relation between adjusted cap rate and adjusted vacancy rate. To do this we regress the adjusted cap rate on the adjusted vacancy rate as well as the adjusted vacancy rate squared. The coefficient of the adjusted vacancy rate remains negative and statistically significant for all property types combined and for each property type independently, as in the previous tables. Additionally, the coefficients of the adjusted vacancy rate squared is also negative and statistically significant in each of the five specifications, except for apartments. When we examine the estimated quadratic function, it is clear that the maximum (minimum) values in the concave (convex) forms are outside the range of reasonable values. Consequently, this analysis suggests that the basic results presented in Table 4 hold when the vacancy rate squared term is included. That said, the improvement in the adjusted R^2 for the specifications presented in Table 6 compared with Table 4 are minimal – suggesting that the squared vacancy rate only minimally improves the explanatory power of the initial model. For simplicity, the remainder of the results concentrate on the linear case as the non-linear specification does not contribute to our understanding of the basic relationships. In other words, the linear case is a sufficient first approximation.

Table 7 presents the results that examine the relation between cap rates and vacancy rates conditioned on whether the rental market in a particular market and/or period is robust. As we describe in the methodology section, High Rent is a binary variable that is set to 1 when the rent rate in real terms for each property is above the average rent for its CBSA and property type over the sample period and 0 otherwise. The coefficients of the adjusted vacancy rate in Table 7, as in the previous tables, are negative and statistically significant for each of the five specifications. While the coefficients of the High Rent variable are statistically insignificant, the coefficients of the variable that interacts High Rent with Adjusted Vacancy are positive and statistically significant when all property types are considered and when each property type is considered independently, except for retail. These results provide evidence that the relation between cap rates and vacancy rates are less negative during high rent periods and markets. This suggests that if a particular property exhibits high vacancy rate during a period of robust rental market, which perhaps points to a fundamental problem with the property, the value of its vacant space is less fully capitalized into value.

The results thus far are consistent with the growth hypothesis: high vacancy properties on average are priced more highly, relative to current NOI, to reflect higher growth potential. But do these properties, in fact, exhibit higher growth in NOI in the future? Table 8 presents the average annualized growth in NOI in the five years after the observation quarter. In order to observe how NOI growth may vary with property characteristics, the sample is broken down into quartiles by adjusted cap rate and adjusted vacancy. The 1st quartile designates the lowest levels of adjusted cap rate or adjusted vacancy, while the 4th quartile includes the highest values.

Average NOI growth declines for higher adjusted cap rates. This result is consistent, and statistically significant, across all adjusted vacancy quartiles. Properties with higher than normal cap rates exhibit less NOI growth over the next five years. In fact, NOI growth is negative for properties in 3rd and 4th quartiles of cap rate, while it is large and positive for properties in the 1st cap rate quartile (those with cap rates the furthest below the norm in their markets). The cap rates set by the valuation process do seem to incorporate future growth.

Within the 1st through 3rd quartiles by adjusted cap rate, higher vacancy properties have significantly higher future NOI growth. Outside of the highest cap rate properties (the 4th quartile by adjusted cap rate, i.e., those properties which the valuation process views as having the lowest growth prospects), high vacancy properties do, in fact, exhibit higher NOI growth in the future compared to low vacancy properties. This is consistent with the valuations placed on high vacancy properties which our previous results showed incorporate the growth potential of vacant space.

While the pattern of valuations seen across properties (higher vacancy receives higher valuation (lower cap rate)) is consistent with the observed future growth (higher vacancy exhibits higher NOI growth), it is not known whether the valuation process is accurate, on average, in incorporating future growth potential. The option inherent in vacant space is valued, but it could be over- or under-valued. To investigate this, we turn to an examination of the return performance of properties based on their cap rate and vacancy.

Return performance and vacancy rate

Table 9 shows the future 5-year annualized total returns of the properties included in our sample, segmented into quartiles of adjusted cap rate and quartiles of adjusted vacancy rates. Again, the 1st quartile includes properties with the lowest level of vacancy rate or cap rate and the 4th quartile includes the highest level of vacancy rate or cap rate. The reported results show that generally future total returns gradually increase as the capitalization rate of the properties increases. This positive relation between future total return and cap rate holds for all four quartiles of vacancy and is consistent with the outperformance of the value investment strategy and the existing literature (Beracha and Downs 2015; Beracha, Downs and MacKinnon 2017). The differences between the future total returns for high vs. low cap rate properties is also statistically significant for all levels of vacancy rates. It is worth noting that the total return differential between low and high vacancy properties is relatively large (about 1.5% annually) for properties with low cap rates. However, the return differential decreases as cap rates increase such that for high cap rate properties the differential is materially smaller at about 0.3% annually.

