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Explaining the Puzzle of High Apartment Returns

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About NMHC

Based in Washington, DC, the National Multifamily Housing Council (NMHC) is a national association representing the interests of the larger and most prominent apartment firms in the U.S. NMHC's members are the principal officers of firms engaged in all aspects of the apartment industry, including ownership, development, management and financing. NMHC advocates on behalf of rental housing, conducts apartment related research, encourages the exchange of strategic business information and promotes the desirability of apartment living. Nearly one-third of Americans rent their housing, and almost 15 percent live in an apartment (buildings with five or more units).

For more information, contact NMHC at 202/974-2300, e-mail the Council at info@nmhc.org, or visit NMHC's Web site at www.nmhc.org

About the NMHC Research Foundation

In 2016, NMHC formed a non-profit (501(c)(3)) Research Foundation to produce research that will further support the apartment industry's business interests. The work supported by the NMHC Research Foundation raises the industry's standard of performance and encourage worldwide investment in the sector.

The NMHC Research Foundation funds unique and original research on a wide range of topics, including issues related to development and redevelopment activity, affordable and workforce housing, demographics, tax policy, regulatory environment and zoning and land use, among others. For more information, visit www.nmhc.org/Research-Foundation.

About the Authors

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Executive Summary

This research seeks to understand what market attributes impact holding period returns at the time of property acquisition. We analyze *ex-post* National Council of Real Estate Investment Fiduciaries (NCREIF) property holding period returns with a focus on the importance and impact of *ex-ante* property purchase assumptions at the time of property acquisition.

Our analysis begins with generating property holding period returns using MSA-level NCREIF Property Index (NPI) data, computing holding period returns by property type, by region of the U.S., and MSA employment size/growth. We find that commercial real estate returns mean-revert with longer-holding period analyses providing higher risk-adjusted returns. The holding period analysis also reveals that apartment returns dominate the other property type returns based on un-adjusted returns, risk-adjusted returns, returns by geographic region, and returns by MSA employment size/growth.

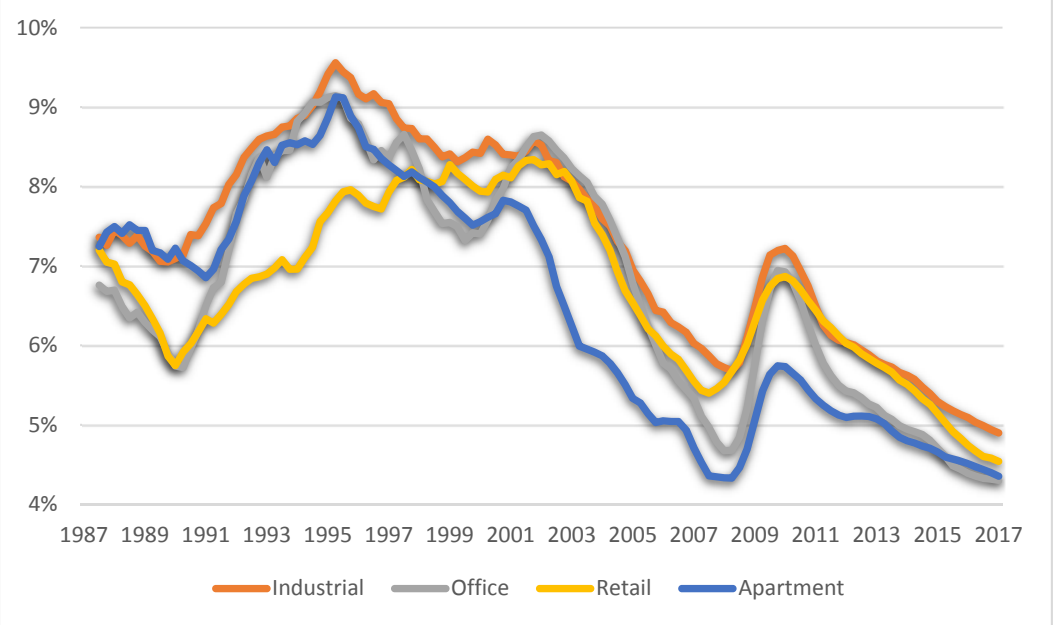
With *ex-post* holding period returns in hand, we then focus on the importance and impact of *ex-ante* property purchase assumptions at the time of property acquisition on *ex-post* apartment property holding period returns. The results reveal that the ex-post holding period returns can be predicted by the ex-ante economic and real estate market conditions.

We find that investment return attributes of real return, bond rate spreads, and inflation positively and significantly impact property holding period returns, while tightening debt underwriting standards and increasing debt availability negatively and significantly impact property holding period returns. Space market attributes impact investment returns as expected. Estimating *ex-post* holding period returns based on *ex-ante* pricing inputs in this paper provides insights and a deeper understanding on the efficiency and rationality of commercial real estate pricing.

Introduction

Real estate investors use a combination of property income and expected income growth to value commercial real estate. Over the past several decades, property capitalization rates (cap rates), a proxy for property income returns have compressed. This cap rate compression has increased property values to all-time highs as property cap rates plumb all-time lows, with property cap rates falling below 5.0% across all property types (see Exhibit 1). This indicates that investors are willing to pay more for each dollar of income generated from property assets.

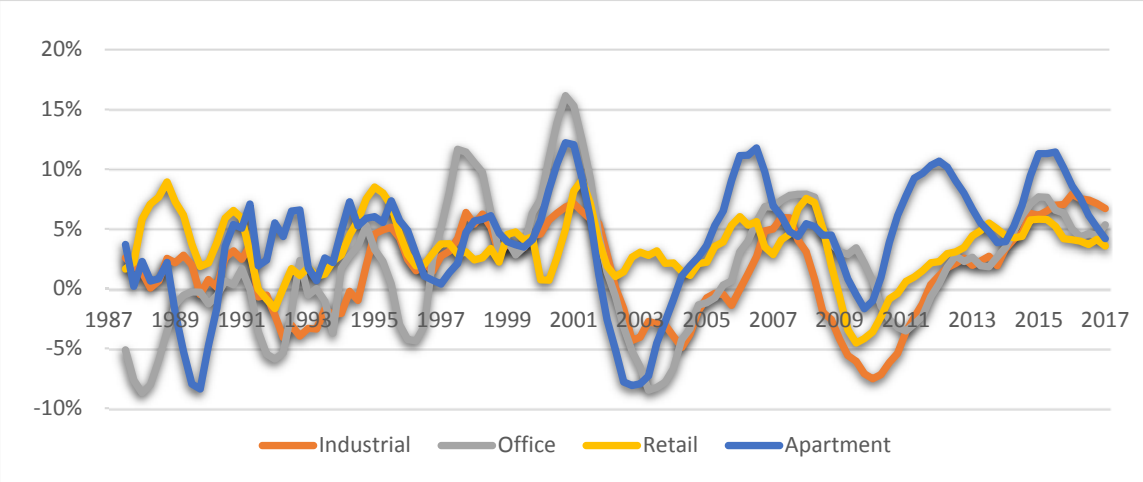
Exhibit 1: NCREIF Cap Rates by Property Type (1987-2Q 2017)



Data Source: National Council of Real Estate Investment Fiduciaries (NCREIF)

The increase in commercial real estate asset prices since 2010 is similar to that of other asset classes and has created asset bubble concerns from some debt providers, equity investors, and bank regulators, with focused concern on apartment property valuations. However, since the Great Recession, property income has grown solidly as well, particularly for apartment properties (see Exhibit 2), providing partial justification for the rise in property values. As property total holding period returns are a function of property income (the cap rate) and expected property income growth (i.e. *IRR = cap rate* + income *growth rate*), current low cap rates may be justified if increased in income growth rates are sustained.[1]

Exhibit 2: NCREIF NOI Growth Rate by Property Type (1987-2Q 2017)



Data Source: National Council of Real Estate Investment Fiduciaries (NCREIF)

To understand property holding period returns, it is necessary to understand the set of ex-ante purchase assumptions that real estate acquisition professionals make at the time of property purchase. The most important and most observable purchase measure is the property cap rate, a static valuation metric capitalizing expected property net operating income. The purchase cap rate is directly impacted by the risk and growth profile of the property space market. However, investors trade off current property yield for future income growth and income stream safety. In combination, the property income return and capital appreciation return are the two components of a property's holding period return.

