The Impact of Capital Expenditures on Property Performance in Commercial Real Estate

Chinmoy Ghosh[*] *and Milena Petrova*[#,**]

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Abstract

Using a sample of 56,144 annual property observations during 2000 – 2011 we analyze the determinants of capital expenditures and their sub-components at the property level when accounting for uncertainty. We argue that uncertainty impacts the relationships between interest rates, profitability and capital expenditures and that these relationships may differ not only by property type, but also by cap-ex categories. We find that interest rates, credit spread and standard deviation of cap rates are all strongly negatively associated with capital expenditures. Interestingly, both lagged income return and lagged appreciation return are negatively associated with property investment. In addition, in the presence of uncertainty the effect of appreciation return is even more negative, which suggests that owners exercise their option to delay investment. Since increased returns may be correlated with the quality of property capital components, we use property fixed effects to control for endogeneity of returns and observe that the negative effect of property returns on capital expenditures disappears. Finally, we analyze the relationship between capital expenditures and performance and find persistently strong positive relationship between capital expenditures and cumulative returns. The observed positive relationship between capital expenditures over the holding period and cumulative returns is even more significant when controlling for the endogeneity of capital expenditures and using 2SLS model.

Keywords: investment, capital expenditures, performance, commercial real estate, uncertainty

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*Chinmoy Ghosh is a Gladstein Professor of Business and Innovation, Department of Finance, School of Business, University of Connecticut, Storrs, CT 06269, Phone: (860) 486-4431, E-mail: cghosh@business.uconn.edu
#Contact author;**Milena Petrova is Assistant Professor, Department of Finance, Whitman School of Management, Syracuse University, NY and Assistant Professor, Department of Finance, Bocconi University, Milan, Italy Phone: +39 02 5836 5918, E-mail: petrova@unibocconi.it

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I. Objective

Investment under uncertainty has been the focus of abound literature in finance and real estate. The neoclassical theory of investment (NTI) posits a linear relationship between cost of capital, firm's profitability and firm's investment (Jorgenson (1963), Tobin (1969)). While multiple studies document strong relationships between interest rates, profitability and firm's investment, the assumptions, on which the neo-classical theory depends, have been criticized. Gordon (1992) presents evidence that the propositions, on which the neo-classical theory hinges, are incorrect. Under uncertainty and irreversibility of investment, the ability to delay investment is valuable (Bulan (2005)), which has a direct bearing on the validity of two of the NTI propositions: (1) that the maximization of the firm's current value is the sole criterion for investment and financing decision and (2) that the investment opportunities that a corporation has are independent of its prior investments. Bulan (2005) and Novy-Marx (2005) show that in an environment of increased uncertainty, there is a significant real option premium to delay investment and as a results investment is depressed. Similarly, Bloom et al (2007) document that with irreversibility, higher uncertainty reduces the responsiveness of investment to demand shocks. That delaying investment can result in higher profits has also been documented in the real estate literature. For example Guthrie (2010) demonstrates that house prices can considerably exceed development costs due to the value of the option to delay development of the marginal piece of undeveloped land. Similarly, Capozza and Helsley (1990) present evidence that the option value of undeveloped land decreases with distance from CBD. Clapp et al's

(2012) analysis shows that towns with positive redevelopment option value have higher house price volatility. The role of uncertainty on real estate investment has been the focus of multiple papers analyzing the determinants of housing investment (Capozza et al. (2001), Holland et al. (2000), Sivitanidou and Sivitanides (2000), Somerville (2001) and Miles (2009)). Since the investment decision is typically done at the project/property level, studies based on project/property level data have the advantage to be better able to relate individual investment decisions to direct measures of demand uncertainty (Bulan et al. 2009). However, due to the lack or limited availability at best of project/property level data, such studies are rare.

We examine the determinants of capital expenditures and their sub-components under uncertainty at the property level and the impact of capital expenditures on subsequent performance. A comprehensive analysis of capital expenditure categories over time and by property market and finding their determinants is important for the accurate estimation of replacement reserves. Due to the more predictable nature of LCs and TIs, as opposed to base building expenses, the relationship between these sub-components and uncertainty may be different. We further analyze the effect of changes in interest rates and the level of cap rates when interacted with uncertainty. Additional potential determinants of capital expenditures are property location, leverage, ownership, and property characteristics. We investigate whether these relationships differ by property type and over the business cycles.