As for the relation between future total return and vacancy rate, it appears that the future total return is higher for low vacancy rate properties compared with high vacancy rate properties. As with the cap rate quartiles, the differentials in the future total return between low and high vacancy rate properties hold for all levels of cap rate and are statistically significant. However, it appears that the level of future return peaks at the second rather than the first quartile of vacancy. These inverted U-shape results may suggest a vacancy "sweet spot" such that properties with some low level of vacancy rate are associated with the best future total return performance. Further statistical tests indicate that the increase in total returns from the first to second adjusted vacancy quartile, and the decrease from the second to fourth, are statistically significant (results not reported in the table, available on request). This holds across all four columns by cap rate quartile and confirms that this sweet spot exists – the highest average returns occur when there is some low level of vacancy but not too much.

Table 10 reports the results that explores the relation between future 5-year total return and vacancy rate as well as cap rate using regression analysis. Specifically, the future 5-year total return is regressed on adjusted cap rate and adjusted vacancy rate. Consistent with the results reported in Table 9, the coefficient of adjusted cap rate is positive and the coefficient for adjusted vacancy is negative in specifications (1) and (2), respectively, both with statistical significance. These coefficients also hold their sign and statistical significance in specification (3) when vacancy rate and cap rate are both considered in the regression. Overall, the results presented in Table 10 confirm the positive relation between cap rates and total returns and the negative relation between total returns and vacancy rates.

Tables 11 and 12 provide additional insight into the analysis presented in Table 9 by decomposing the future 5-year total return into income returns (Table 11) and appreciation returns (Table 12). The results presented in Table 11 indicate, as might be expected, that income returns are increasing with cap rates for properties in each quartile of vacancy rates. The income return differentials between the first and fourth quartiles of cap rates are monotonic, economically meaningful at roughly 1.1% to 1.4% annually, and are also statistically significant. The relation between income returns and vacancy is negative as the income return from the properties included in the 1^{st} quartile of vacancy is higher compared with the income return from properties included in the 4^{th} quartile of vacancy. As with the income return differentials for varying levels of cap rates, the income returns from properties included in the 1^{st} and 4^{th} quartile of vacancy rates are statistically significant. Income return is increasing monotonically from the 4^{th} to the 1^{st} quartile and the differentials are in the range of 0.3% to 0.7% annually. These results are consistent with the results presented in Table 9, except for the fact that returns are highest for the lowest level of vacancy rather than the second quartile of vacancy.

The results presented in Table 12 illustrate that for low vacancy rates (i.e., the 1^{st} and 2^{nd} quartiles) appreciation return is negatively related to cap rates. This is consistent with the expectation that growth (low cap rate) properties appreciate more than value (high cap rate) properties. While these appreciation return differentials are statistically significant and range between 0.4% and 0.5% annually, they do not offset the higher income return differentials between low and high cap rate properties. For high vacancy rates the appreciation return between low and high cap rate properties is either statistically insignificant (3^{rd} quartile) or higher for high cap rate properties. These results suggest that the growth element that is expected from low cap rate properties is not present, on average, in high vacancy properties. The relation between vacancy rate and appreciation return is negative as a higher appreciation rate is associated with lower vacancy rate properties, on average. Like the results presented in Table 9, however, the appreciation return peaks at the 2^{nd} quartile for vacancy rate. These results suggest that the inverted U-shape relation between total returns and vacancy stems from the appreciation rather than the income return component.

Capital expenditure, risk and vacancy rates

Table 13 reports the average capital expenditure, over the next five years, as a percentage of each property's market value for the properties included in each of the vacancy rate and cap rate quartiles. As cap rates increase from the 1st to the 4th quartile it appears that capital expenditures first decrease and then increase such that they form a U-shape relation between capital expenditure and cap rates. On average, however, properties associated with the highest adjusted cap rates experience higher capital expenditures compared with properties associated with the lowest adjusted cap rates, which is fundamentally expected. Vacancy rates are positively related to capital expenditures. As vacancy rate declines capital expenditure declines as well. The decline in capital expenditure from the 4th to the 1st quartile of vacancy is monotonic and statistically significant for all levels of cap rate. The average differential in capital expenditure between the 4th and 1st quartile of properties sorted by vacancy rate is also economically meaningful and ranges between 3.7% and 6.2% of the total asset values per year. These results are consistent with expectations that high vacancy properties may require more capital expenditure in order to attract new tenants. This may explain why high vacancy properties exhibit higher NOI growth but lower actual returns – the level of capital expenditures required to grow NOI in these properties may be systematically underestimated in the market.