The purpose of this research is to estimate property holding period returns and analyze the importance and impact of the property cap rate and expected income growth rate at the time of property purchase. Two discrete steps are completed in this research. First, we calculate holding period returns for the NCREIF Property Index (NPI) commercial real estate data series and its subcomponents. Second, using the calculated holding period returns from the first step, we estimate *ex-post* property holding period returns using *ex-ante* cap rate and growth rate attributes. Estimating *ex-post* holding period returns based on *ex-ante* pricing inputs provides insights and a deeper understanding of the efficiency of commercial real estate pricing.

Comparison of Holding Period Returns

NCREIF Property Index (NPI) [2]

The primary data source for this research is the MSA-level NPI data which includes quarterly property income and appreciation returns for the period 1978-2Q 2017. Prepared by the National Council of Real Estate Investment Fiduciaries (NCREIF), this index is the longest running commercial property return series in the U.S. As of Q2 2017 the NPI maintains 7,161 properties with a market value of $539 billion. The NPI is a total return index of privately held commercial real estate properties owned by tax-exempt institutional investors.

NPI returns are reported on an unlevered basis and have maintained a 9.26% total return over the 39.5 years since inception. The 2Q 2017 allocation of the NPI by property type is: office (36.7%), apartment (24.4%), retail (23.8%), and industrial (14.2%) with the remaining being hotel investments. Hotel returns are not included in our analysis as there are several quarters where some of the NCREIF regions did not report hotel investment returns making analysis comparisons difficult. The market value of the NPI by region is: West (38.4%), East (33.2%), South (19.8%), and Midwest (8.6%).[3]

While the NPI maintained property return data as early as 1978, prior to 1987, non-taxable institutional investors (i.e. NCREIF members) had a difficult time competing with taxable private investors in tax-preferred apartment investments, limiting the number of apartment properties in the NCREIF portfolio. In 1986, the aggregate market value of the NPI apartment investments was only $500 million and accounted for just 2.7% of the $18.8 billion NCREIF portfolio. Moreover, from 1978-1981 apartment investment in the NCREIF index did not exceed $100 million. The low number and value of apartment properties in the NPI greatly limits our ability to disaggregate the data into geographic or other property market subcategories.

However, since 1986, apartment investment as reported in the NPI maintained large increases in terms of the share of the NPI and absolute dollar amount, which allows us to comfortably use the NPI data in this research beginning 1Q 1987. At the end of 2016, the value of the apartments in the NPI totaled $128 billion. As such, the data analysis period for this study is the 30-years from 1987-2016.

Property Type Comparison

NPI property income and capital appreciation data are reported for 42 MSA's across the four property types for the 30-year period from 1987-2016. Exhibit 3 presents the one-, three-, five-, seven-, 10- and 15-year average annual holding period returns for the total NPI index and for each property type. Holding period returns for the entire index range from 7.79% to 8.71% across various holding periods. Holding period returns are calculated on a rolling basis. For example, five-year holding period returns are calculated for sequential five-year return horizons quarter-

after-quarter.[4] After all five-year holding period returns are computed for the 30-year analysis horizon from 1987 to 2016, the average of those holding period returns is reported. Not surprisingly, as property holding periods lengthen, return standard deviations decline as property returns tend to mean-revert.

Exhibit 3: Comparison of Holding Period Returns by Property Type (1987-2016)

*(Best performing property type by category are in **bold**)*

	1-year Holding Period			3-year Holding Period		
Property Type	Mean	S.D.	Sharpe Ratio	Mean	S.D.	Sharpe Ratio
All	8.20%	7.94%	0.58	7.98%	6.19%	0.58
Apartment	9.18%	7.38%	0.75	**9.07%**	**5.27%**	**0.89**
Industrial	8.83%	8.19%	0.64	8.49%	6.59%	0.62
Office	7.08%	9.70%	0.36	6.93%	7.80%	0.32
Retail	**9.36%**	**7.26%**	**0.79**	9.06%	5.85%	0.80
	5-year Holding Period			**7-year Holding Period**		
Property Type	Mean	S.D.	Sharpe Ratio	Mean	S.D.	Sharpe Ratio
All	7.79%	4.73%	0.58	7.87%	3.56%	0.62
Apartment	**8.97%**	**3.74%**	**1.05**	**9.05%**	**2.81%**	**1.21**
Industrial	8.23%	5.03%	0.63	8.27%	3.75%	0.70
Office	6.79%	6.19%	0.28	6.99%	4.76%	0.28
Retail	8.73%	4.59%	0.80	8.68%	3.54%	0.85
	10-year Holding Period			**15-year Holding Period**		
Property Type	Mean	S.D.	Sharpe Ratio	Mean	S.D.	Sharpe Ratio
All	8.39%	2.47%	0.89	8.71%	1.33%	1.24
Apartment	**9.35%**	**1.98%**	**1.59**	**9.62%**	**1.04%**	**2.45**
Industrial	8.83%	2.44%	1.08	9.13%	1.22%	1.71
Office	7.72%	3.20%	0.48	8.01%	1.91%	0.50
Retail	9.02%	2.64%	1.07	9.46%	1.46%	1.65

Data Source: National Council of Real Estate Investment Fiduciaries (NCREIF)

Exhibit 3 reveals apartment holding period returns dominate the other property types across all holding period returns, standard deviations, and Sharpe ratios other than for one-year holding period. (The Sharpe ratio is the average return minus the risk-free rate divided by standard deviation of the investment return. A higher Sharpe ratio indicates a higher return per unit of risk.) Apartment holding period returns range from 8.97% to 9.62%, with risk-adjusted Sharpe ratios of 0.75-2.45. The average holding period return for the other three property types (industrial, office, and retail) had a range of 6.79-9.46% with Sharpe ratios ranging from 0.28-1.65.

Exhibits 4-7 graph the holding period returns for the three, five, seven and 10 year holding periods by property type. They reveal apartment holding period returns are generally higher than other property types with a lower variance, which is more easily seen in the three and five-year graphs (Exhibits 4 and 5). In Exhibit 7, the graph of 10-year holding period returns, return variance narrows across all property types as property returns mean-revert, which reveals that over time property returns revert to an equilibrium level, as such return volatility in Exhibit 7 is much

lower than return volatilities in Exhibits 4-6. The mean-reverting behavior of real estate is important for investors to consider as most investors in commercial real estate have a long-term investment horizon and should consider the risk/return profile for their chosen holding period.

Exhibit 4: 3-Year Holding Period Returns (1987-2016)

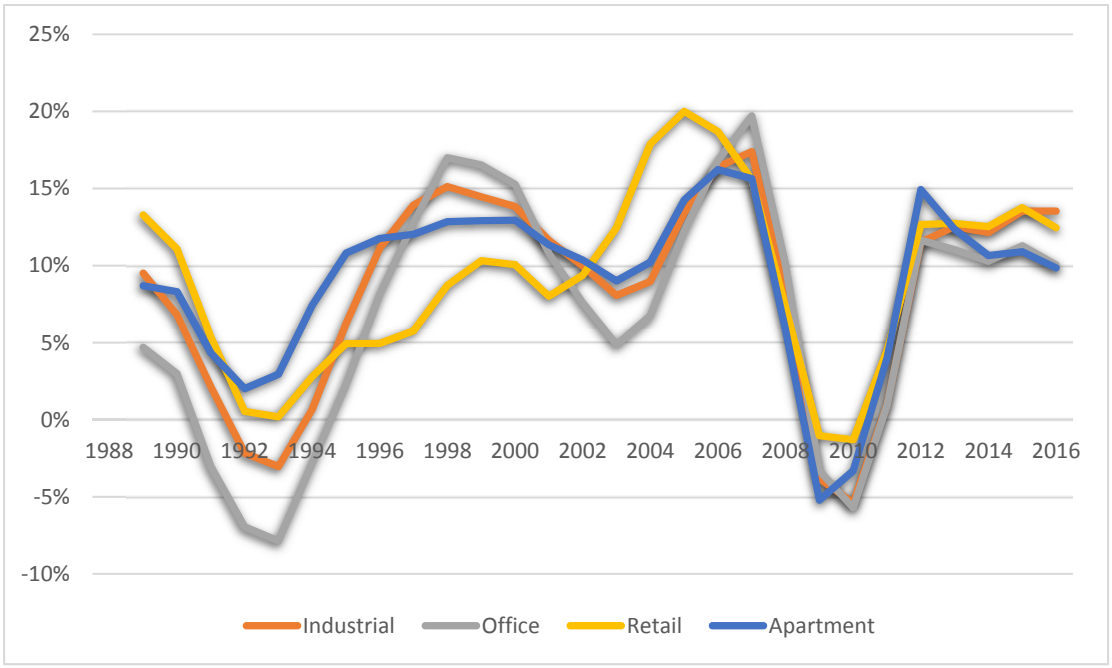


Exhibit 5: 5-Year Holding Period Returns (1987-2016)