Next, we study whether increased capital expenditures and building expenses at the property level lead to higher overall return on investment over the holding period. Unlike with conventional firms, capital expenditures in real estate are argued to be largely predictable. Capital expenditures include in addition to tenant improvements (TI) and leasing commissions (LC), scheduled and unplanned improvements. The level of capital expenditures related to leasing commissions depends on the term of the lease, renewal probability and the rental rates. On another hand, TI expenses depend the current space market conditions. In markets of strong demand and limited supply, owners of space will have higher negotiation power and be able to negotiate lower TIs. Conversely, when supply is higher than demand owners of space may need to offer rent concessions and incur higher TI costs. Anecdotal evidence suggests that capital expenditures related to TIs may be significantly higher than building expenses. Therefore, we analyze the impact of investments in TI and building expenses by property type and cycle phases, controlling for property size, leverage and other characteristics, location and investment holding periods.

To summarize, the objectives of our paper are threefold. First, we examine the cross-sectional characteristics of capital expenditures and building expenses at the property and portfolio level. Second, we analyze the determinants of capital expenditures and their sub-components at the property level when accounting for uncertainty. Third, we investigate the relationship between capital expenditures and performance.

We find that interest rates, credit spread and standard deviation of cap rates are all strongly negatively associated with capital expenditures. These results are consistent with our prediction that high interest rates, unfavorable credit market conditions and high uncertainty depress property investment. Interestingly, both lagged income return and lagged appreciation return are negatively associated with property investment. This relationship appears to be stronger for appreciation returns, with one- and two-year-lagged appreciation returns being significantly negatively related to tenant improvement, building improvement and total capital expenditures. In addition, in the presence of uncertainty the effect of appreciation return is even more negative, which suggests that owners exercise their option to delay investment. Two-year-lagged income returns are positively associated with property investment, but this effect is smaller in magnitude than the negative effect of one-year-lagged returns. Office and industrial properties tend to have significantly higher tenant improvement expenditures, while apartment and retail properties have on average higher building improvement and building expansion expenses, respectively. Finally, property leverage and occupancy levels are negatively related, while age is positively related to capital expenses.

Our results for the relationship between profitability and investment are not consistent with the linear relationship between profitability and investment posited by NTI at the firm level. However, NTI assumes that that the investment opportunities that a firm has are independent of its prior investments. Therefore, if the objective at the firm/fund level is to maximize value, profits from properties should be invested in the highest NPV projects, which may not necessarily be the same properties. In addition, real estate capital expenditures are unique, as they are to a large extent dependent on lease renewals (in the case of tenant improvements), or replacement/renovation needs of the property capital components (e.g. roof, HVAC, appliances replacement, etc.). Therefore, increased returns may be correlated with the quality of property capital components. Indeed, if using property fixed effects the negative effect of property returns on capital expenditures disappears.

When examining the relationship between capital expenditures and cumulative returns over the holding period of the property (or the period during which a property is present in the data; whichever is shorter) we find persistently strong positive relationship between capital expenditures and cumulative returns. This relationship remains strong for the four main capital expenditures categories – tenant improvements, building improvements, building expansions, and other (including leasing commissions). Finally, the positive relationship between capital expenditures over the holding period and cumulative returns is even more significant, when controlling for the endogeneity of capital expenditures and using 2SLS model.

The rest of the paper is structured as follows. We present our research methodology in Section II. Next, we describe our sample selection and data in Section III. Section IV examines the determinants of capital expenditures at the aggregate level and by property type. In Section V, we investigate the impact of capital expenditures on cumulative returns over the holding period of the property. In Section VI, we conduct robustness checks and control for endogeneity of capital expenditures. We conclude with Section VII.