Table 14 reports results that explore the investment performance risk of properties in our sample across cap rate and vacancy rate quartiles. Risk is measured as the cross-sectional standard deviation of the annualized future 5-year return across properties in each quartile category. Given our use of five-year horizon returns, the traditional time-series volatility measure of risk is unavailable to us.[3] However, the dispersion of returns across properties as measured by the cross-sectional standard deviation is a reasonable and intuitive measure of risk. Given that real estate is an asset class characterized by large, indivisible assets, the vast majority of investors will not be fully diversified but rather will be choosing one or a few assets from within a particular category. Investors are therefore unlikely to achieve average performance within a category, and the major risk is that they choose an asset whose investment horizon return is less than average; this risk is measured by the dispersion of returns over the five-year horizon across properties.

Moving from the 1st to the 4th quartiles of properties in terms of cap rate in Table 14, the level of risk first declines and bottoms out at the 2nd quartile before it increases and peaks at the 4th quartile. This pattern holds for all levels of vacancy. Overall, the level of risk associated with the properties in the 4th quartile of cap rates is higher, on average, than the risk associated with the properties includes in the 1st quartile of cap rates, and the difference is statistically significant. The level of risk is also the highest for the properties with the highest level of vacancy rate, regardless of the level of cap rate. Properties included in the 1st vacancy rate quartile are associated with risk that is lower than the risk of the 4th quartile properties, with statistical significance for all cap rates levels. However, it is only for the 2nd and the 3rd cap rate quartiles that the lowest risk levels are found in the lowest vacancy quartile. The results presented in Table 14 indicate that the higher total return associated low vacancy rate properties is not accompanied by higher risk. Therefore, the results presented in Table 14 combined with the results presented in Table 9 suggest that lower vacancy properties outperform high vacancy properties in terms of risk-adjusted total return.

[3] Further, real estate returns are well known to be serially correlated, especially when appraisal based. Hence, we cannot use volatility of annual (or quarterly) returns within the five year window to accurately gauge risk for a five year holding period.

Conclusion:

We use property-level data to examine the relationship between cap rates and vacancy in the context of an investment strategy. Our empirical approach addresses whether, how, and why the vacancy and cap rate relationship vary across market conditions as well as the implications for future research performance. We apply the market-adjusted cap rate approach used by Beracha, Downs and MacKinnon (2017), so that we can draw conclusions from a national sample of nearly 20,000 individual properties covering the period 1978 to 2018.

Our analysis shows that high vacancy properties have, on average, low cap rates or higher current valuations relative to low vacancy properties. This finding provides support for our growth hypothesis, which argues that investors value the optionality associated with vacant space. Additional analysis shows that higher vacancy properties are associated with higher future NOI growth. More importantly, our research shows that high vacancy properties tend to underperform as an investment strategy suggesting that vacancy may be overvalued in some cases.

References

Beracha, E. and D.H. Downs, 2015, Value and Momentum in Commercial Real Estate: A Market-Level Analysis, *Journal of Portfolio Management – Special Real Estate Issue*, Volume 41, Number 6, pp. 48-61.

Beracha, E., D.H. Downs and G. MacKinnon, 2017, Are High CAP Rate Properties Better Investment?, *Journal of Portfolio Management – Special Real Estate Issue*, Volume 43, Number 6, pp. 162-178.

Chervachidze, S., J. Costello, and W., Wheaton, 2009, The Secular and Cyclic Determinants of Capitalization Rates: The Role of Property Fundamentals, Macroeconomic Factors, and 'Structural Changes', *Journal of Portfolio Management – Special Real Estate Issue*, Volume 35, Number 5, pp. 50-69

Ghent A.C. 2019. What's Wrong with Pittsburgh? Investor Composition and Trade Frequency in US Cities *Working Paper*.

Plazzi, A., W. Torous and R. Valkanov. 2011. Exploiting Property Characteristics in Commercial Real Estate Portfolio Allocations. *Journal of Portfolio Management* 35(5): 39-50.