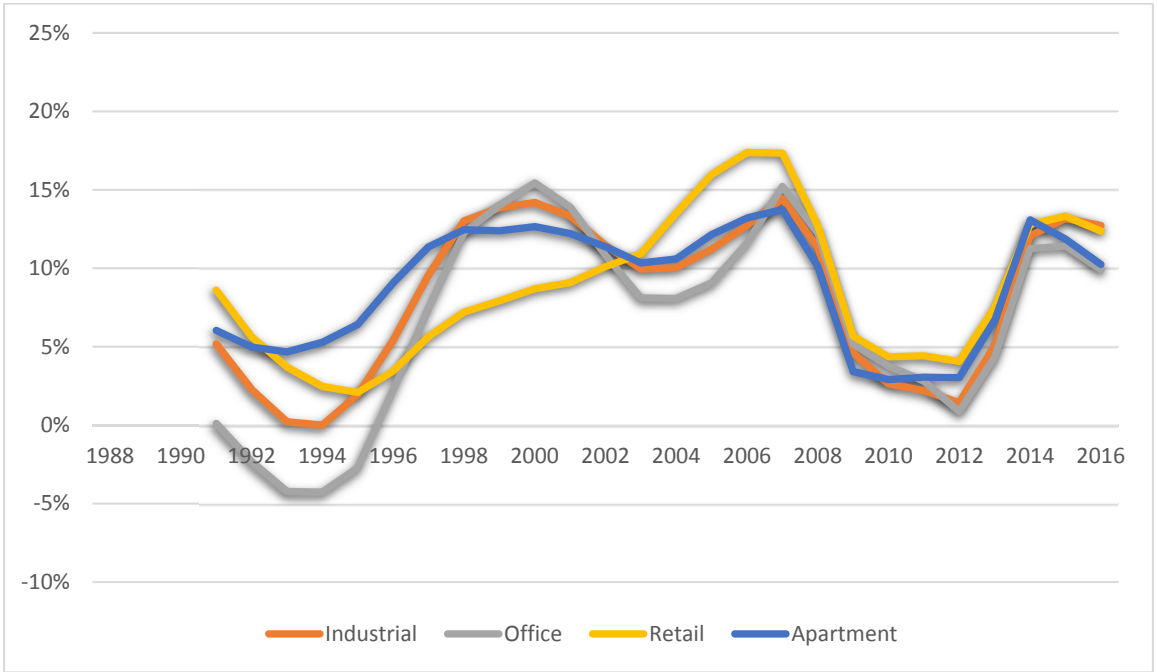


Exhibit 6: 7-Year Holding Period Returns (1987-2016)

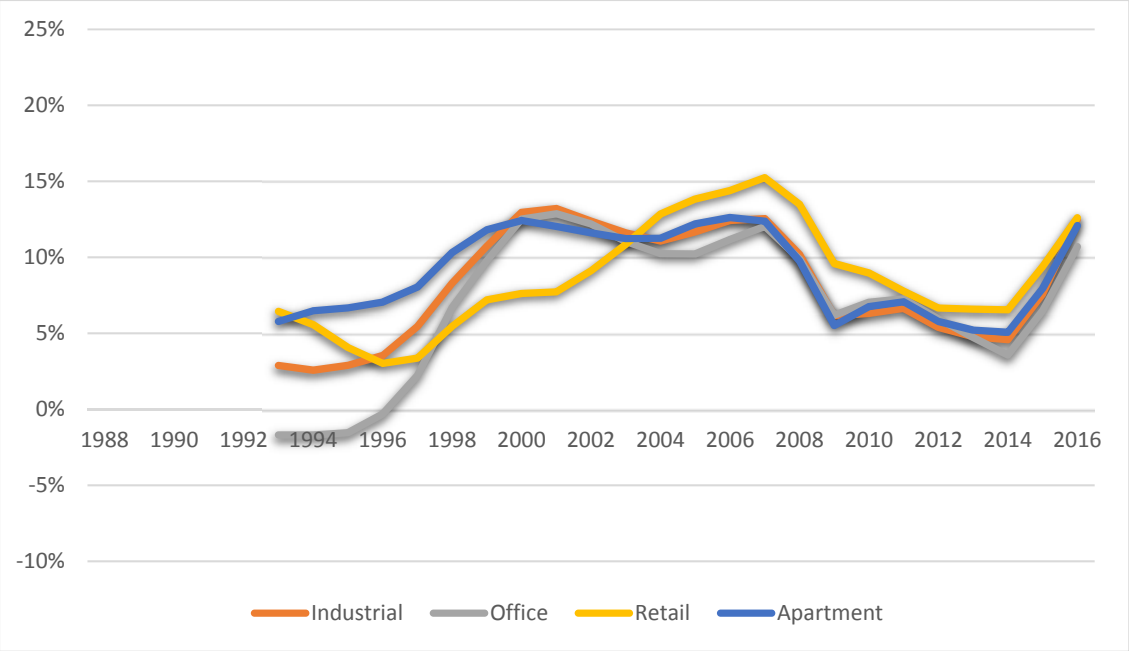
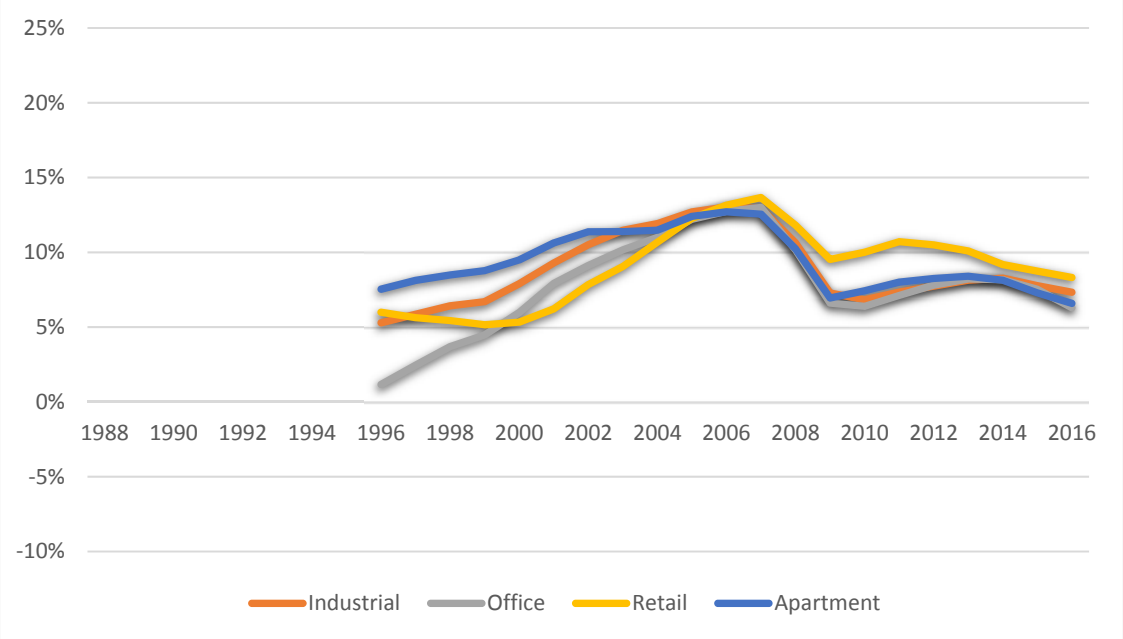


Exhibit 7: 10-Year Holding Period Returns (1987-2016)



Of note, seven- and 10-year apartment holding period returns remained above 5.0% across all holding periods analyses, including the Great Recession. Conversely, office seven-year office property holding period returns provided several negative return observations. None of the property types had negative 10-year holding period returns. Importantly, all property types across all 10-year holding periods maintained a 5% or higher investment holding period return, with the exception of a few data points. In summary, the mean-reverting nature of property

returns suggests that real estate is a low volatility investment that provides roughly an 8.5% return, with a Sharpe Ratio approaching 1.0. Apartment property returns and risk-adjusted returns outperformed other property types.

Regional Property Comparison

Exhibit 8 disaggregates holding period returns by NCREIF-defined regions of the United States. The purpose of this analysis is to determine if property returns and risk-adjusted returns vary regionally, where we limit our holding period return analyses to five-, seven- and 10-year holding periods. Across the four regions of the U.S, apartment holding period returns and risk-adjusted returns dominate the other property types, with average unadjusted returns ranging 8.60-10.27% and with risk adjusted Sharpe ratios ranging 0.85-1.93 across the five-, seven-, and 10-year holding periods. The South and Midwest regions provided lower investment returns and the West region had higher returns. Across all regions and holding periods apartment returns exceeded 8.6%, revealing stable and solid returns.

EAST

	5-year Holding Period			7-year Holding Period			10-year Holding Period		
Property Type	Mean	S.D.	Sharpe Ratio	Mean	S.D.	Sharpe Ratio	Mean	S.D.	Sharpe Ratio
Apartment	**9.00%**	**4.63%**	**0.85**	**9.15%**	3.84%	**0.91**	**9.59%**	2.94%	**1.16**
Industrial	8.04%	5.06%	0.59	8.15%	3.97%	0.63	8.70%	**2.69%**	0.93
Office	7.61%	6.11%	0.42	7.90%	4.87%	0.46	8.64%	3.41%	0.72
Retail	8.59%	4.68%	0.76	8.54%	**3.61%**	0.80	8.86%	2.76%	0.97

MIDWEST

	5-year Holding Period			7-year Holding Period			10-year Holding Period		
Property Type	Mean	S.D.	Sharpe Ratio	Mean	S.D.	Sharpe Ratio	Mean	S.D.	Sharpe Ratio
Apartment	**8.69%**	**3.42%**	**1.06**	**8.77%**	2.54%	**1.22**	**8.93%**	**1.76%**	**1.56**
Industrial	6.91%	3.95%	0.47	6.88%	2.85%	0.43	7.25%	1.87%	0.57
Office	4.85%	4.99%	-0.04	5.03%	3.79%	-0.17	5.63%	2.43%	-0.23
Retail	8.04%	3.61%	0.83	7.95%	**2.53%**	0.91	8.16%	**1.76%**	1.11

SOUTH

	5-year Holding Period			7-year Holding Period			10-year Holding Period		
Property Type	Mean	S.D.	Sharpe Ratio	Mean	S.D.	Sharpe Ratio	Mean	S.D.	Sharpe Ratio
Apartment	**8.60%**	**3.46%**	**1.02**	**8.69%**	**2.32%**	**1.31**	**8.88%**	**1.57%**	**1.71**
Industrial	6.16%	**3.46%**	0.32	6.51%	2.80%	0.30	6.87%	1.92%	0.35
Office	5.83%	6.23%	0.12	6.07%	4.62%	0.09	6.75%	2.99%	0.19
Retail	8.50%	4.37%	0.79	8.44%	3.30%	0.84	8.71%	2.45%	1.03

WEST									
	5-year Holding Period			7-year Holding Period			10-year Holding Period		
Property Type	Mean	S.D.	Sharpe Ratio	Mean	S.D.	Sharpe Ratio	Mean	S.D.	Sharpe Ratio
Apartment	**9.90%**	**4.16%**	**1.16**	**9.93%**	**3.12%**	**1.37**	**10.27%**	**2.11%**	**1.93**
Industrial	9.24%	5.88%	0.71	9.27%	4.47%	0.81	9.96%	2.92%	1.29
Office	7.11%	7.13%	0.29	7.20%	5.40%	0.29	8.04%	3.58%	0.51
Retail	9.24%	5.37%	0.78	9.24%	4.32%	0.83	9.69%	3.21%	1.09

Data Source: National Council of Real Estate Investment Fiduciaries (NCREIF)

Regional holding period returns for industrial, office, and retail property types maintained lower returns than apartment returns with higher standard deviations across all regions. Overall, the non-apartment holding period return average was in the high 7.0% range, but there were exceptions. Office property holding period returns were in the 5.0-6.0% return range for the Midwest and South, underperforming other property types.

Non-apartment property types maintained Sharpe ratios that ranged 0.28-1.65, with Sharpe ratios for office properties in the Midwest and South approaching zero and with several negative observations. The narrow return band and consistent level of investment returns across geographic regions reveals that institutional investment in commercial real estate provides consistent returns with low volatility, it also suggests that geographic diversification is unlikely to provide much benefit.

Comparison by Employment and Employment Growth

Analyzing holding period returns by employment size/growth attempts to answer the question: "Do high growth/low cap rate markets outperform low growth/high cap rate markets?" Beracha, Downs and MacKinnon (2017) find that high cap rate properties outperform low cap rate properties after controlling for location, property type, and time.[5] Using NPI data disaggregated to the property level, they find that high cap rate (value) properties earn higher returns compared with low cap rate (growth) properties, and outperform low cap rate properties on a risk-adjusted basis. They find that the return differential is statistically significant, economically meaningful, and holds across property types and over the real estate cycle.

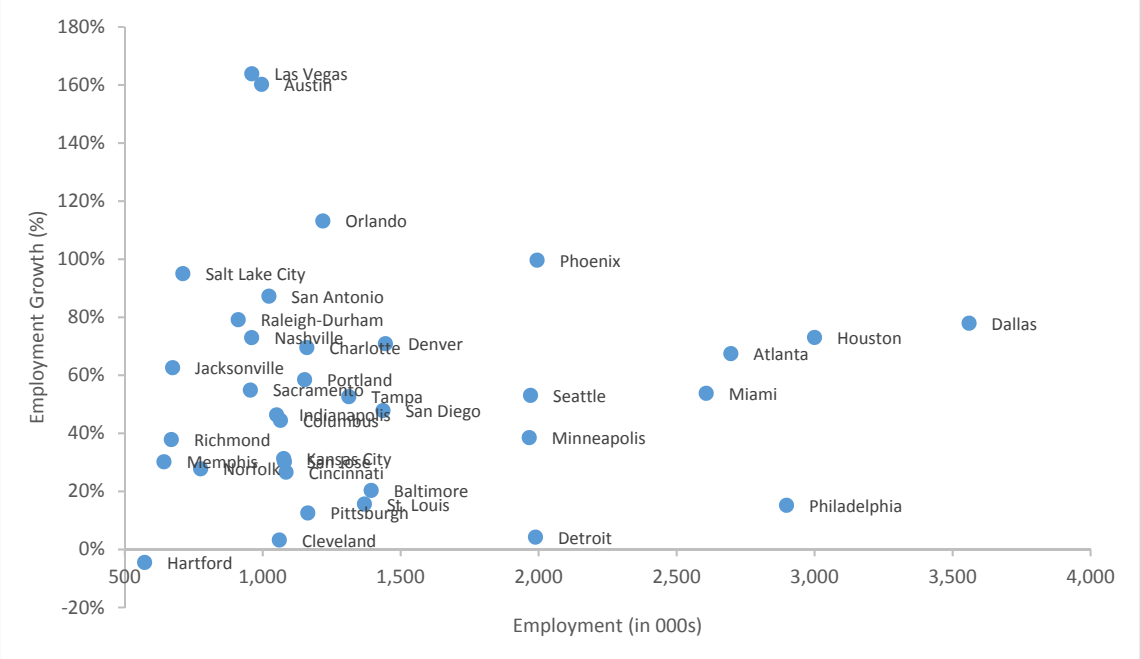
Different from the Beracha, Downs, and MacKinnon where they compare low and high cap rate properties *within* a market, we use a tiering system to compare large employment/high employment growth markets (arguably low cap rate markets) with low employment/slow employment growth markets (arguably high cap rate markets). If the commercial real estate markets are efficient, property cap rates in the large, high growth markets will be lower than those in small, slow growth markets to offset slower income growth rates (i.e. property capital appreciation) and higher liquidity risk premiums attributable to fewer market participants in the small/slow growth markets.

Categorizing markets by employment size and growth is a proxy for measuring property income growth potential and market liquidity. Many market participants look at expected employment growth to assess the strength of a MSA's property market growth potential and ascribe lower

cap rates to markets with higher expected employment growth. For example, most investors model higher property appreciation rates (and arguably lower cap rates) for Austin, which had a 160% employment growth over the past 27 years, relative to that of Hartford, CT which had an employment loss of 4% over that same period (and arguably higher cap rates).

Also, large metropolitan areas generally have a lower liquidity risk embedded in purchase cap rates, as a larger and more diverse set of debt and equity providers participate in those markets making them more liquid and thus reducing the investment liquidity premium embedded in property cap rates, all else equal (consider the range of debt and equity investors in NYC versus Memphis).