Table 1 – Distributions of adjusted vacancy and adjusted cap rate across full sample, winsorized at 1% and 99%		
	Adjusted vacancy	**Adjusted cap rate**
1% percentile (winsorized min.)	-0.1732	-0.0902
5%	-0.1293	-0.0455
10%	-0.1051	-0.0278
25%	-0.0686	-0.0095
50%	-0.0291	0.0012
75%	0.0196	0.0112
90%	0.1383	0.0241
95%	0.2569	0.0357
99% percentile (winsorized max.)	0.5392	0.0748

Table 2 – Distributions of adjusted vacancy by property type, winsorized at 1% and 99%				
	Apartment	**Industrial**	**Office**	**Retail**
1% percentile (winsorized min.)	-0.0816	-0.1822	-0.1840	-0.1274
5%	-0.0583	-0.1307	-0.1518	-0.0970
10%	-0.0476	-0.1077	-0.1326	-0.0847
25%	-0.0298	-0.0782	-0.0939	-0.0603
50%	-0.0099	-0.0429	-0.0368	-0.0293
75%	0.0126	0.0043	0.0522	0.0243
90%	0.0421	0.1858	0.1751	0.1119
95%	0.0753	0.3226	0.2830	0.1956
99% percentile (winsorized max.)	0.2763	0.5929	0.5419	0.4575

Table 3 – Distributions of adjusted cap rate by property type, winsorized at 1% and 99%				
	Apartment	**Industrial**	**Office**	**Retail**
1% percentile (winsorized min.)	-0.0488	-0.0998	-0.1010	-0.0659
5%	-0.0224	-0.0539	-0.0526	-0.0332
10%	-0.0141	-0.0336	-0.0345	-0.0210
25%	-0.0055	-0.0107	-0.0138	-0.0087
50%	0.0010	0.0020	0.0007	0.0005
75%	0.0070	0.0134	0.0146	0.0093
90%	0.0131	0.0273	0.0308	0.0193
95%	0.0175	0.0392	0.0449	0.0280
99% percentile (winsorized max.)	0.0305	0.0812	0.0948	0.0591

Table 4 – Regressions of Adjusted cap rate on adjusted vacancy rate					
	All Property Types	Apartment	Industrial	Office	Retail
Constant	-0.0005 [-13.38]***	-0.0002 [-3.96]***	-0.0006 [-9.44]***	-0.0007 [-7.66]***	-0.0004 [-3.81]***
Adjusted Vacancy Rate	-0.0886 [-263.59]***	-0.0719 [-84.92]***	-0.0933 [-189.91]***	-0.0926 [-131.96]***	-0.0525 [-51.52]***
Adj. R2	0.1917	0.1036	0.2240	0.1964	0.0716
N	293003	62411	124937	71264	34391

Table 5 – Primary versus secondary markets					
	All Property Types	Apartment	Industrial	Office	Retail
Constant	-0.0005 [-8.59]***	-0.0003 [-4.63]***	-0.0005 [-6.22]***	-0.0005 [-3.60]***	-0.0004 [-2.77]***
Adjusted Vacancy Rate	-0.0916 [-211.13]***	-0.0747 [-67.50]***	-0.0949 [-160.33]***	-0.0977 [-94.72]***	-0.0545 [-39.01]***
Primary	-0.0002 [-2.76]***	0.0003 [2.42]**	-0.0003 [-2.31]**	-0.0004 [-2.17]**	-0.0000 [-0.12]
Primary X Adjusted Vacancy	0.0075 [10.92]***	0.0066 [3.83]***	0.0052 [4.86]***	0.0095 [6.76]***	0.0044 [2.13]**
Adj. R2	0.1920	0.1038	0.2242	0.1969	0.0717
N	293003	62411	124937	71264	34391
Dependent variable is adjusted cap rate.					

Table 6 – Regressions of Adjusted cap rate on adjusted vacancy rate, including non-linear term					
	All Property Types	Apartment	Industrial	Office	Retail
Constant	-0.0001 [-2.75]***	-0.0004 [-7.79]***	-0.0000 [-0.08]	-0.0003 [-2.48]**	0.0003 [2.79]***
Adjusted Vacancy Rate	-0.0813 [-152.09]***	-0.0869 [-64.01]***	-0.0839 [-96.44]***	-0.0873 [-86.40]***	-0.0356 [-22.31]***
Adjusted Vacancy Rate Squared	-0.0277 [-17.57]***	0.0544 [14.12]***	-0.0325 [-13.06]***	-0.0238 [-7.24]***	-0.0680 [-13.67]***
Adj. R2	0.1925	0.1064	0.2251	0.1969	0.0766
N	293003	62411	124937	71264	34391
Dependent variable is adjusted cap rate.					