Exhibit 9: Employment (2016) vs. Employment Growth (1990-2016)



Data Source: Bureau of Labor Statistics

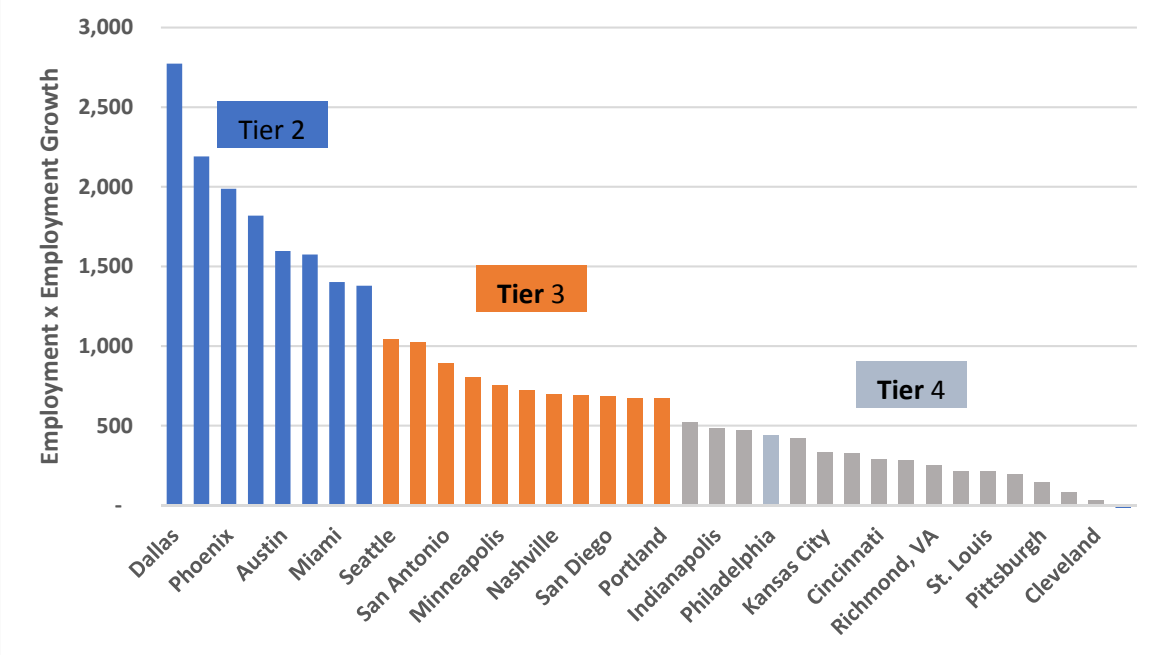
Real Capital Analytics identifies the largest and most liquid real estate markets in the United States as their Major Metropolitan Six Markets (MM6), which include Boston, Chicago, Los Angeles, New York, San Francisco, and Washington, DC. From there we categorize the remaining NPI markets using metropolitan area, non-farm employment levels in 2016 and non-farm employment growth for the period 1990-2016, which is plotted in Exhibit 9 (excluding the MM6 cities).

The exhibit reveals that there exists a wide range of MSA employment levels and growth rates for the NCREIF MSAs. Austin and Las Vegas are the fast-growing employment markets have grown by over 160% in the last 27 years, while Houston, Dallas, and Philadelphia, are the largest non-MM6 employment markets, all with 2.9 million or more non-farm employees in 2016.

To further clarify the data in Exhibit 9, in Exhibit 10 we present the results of interacting (multiplying) the MSA employment levels in 2016 with employment growth rates for the period 1990-

2016 to create an employment size/growth index.[6] There are several natural breaks in the index data presented in Exhibit 10, at approximately 600 and 1200. As such, we delineate NPI markets into Tiers 1-4, where the MM6 are the Tier 1 cities, tier 2 cities are those maintaining an index value of greater than 1200, Tier 3 cities have a 600-1200 index value, and Tier 4 cities are the rest. The results of such an analysis should reveal the impact of lower cap rates (proxied by high growth/large MSAs that likely maintain higher capital appreciation rates and lower liquidity premiums) compared with higher cap rates (proxied by slower employment growth/smaller MSAs) on property holding period returns.

Exhibit 10: Interaction of Employment and Employment Growth



Analyzing the five-, seven-, and 10-year holding period returns by MSA employment size/growth and property type, apartment holding period returns and risk adjusted returns are highest across all tiers, with the exception of Tier 2 where five- and 10-year retail returns were five basis points higher than apartment returns (see Exhibit 11). Anecdotally, it appears as if investors like the liquidity of large MM6 markets and then look for growth in the Tier 3 markets as the Tier 3 markets outperform both the Tier 2 and Tier 4 markets by about 75-90 basis points across property types and holding periods. Holding period returns for Tier 4 markets echo those of Tier 2.

Exhibit 11: Comparison of Holding Period Returns by Tier (1987-2016)
(Best performing property type by category are in bold)

Tier 1

	5-year Holding Period			7-year Holding Period			10-year Holding Period		
Property Type	Mean	S.D.	Sharpe Ratio	Mean	S.D.	Sharpe Ratio	Mean	S.D.	Sharpe Ratio
Apartment	**9.53%**	5.32%	**0.84**	**9.63%**	4.36%	**0.91**	**10.18%**	3.24%	**1.23**
Industrial	8.52%	5.53%	0.63	8.54%	4.26%	0.68	9.20%	**2.82%**	1.07
Office	7.37%	6.43%	0.36	7.57%	5.05%	0.38	8.34%	3.46%	0.62
Retail	9.15%	**4.92%**	0.83	9.14%	**3.92%**	0.89	9.53%	2.99%	1.11

Tier 2

	5-year Holding Period			7-year Holding Period			10-year Holding Period		
Property Type	Mean	S.D.	Sharpe Ratio	Mean	S.D.	Sharpe Ratio	Mean	S.D.	Sharpe Ratio
Apartment	8.62%	**3.44 %**	**1.03**	**8.70%**	**2.29%**	**1.33**	8.88%	**1.53%**	**1.75**
Industrial	7.39%	4.85%	0.48	7.51%	3.42%	0.54	7.96%	2.15%	0.82
Office	5.84%	6.33%	0.12	6.07%	4.70%	0.09	6.78%	3.09%	0.19
Retail	**8.69%**	4.73%	0.77	8.61%	3.69%	0.80	**8.93%**	2.69%	1.02

Tier 3

	5-year Holding Period			7-year Holding Period			10-year Holding Period		
Property Type	Mean	S.D.	Sharpe Ratio	Mean	S.D.	Sharpe Ratio	Mean	S.D.	Sharpe Ratio
Apartment	**9.54%**	**3.46%**	**1.29**	**9.62%**	**2.39%**	**1.66**	**9.82%**	**1.47%**	**2.47**
Industrial	8.67%	4.34%	0.83	8.74%	3.24%	0.95	9.24%	2.13%	1.43
Office	6.27%	6.35%	0.19	6.43%	4.85%	0.16	7.23%	3.23%	0.32
Retail	8.94%	4.52%	0.86	9.00%	3.62%	0.92	9.39%	2.78%	1.15

Tier 4

	5-year Holding Period			7-year Holding Period			10-year Holding Period		
Property Type	Mean	S.D.	Sharpe Ratio	Mean	S.D.	Sharpe Ratio	Mean	S.D.	Sharpe Ratio
Apartment	**8.81%**	**3.58%**	**1.05**	**8.91%**	**2.81%**	**1.16**	**9.15%**	**2.14%**	**1.39**
Industrial	7.79%	4.82%	0.57	7.80%	3.54%	0.60	8.32%	2.32%	0.92
Office	5.73%	5.45%	0.12	5.76%	3.88%	0.03	6.30%	2.33%	0.05
Retail	8.50%	4.31%	0.80	8.45%	3.11%	0.90	8.78%	2.25%	1.15 g

Data Source: National Council of Real Estate Investment Fiduciaries (NCREIF)

Overall, holding period returns do not reveal a clear trend of large/high employment growth markets out (or under) performing small/low growth markets, revealing that market participants price real estate using lower cap rates in higher growth market and higher cap rates in lower growth markets. However, apartment holding period return performance is noteworthy. Across most all tiers and holding period analyses, apartment outperform other property types in terms of both holding period returns and risk adjusted returns.

Holding Period Returns by Income and Capital Appreciation

Quarterly NPI returns are reported for both property income and capital appreciation. In this final analysis of holding period returns we focus on seven-year holding period returns for the entire NPI where we find that the income return component accounted for 7.38% of the 7.87% total return with the capital appreciation component generating 0.48% of the index return.

Exhibit 12 reveals the seven-year holding period income and capital appreciation returns for each of the four property types. Holding period income returns were roughly between 7.0% and 8.0% with apartments having the lowest income return across the four property types. These income returns were much as expected as property cap rates are lower for apartments across most years (see Exhibit 1).

Capital appreciation returns were lower than expected and varied widely across property types with several property types maintaining negative average capital appreciation rates. Specifically, the office sector maintained negative capital appreciation returns and industrial properties provided a slightly positive appreciation return of 0.30%. Apartments and retail property types had property appreciation rates of 1.97% and 1.33% respectively.

Exhibit 12: Income vs. Capital Appreciation Returns (7-Year Holding Period)
(Best performing property type by category are in bold)

Property Type	Income Return	Capital Return	Total
All	7.37%	0.48%	7.87%
Apartment	6.98%	**1.97%**	**9.05%**
Industrial	**7.96%**	0.30%	8.27%
Office	7.44%	-0.43%	6.99%
Retail	7.29%	1.33%	8.68%

Data Source: National Council of Real Estate Investment Fiduciaries (NCREIF)

The low-to-negative property appreciation rates for office and industrial property types were not expected. Property cap rates averaged 6.8% in 1987 and 5.1% in 2016 suggesting that across the 30-year analysis property values should have increased handsomely. Additionally, increasing property NOIs, as revealed in Exhibit 2, also should have pushed property values higher. Combining falling cap rates and rising property NOIs, capital appreciation rates should be positive and large.

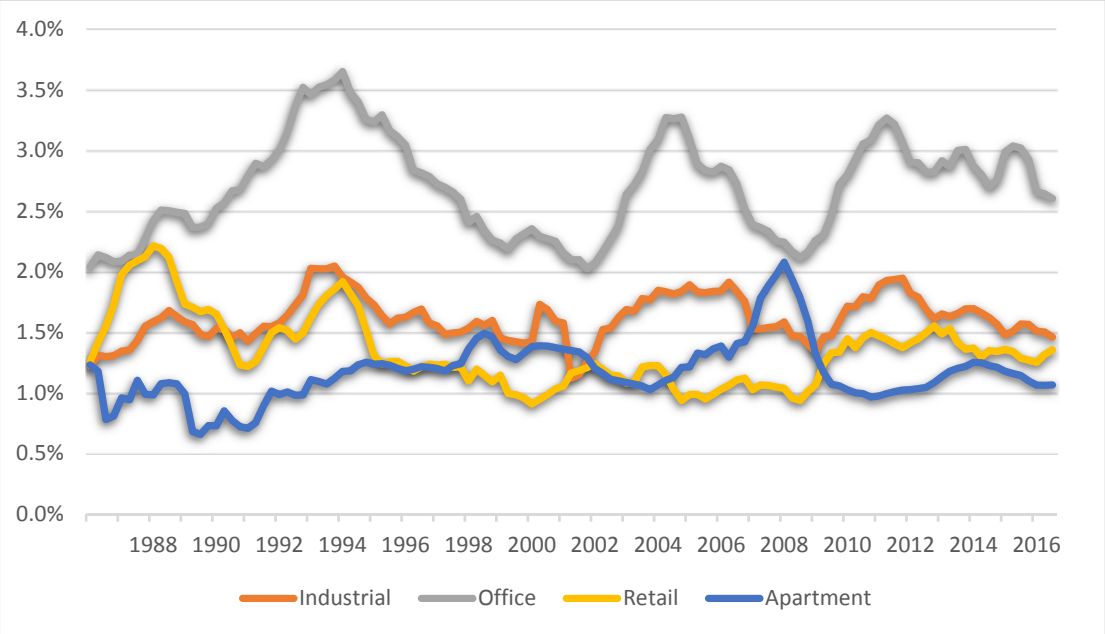
Research by Young, Fisher, and D'Alessandro (2017) reveal that NPI capital appreciation rates are significantly impacted by capital expenditures, as property capital expenditures reduce capital return rates in the NPI.[7] For the period 3Q 1978 to 2Q 2017 the average NPI appreciation rate was 3.2% not including the impact of capital expenditures. However, the reported NPI includes the impact of capital expenditures, which on average were 1.9% of market value, providing only a 1.3% capital appreciation rate for the 3Q 1978-2Q 2017 period. In short, capital expenditures reduced capital appreciation rates by 60%.

Since 2001 NCREIF collected detail information on property capital expenditures where they segment capital expenditures into five categories: tenant improvement and leasing commissions, building improvements, building expansion, property acquisition costs, and other. As expected, the largest two capital expenditure categories are tenant improvement and leasing commissions (42% of all capital expenditures) and building improvements (33% of all capital expenditures).

Building expansions accounted for less than 5% of all capital expenditures and additional acquisition costs and other capital improvements were the remaining 20% of all capital improvements. Based on the detailed capital expenditure data, maintaining property tenancy and building capital costs, dramatically impact capital appreciation rates.

For the period 1987-2016, the analysis time frame for this research, average annualized capital expenditures were 1.99% of property market value. Removing property capital expenditures from average property holding period return reduces property holding period returns from 9.86% to 7.87% when capital expenditure costs are included. Exhibit 13 reveals capital expenditures as a percent of market value for the four major property types across time. As expected, office properties have the highest average capital expenditures as a percent of market value at 2.7%, while industrial and retail's ratio is 1.6% and 1.3% (see Exhibit 14).

Exhibit 13: Annual Capital Expenditures as a Percent of Market Value (1987-2016)



Data Source: National Council of Real Estate Investment Fiduciaries (NCREIF)

Exhibit 14: Holding Period Returns (HPR) with and without Capital Expenditures
(Best performing property type by category are in bold)

Property Type	7-Year HPR	Capital Expenditures	HPR Excluding CapEx
All	7.87%	1.99%	9.86%
Apartment	**9.05%**	**1.18%**	**10.23%**
Industrial	8.27%	1.62%	9.89%
Office	6.99%	2.72%	9.71%
Retail	8.68%	1.34%	10.02%

Data Source: National Council of Real Estate Investment Fiduciaries (NCREIF)

The property type with the lowest capital expenditure to market value is apartments at 1.2%. Even with a capital expenditure to market value rate of 1.2%, apartment capital appreciation returns averaged 1.97%. Conversely, if capital expenditures are removed from apartment capital appreciation rates, apartment market value appreciation would approach 3.2%. However, capital expenditures are necessary to secure and retain tenants and maintain and update buildings and building systems.

Anecdotal evidence reveals that many apartment market participants include in their acquisition proformas a $300-550 per unit tenant rollover cost to secure new tenants and a modest structural reserve, of say $0.15-0.50 per square foot of gross building area. Combined these capital expenditures might total $500-1,000 per unit. Based on the NPI data actual capital expenditures are closer to $1,800-2,400 for apartments with a market value of $150,000-200,000.

The difference reveals approximately a one percent understatement of property capital expenditures by market participants for apartments, the property type with the *lowest* capital expenditure to market value ratio.

As such, it appears as if investors underestimate capital expenditures at the time of acquisition. Exhibit 14 reveals property returns both before and after capital expenditures. It is noteworthy to reflect on the fact that institutional investors that provide data to NCREIF and the NPI properties are some of the highest quality assets, which means capital investment costs are likely to be lower than for value-add, smaller, older, and other more opportunistic investments.

In summary, we find that that apartments provide the lowest income return of 6.98% and the highest capital appreciation return, of 1.97%, across the four property types for the 1987-2016 investment analysis period. The low capital appreciation rates for several of the property types, especially office, are negatively impacted by property capital expenditures. However, the 1.97% average capital appreciation for apartments rate compares favorably to other property types and approximates the average inflation of 2.3% during that time horizon, anecdotally revealing that apartment investments may be a good inflation hedge.

Overall, the NPI holding period analyses presented above reveal apartment holding period returns dominate the other property types based on a range of reasonable holding period analyses, adjusting returns for risk, across geographic delineations, and accounting for employment

size/growth.[8] The relative low-volatility of apartment returns period-after-period, is likely attributable to fewer large capital expenditures from tenant improvements and leasing costs.[9] While property returns tend to mean-revert across time, it appears as if market participants under-estimate property capital expenditures, especially for office and industrial properties, a factor that investors may want to more carefully consider in future acquisitions.