Table 7 – Effect of high rent conditions in market					
	All Property Types	Apartment	Industrial	Office	Retail
Constant	-0.0006 [-10.66]***	-0.0001 [-2.08]**	-0.0007 [-7.14]***	-0.0009 [-7.02]***	-0.0005 [-3.36]***
Adjusted Vacancy Rate	-0.0906 [-211.64]***	-0.0796 [-68.58]***	-0.0942 [-151.93]***	-0.0948 [-106.78]***	-0.0525 [-38.77]***
High Rent	0.0001 [1.35]	-0.0002 [-1.46]	0.0001 [0.38]	0.0002 [2.15]**	0.0003 [1.17]
High Rent X Adjusted Vacancy	0.0067 [9.60]***	0.0179 [10.70]***	0.0031 [2.99]***	0.0099 [6.82]***	-0.0026 [-1.22]
Adj. R2	0.1990	0.1099	0.2300	0.2020	0.0832
N	271945	59020	116743	66989	29193

Dependent variable is adjusted cap rate.

Table 8 - NOI growth (annualized percentage) over next five years					
	1st quartile adj cap rate	2nd quartile adj cap rate	3rd quartile adj cap rate	4th quartile adj cap rate	Tests of Q1 vs Q4 t-test [rank sum]
1st quartile adj vacancy	0.1025 [0.0703]	0.0099 [0.0235]	-0.0128 [0.0067]	-0.0420 [-0.0168]	47.99*** [50.19]***
2nd quartile adj vacancy	0.0950 [0.0622]	0.0084 [0.0214]	-0.0143 [0.0036]	-0.0411 [-0.0188]	37.66*** [50.408]***
3rd quartile adj vacancy	0.0853 [0.0619]	0.0071 [0.0201]	-0.0141 [0.0043]	-0.0391 [-0.0183]	33.87*** [45.44]***
4th quartile adj vacancy	0.1416 [0.1042]	0.0166 [0.0301]	-0.0087 [0.0101]	-0.0450 [-0.0236]	33.65*** [46.50]***
Tests of Q1 vs Q4 t-test [rank sum]	-7.42*** [-11.45]***	-3.30*** [-5.32]***	-1.93* [-4.48]***	1.18 [0.33]	

Table contains mean NOI growth in each cell, with median growth in square brackets

Table 9 – Total returns by adjusted vacancy and adjusted cap rate quartiles					
	1st quartile adj cap rate	2nd quartile adj cap rate	3rd quartile adj cap rate	4th quartile adj cap rate	Tests of Q1 vs Q4 t-test [rank sum]
1st quartile adj vacancy	0.0731 [0.0783]	0.0807 [0.0864]	0.0806 [0.0866]	0.0808 [0.0860]	-4.81*** [-6.09]***
2nd quartile adj vacancy	0.0789 [0.0835]	0.0837 [0.0877]	0.08612 [0.0919]	0.0858 [0.0886]	-4.42*** [-4.68]***
3rd quartile adj vacancy	0.0729 [0.0772]	0.0752 [0.0775]	0.07996 [0.0814]	0.0863 [0.0902]	-8.41*** [-8.41]***
4th quartile adj vacancy	0.0580 [0.0621]	0.0722 [0.0767]	0.07314 [0.0754]	0.0774 [0.0820]	-10.30*** [-10.30]***
Tests of Q1 vs Q4 t-test [rank sum]	9.41*** [9.29]***	6.24*** [6.18]***	4.88*** [4.39]***	1.78* [2.16]**	
Table contains mean total return (annualized, over five years) in each cell, with median in square brackets					

Table 10 – Regression of five-year total returns on adjusted vacancy and adjusted cap rate			
	(1)	(2)	(3)
Constant	0.0775 [323.93]***	0.0770 [320.66]***	0.0771 [321.14]***
Adj cap rate	0.2291 [23.39]***		0.1349 [12.22]***
Adj vacancy		-0.0545 [-27.14]***	-0.0416 [-18.37]***
Adj Vacancy squared			
Adj cap X adj vac			
Adj R2	0.0059	0.0079	0.0095
N	92554	92554	92554