Empirical Analyses of Holding Period Returns

Analysis Methodology

Most institutional investors analyze and purchase income producing property based on Internal Rate of Return (IRR) estimates, which can be represented as:

IRR = Cap Rate + Growth Rate, **(1)**

where the property IRR is only known *ex-post,* after the property holding period cash flows and asset sale price at the end of the holding period are known with certainty. However, properties are purchased with uncertainty surrounding the expected property income and income growth such that at the time of purchase, expected holding period returns are estimated as:

E(IRR) = E(Cap Rate) + E(Growth Rate) + error term, **(2)**

where *E(IRR)* is the expected holding period return at the time of acquisition, *E(Cap Rate)* is the cap rate at purchase based on expected income in the first year, and *E(Growth Rate)* is the expected growth rate.

Embedded in ex-ante property cap rates are several investment return components as follows:

E(Cap rate) = f(real rate of return, market risk premium, liquidity premium)+error term, **(3)**

where the real rate of return is the inflation-adjusted return on comparable term U.S. Treasury securities, the property risk premium is the return premium required by market participants for the systematic risk embedded in the market, and the liquidity premium is the additional return required to invest in an illiquid asset with high transaction costs.

The property income growth rate is largely a function of local space market attributes and inflation. Local space market characteristics that separately, or in combination (interactively), proxy for growth include market occupancy rates, market rent growth, and job growth. Price inflation at the national level also impacts expectations of property rent growth at the local level, where expected property income growth rate is represented as:

E(Growth) = f(space market occupancy rates, rent growth, job growth, inflation) + error term. **(4)**

Combining Equations (2), (3), and (4) and replacing the IRR with Holding Period Returns (HPR), the empirical estimation model becomes

E(HPR) = f(real rate of return, market risk premium, liquidity premium, space market occupancy rates, metropolitan area job growth, inflation) + error term, (5)

where Equation (5) reveals the observable attributes embedded in property holding period returns that are used in the estimation model.

Data

Multiple data sources are required to complete the empirical analysis. In addition to the NPI property holding period returns, Exhibit 15 shows the data sources used in the estimation analysis. Detailed MSA-level data is provided by REIS for the period 1990-2016. REIS is a data vendor that maintains MSA-level real estate market data including market occupancy rates, rent levels, and stock levels. REIS is the only provider of MSA-level time series data for an extended time period and across all NPI MSA markets. Additionally, data from the Federal Reserve, Moody's, and Bureau of Labor statistics are included in the analysis.

Exhibit 15: Data Sources

Data Source and Type	Data Level	Data Frequency	Data Period
NCREIF			
Total, Income and Capital Returns	MSA	Quarterly	1987-2016
Capitalization Rates	National	Quarterly	1987-2016
NOI Growth	National	Quarterly	1987-2016
Capital Expenditures	National	Quarterly	1987-2016
REIS[1]			
Rental Rates	MSA	Quarterly	1990-2016
Property Occupancy Rates	MSA	Quarterly	1990-2016
Federal Reserve			
10-Year Treasury Yield	National	Monthly	1990-2016
10-Year Treasury Inflation-Protected Security	National	Monthly	1990-2016
Inflation	National	Monthly	1990-2016
Federal Reserve Survey of Bank Lending	National	Quarterly	1990-2016
Federal Reserve Flow of Funds	National	Monthly	1990-2016
Moody's			
BBB Spread over 10-Yr Treasury	National	Monthly	1990-2016
Bureau of Labor Statistics			
Employment	MSA	Monthly	1990-2016

[1] REIS data was collected quarterly back to 1998. Prior to 1998, annual data was collected and interpolated into quarterly using cubic spline method.
[2] 10-year Treasury Inflation-Protected Securities began trading in 1997. Prior to 1997, real returns were estimated.

Summary statistics are provided in Exhibit 16 starting with seven-year holding period returns. Based on empirical work and anecdotal discussions with market participants, the most likely holding period return for institutional investors is roughly seven years. Therefore, the dependent variable will be the seven-year holding period returns which average 9.58%, have a standard deviation of 3.66%, and range of 0.50 – 18.99% across 1,674 metropolitan area-level observations.

Exhibit 16: Summary Statistics

Variable	No. of Observations	Mean	Std. Dev.	Max.	Min.
Dependent Variables					
Seven-Year Holding Period Return (%)	1,674	9.58	3.66	18.99	0.50
Independent Variables					
Seven-Year Real Return (%)	88	1.76	1.47	4.68	-1.14
Inflation (%)	88	2.22	1.16	5.25	-1.61
Baa Spread over Treasuries (%)	88	2.50	0.79	5.58	1.40
Fed Lending Survey (%)	88	13.26	25.62	87.00	-23.70
Multifamily Debt Growth (%)	88	1.71	1.16	4.97	-0.62
Job Growth Rate (%)	1,890	0.31	0.76	3.68	-3.63
Occupancy Rate	1,890	0.95	0.02	0.99	0.87
Rent Growth Rate (%)	1,890	0.74	1.23	12.85	-9.78
Tier 1	1,890	0.22	0.42	1	0
Tier 2	1,890	0.26	0.44	1	0
Tier 3	1,890	0.30	0.46	1	0
Tier 4	1,890	0.22	0.42	1	0
East	1,890	0.30	0.46	1	0
Midwest	1,890	0.15	0.36	1	0
South	1,890	0.26	0.44	1	0
West	1,890	0.30	0.46	1	0

The independent variables include the component costs of capital data, which are secured from the Federal Reserve and consist of the real rate of return, the inflation premium, and Baa risk spreads over long-term U.S. Treasuries (UST). The expected real return and inflation premium are revealed in the "Seven Year Treasury Inflation-Indexed Security, Constant Maturity" index. This index removes the inflation premium embedded in long-term U.S. Treasury Securities and provides the inflation-adjusted return or real rate of return required to invest in Treasuries. As Treasury Inflation-Indexed Securities began trading in February 1997, alternative methods for estimating the real rate of return prior to 1997 are used. The average real rate of return for seven-year UST is 1.76%, with an average expected inflation rate embedded in the seven-year UST of 2.22%.

"Moody's Baa Corporate Bond Yield Relative to Yield on 10 Year Treasury Constant Maturity" serves as a proxy for the expected systematic macroeconomic market risk premium. Baa corporate bond default risk is thought to provide a similar systematic macroeconomic risk profile as core real estate investments in major markets once idiosyncratic MSA-level market risks are removed. The average Baa risk premium over 10-year U.S. Treasuries is 2.50% over the last thirty years.

Proxies for the liquidity premium include Federal Reserve's monthly flow of funds data for commercial real estate and the Federal Reserve's survey of bank lending standards for commercial real estate loans. The Federal Reserve's flow of funds data aggregates all sources of multifamily real estate debt including banks, agency, CMBS, among other smaller commercial real estate debt providers. Separately, the Federal Reserve's survey of bank lending standards reveals the percent of banks easing lending standards (a negative number) and tightening standards (a positive number), with a zero revealing that banks neither tightened or eased bank lending standards. Over the past thirty-years, multifamily real estate debt funds had an average quarterly growth rate of 1.71%, with banks tightening lending standards on average with a positive 13.26 bank survey response, indicating that on average a net of 13.26% of banks tightened commercial real estate lending standards in the quarter.

Property income growth rates are proxied using two factors, the MSA-level employment growth and MSA-level rent growth rates. Bureau of Labor Statistics data is collected for each of the 42 MSAs for the period 1990-2016 and year-over-year employment growth is calculated on a quarterly basis. REIS provided MSA-level rental rates where rental growth rates are calculated on a quarter-over-quarter basis. Average annual employment growth for the 42 MSAs is 0.31% with the average quarterly rent growth of 0.74%. Finally, binary variables are included for demographic regions of the United States and MSA employment size/growth.

In summary, the ex-post seven-year property holding period returns data were computed using the NPI data from NCREIF and is the dependent variable. The independent variable data is collected to provide ex-ante information at the national and MSA-level as proxies for how property investors think about investment expectations at different points along the investment cycle. Estimating ex-post property returns using data will allow us to analyze which ex-ante assumptions are most predictive of ex-post property returns – an analysis that is not found in the extant literature.