Table 11 – Income returns by adjusted vacancy and adjusted cap rate quartiles

	1st quartile adj cap rate	2nd quartile adj cap rate	3rd quartile adj cap rate	4th quartile adj cap rate	Tests of Q1 vs Q4 t-test [rank sum]
1st quartile adj vacancy	0.0636 [0.0636]	0.0672 [0.0652]	0.0706 [0.0689]	0.0766 [0.0750]	-20.53*** [-24.75]***
2nd quartile adj vacancy	0.0617 [0.0602]	0.0644 [0.0624]	0.0679 [0.0666]	0.0731 [0.0704]	-21.16*** [-25.72]***
3rd quartile adj vacancy	0.0616 [0.0600]	0.0645 [0.0630]	0.0681 [0.0664]	0.0743 [0.0700]	-22.08*** [-27.19]***
4th quartile adj vacancy	0.0562 [0.0563]	0.0645 [0.0627]	0.0671 [0.0651]	0.0703 [0.0675]	-25.03*** [-25.75]***
Tests of Q1 vs Q4 t-test [rank sum]	13.88*** [18.35]***	7.71*** [8.37]***	7.73*** [8.94]***	8.97*** [12.30]***	

Table contains mean income return (annualized, over five years) in each cell, with median in square brackets

Table 12 –Appreciation returns by adjusted vacancy and adjusted cap rate quartiles					
	1st quartile adj cap rate	2nd quartile adj cap rate	3rd quartile adj cap rate	4th quartile adj cap rate	Tests of Q1 vs Q4 t-test [rank sum]
1st quartile adj vacancy	0.0090 [0.0113]	0.0130 [0.0179]	0.0097 [0.0138]	0.0041 [0.0073]	3.35*** [2.35]**
2nd quartile adj vacancy	0.0165 [0.0192]	0.0185 [0.0228]	0.0174 [0.0231]	0.0122 [0.0147]	2.96*** [2.78]***
3rd quartile adj vacancy	0.0109 [0.0142]	0.0103 [0.0111]	0.0114 [0.0122]	0.0116 [0.0154]	-0.50 [-0.87]
4th quartile adj vacancy	0.0017 [0.0024]	0.0075 [0.0096]	0.0058 [0.0081]	0.0068 [0.0115]	-2.92*** [-3.36]***
Tests of Q1 vs Q4 t-test [rank sum]	4.98*** [4.77]***	4.26*** [4.18]***	2.70*** [2.45]**	-1.55 [-1.48]	

Table contains mean appreciation return (annualized, over five years) in each cell, with median in square brackets

Table 13 – Capital expenditure as percentage of market value, by adjusted vacancy and adjusted cap rate quartiles

	1st quartile adj cap rate	2nd quartile adj cap rate	3rd quartile adj cap rate	4th quartile adj cap rate	Tests of Q1 vs Q4 t-test [rank sum]
1st quartile adj vacancy	.0911642 [.0526095]	.0721407 [.0477086]	.0718193 [.0492072]	.1070154 [.0632141]	-1.19 [-8.24]***
2nd quartile adj vacancy	.0842679 [.0499397]	.0775868 [.051151]	.0800199 [.0535904]	.1211741 [.0677776]	-2.11** [-13.52]***
3rd quartile adj vacancy	.1048562 [.0681822]	.0903551 [.0624217]	.0904373 [.0652139]	.126058 [.078976]	-1.91* [-6.78]***
4th quartile adj vacancy	.14411 [.0965993]	.1096059 [.0798478]	.120234 [.0806225]	.1687153 [.0976119]	-2.24** [0.33]
Tests of Q1 vs Q4 t-test [rank sum]	-11.12*** [-28.08]***	-13.27*** [-29.45]***	-12.33*** [-24.67]***	-3.33*** [-17.91]***	

Average [median in brackets], across properties of total capex over next five years divided by beginning MV (e.g. $(\sum_1^{20} capex_{t+i})/MV_t$)

Table 14 - Cross-sectional Standard deviation of total returns within adjusted vacancy/adjusted cap rate quartiles					
	1st quartile adj cap rate	2nd quartile adj cap rate	3rd quartile adj cap rate	4th quartile adj cap rate	F-test of equality of variances, quartile 1 vs quartile 4
1st quartile adj vacancy	0.0754	0.0652	0.0666	0.0801	0.8862***
2nd quartile adj vacancy	0.0700	0.0678	0.0698	0.0781	0.8030***
3rd quartile adj vacancy	0.0681	0.0655	0.0684	0.0749	0.8272***
4th quartile adj vacancy	0.0791	0.0733	0.0757	0.0825	0.9199**
F-test of equality of variances, quartile 1 vs quartile 4	0.9094***	0.7931***	0.7741***	0.9440*	
Each cell is cross-sectional standard deviation of total returns (annualized, over five years) across properties within that cell					