Empirical Results

Estimation Results

Equation (5) is estimated using seven-year property holding period returns as the dependent variable. Three estimation models are presented in Exhibit 17: Model 1 includes the component cost of capital, capital markets, and space market attributes; Model 2 includes Model 1 attributes and the MSA employment size/growth tiers and NCREIF geographic delineations; and Model 3 includes Model 2 attributes and several investment cycle binary attributes.[10]

Across all models, reasonably high coefficients of determination are achieved with R^2 ranging from 36.5 to 43.6%, indicating that approximately 40% of the variability of seven-year holding period returns can be explained. Considering that the estimates are at the MSA level, without the ability to account for intra-MSA differences, which can be significant, the estimation R^2 are reasonable. All financial market attributes (real return, inflation premium, and risk premium), capital market attributes (Federal Reserve bank lending survey and apartment loan debt growth), and the space market variable (occupancy rate) carry the expected sign and are statistically significant at the 99% confidence level across all three models. Importantly, all variables maintain consistent parameter estimates across the three models providing some confidence of the parameter estimate magnitudes.

The Financial, Capital Markets and Growth Attributes

Given the statistical significance and robustness of the financial, capital markets, and space market attributes across all three models, we are comfortable discussing the magnitude of the impact of these attributes on holding period returns. The two primary variables in the estimation model that are embedded in a property cap rate are the real rate of return and the Baa risk spread. The parameter estimate for the real return is about 0.01 across the three models, suggesting that for each one percent of seven-year UST real return, apartment returns provided similar 1.0% increase in holding period returns. For the Baa risk spread the empirical results reveal that for each 1.0% of Baa risk spread there is a 1.5% increase holding period returns. Combining the interpretation of these two attributes using the data averages for the 30-year analysis period the combined real return and Baa risk spread returns a proxy cap rate of 5.22% where we multiply the parameter estimate for these two attributes from Exhibit 17 by their respective averages from Exhibit 16.

Similarly, the impact of property growth rates on apartment property holding period returns can be interpreted using the inflation premium, where the parameter estimate suggests that for each percent of inflation, holding period returns increase 1.6%. Multiplying the inflation parameter estimate from Exhibit 17 by the average inflation observation of 2.22% returns a 3.55% impact of inflation on property holding period returns. Both the estimated cap rate and estimated growth rate should be considered in tandem with the parameter estimates for the variables. In summary, the parameter estimates that proxy for the cap rate and growth rate worked well, suggesting that the financial attributes embedded in a cap rate are critical factors in estimating property holding period returns.

Model 2 and 3 Empirical Results

In Model 2 the employment size/growth tiers and regional binary variables are added. The representative variable for the employment size/growth tiers is Tier 1 (the MM6 large metro areas) and for the regional binary variables is East, as such interpretation of the other binary variable is relative to the representative variable. We find, much as expected, that Tier 2 and Tier 3 cities provide lower holding period returns and for Tier 2 cities the return is 1.4% lower than Tier 1 cities and is statistically significant, the Tier 3 difference is smaller and is not statistically significant. Similarly, the Tier 4 city employment/employment growth is not statistically significant, but provides a positive parameter estimate, echoing the results of Beracha, Downs, and MacKinnon where they found that high cap rate properties outperform low cap rate properties. The Midwest regional parameter estimate is negative and significant indicating that investments in the Midwest underperformed those in the East by about 60 basis points on average. The South and West were also statistically significant different from the East and provide approximately 1.6% higher property holding period returns than the East.

Model 3 includes several market timing variables where we investigate how investing in market downturns or market recoveries impact property holding period returns. During the study period, there were two recessions, a moderate recession in 2001 and the Great Recession from 4Q 2007 to 2Q 2009. A series of binary variables were created to represent the timing of acquisition or exit, relative to a recession, where *B_Recession* indicates that the investment was acquired or "bought" during a recession; *B_Recovery* indicates that the acquisition occurred in the two quarters after the economy officially came out of recession. Similarly, the three variables—*S_Before*, *S_During* and *S_After*— are binary variable representing the sale of an asset immediate prior to a recession (two quarters prior), during the recession, or immediately after the recession (two quarters after), respectively. The results reveal, as expected, both buying indicators have positive coefficient and are statistically significant, with the *B_Recovery* providing a statistically significant 1.4% higher property holding period returns. Somewhat surprising is that *S_Before* and *S_During* are both insignificant. These results suggest that timing the market to sell right before the recession does not make a difference. In contrast, liquidating properties after the recession reduce property holding period returns by 2.2%, a number that is statistically significant. Overall, the Model 3 results indicate that investors should be patient after an economic downturn when selling a property but jump into the market when acquiring.

Summary

In this research we use the NCREIF Property Index to complete two analyses. First, we analyze property holding period returns of four property types: apartment, industrial, office and retail. During the 30-year period 1987-2016, property holding period returns for apartments dominate the other property types when considering unadjusted returns and risk-adjusted returns. The results are highly consistent across a range of property holding period analyses, different geographic regions, and employment size/growth tiers. The difference between apartment returns and the other types is sizeable, significant, and economically important.

Second, we empirically estimate ex-post apartment seven-year holding period returns using a series of ex-ante attributes where the findings provide insights into the important financial, capital market, and space market attributes that impact holding period returns. We estimate three models and find that the real return and bond risk spread predict much of the property income return. Similarly, property growth rates are reflected in national inflation. Additionally, a series of controls for debt market growth, MSA employment size and growth, and regional delineations are generally significant and economically meaningful. Lastly, we consider a series of market timing attributes to assess if market participants can achieve higher returns through timing the purchase and sale of property assets. We find that acquiring/selling properties immediately after a downturn provides excess/lower property holding period returns. The results reveal that a significant portion of ex-post holding period returns can be predicted by the ex-ante economic and real estate market attributes.

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[1] The NCREIF Property Index returns are calculated quarterly using chain-linked returns that are rolled from one quarter to the next. As a result, the NPI is thought of as a time-weighted return (TWR) or holding period return series. In contrast, transaction-oriented performance series, such as the Internal Rate of Return (IRR) is a dollar-weighted return series. For a complete discussion on this topic, see Brian A. Ciochetti and Jeffrey D. Fisher, "The Characteristics of Commercial Real Estate Holding Period Returns (IRRs)," Real Estate Research Institute, (2002).

[2] For a complete discussion of the NCREIF data series and NCREIF data research, please see "NCREIF Insights," "Member Contributions," and "Academic Papers" at https://www.ncreif.org/research/.

[3] For a detailed discussion of the NPI and a quarterly return updates see: www.ncreif.org.

[4] There are 101 five-year holding periods – starting with the initial five-year hold from 1987Q1 to 1991Q4, then rolling forward for the next 100 quarter, and ending with the period from 2012Q1 to 2016Q4.

[5] Eli Beracha, David H. Downs, and Greg MacKinnon, "Value Investment Strategies for Commercial Real Estate," Real Estate Research Institute, 2017.

[6] We searched the property market literature for ways to segment MSAs by size and growth and found very little guidance. While the interaction of MSA size and MSA growth over the last 27 years is an arbitrary way to segment the market, we found the process and results a reasonable way to segment property markets.

[7] Michael S. Young, Jeffrey D. Fisher, and Joseph D'Alessandro, "New NCREIF Value Index and Operations Measures," *Journal of Real Estate Literature* Vol. 25, No. 1, pp. 221-235, 2017.

[8] The superior apartment property returns with low volatility creates a bit of a market efficiency puzzle, as the results suggest that commercial real estate markets may not be efficient. An alternative view might be to look at the analysis horizon as an incomplete data set. As real estate markets morphed over the past several decades, acquisition assumptions for office properties may have dramatically understated capital expenditure costs based on how the market has moved. The same might be said prospectively about the retail market as

disruptive technologies change the way people shop and retailers sell goods. As such, the relative out-sized returns and under-sized volatility of apartment properties may be a function of incomplete data or possibly changing risk perspectives by property type that has favored apartments that will likely mean-revert over the coming decades.

[9] Large 10ant rollovers in office, industrial, and retail buildings of10 generate significant variability in property cash flow and capital expenditures. As apartment buildings generally have hundreds of similarly-sized 10ants with lower 10ant rollover costs, the period-over-period variability of apartment capital expenditures is of10 lower than other property types.

[10] We estimate several different model specifications to ensure the results are robust. One of the statistical issues was multi-collinearity, i.e. high correlation between two independent variables. For example, occupancy level and rent growth in an MSA are highly correlated. As a result, the final version includes the occupancy rate as the only MSA-level space market variable. We also estimated several models with different property holding period returns where less consistent results were returned.