II. Research Methodology

To examine the effect of uncertainty on investment and the interplay between capital expenditures and a number of factors including interest rates, credit spreads and cap rates, we need to define a measure of uncertainty. The cross-sectional standard deviation of cap rates by property types represents our proxy for "industry" uncertainty. To examine the determinants of capital expenditures, we define the following regression model, which we estimate for the total sample and by the four main property types (apartment, office, industrial and retail):

$$CapEx_{it+1} = \alpha_0 + \alpha_1 RF10_t + \alpha_2 SPREAD_t + \alpha_3 SD_t + \alpha_4 INCRET_{it} + \alpha_5 INCRET_{it-1} + \alpha_6 APPRET_{it}$$
$$+ \alpha_7 APPRET_{it-1} + \alpha_8 SD_t * RF10_t + \alpha_9 SD_t * INCRET_{it} + \alpha_{10} SD_t * APPRET_{it} +$$
$$+ \alpha_{11} LEVERAGE_{it} + \alpha_{12} SQFT_{it} + \alpha_{13} AGE_{it} + \alpha_{14} PCTLEASED\_DT_{it} +$$
$$+ \sum_{j=1}^{3} \beta_j Investor\_Type_{ji} + \varepsilon_{\text{it}} \qquad (1)$$

where:

$CapEx_{it+1}$	is property *i*'s capital expenditures scaled by market value in year t+1;
$RF10_t$	is the 10-year Treasury bond yield;
$SPREAD_t$	is the spread between Moody's AAA bond yield and the 10-year Treasury bond yield;
SD_t	is the cross-sectional standard deviation of cap rates by property type;
$INCRET_{it}$	is property *i*'s annual income return as defined by NCREIF;
$APPRET_{it}$	is property *i*'s annual appreciation return as defined by NCREIF;
$LEVERAGE_{it}$	is property *i*'s leverage;
$SQFT_{it}$	is property *i*'s total square footage of improvements;
AGE_{it}	is property *i*'s age in years;
$PCTLEASED\_DT_{it}$	is property *i*'s change in occupancy level;
$Investor\_Type_{jt}$	are dummy variables indicating that the investor is non-taxable, mixed, or public REIT; taxable investor dummy is the omitted variable;

We estimate the regression above for the total sample and by property type with the dependent variable being aggregate property capital expenditures ($CapEx_{it+1}$). Next, we estimate the model when the dependent variable is one of the main capital expenditures sub-categories. Finally, we estimate the main regression model by periods to examine if the results differ in different cycle conditions.

To analyze the relationship between capital expenditures and performance, we define the following regression model, which we estimate for the total sample and by the four main property types (apartment, office, industrial and retail):

$$TOTRET\_H_i = \delta_0 + \delta_1 RF10\_AVE_i + \delta_2 SPREAD\_AVE_i + \delta_3 CAPEX\_MV\_H_i + \delta_4 SD\_AVE_i$$
$$+ \delta_5 LEVERAGE\_AVE_i + \delta_6 PCTLEASED\_AVE_i + \delta_7 AGE\_AVE_i$$
$$+ \delta_8 SQFT\_AVE_i + \sum_{j=1}^{3} \kappa_j Investor\_Type_{ji} + \mu_i \qquad (2)$$

where:

$TOTRET\_H_i$ is the property *i*'s cumulative holding period total return;

$RF10\_AVE_i$ is average 10-year Treasury bond yield over the property *i*'s holding period;

$SPREAD\_AVE_i$ is the average spread between Moody's AAA bond yield and the 10-year Treasury bond yield over the property *i*'s holding period;

$CAPEX\_MV\_H_i$ is property *i*'s cumulative capital expenditures scaled by its market value over the property *i*'s holding period;

SD_AVE_i is the average cross-sectional standard deviation of cap rates by property type over the property *i*'s holding period;

$LEVERAGE\_AVE_i$ is property *i*'s average leverage over the property *i*'s holding period;

$PCTLEASED\_AVE_i$ is property *i*'s average occupancy level over the property *i*'s holding period;

$SQFT\_AVE_i$ is property *i*'s the average total square footage of improvements over its holding period;

AGE_AVE_i is property *i*'s average age in years over the property *i*'s holding period;

$Investor\_Type_{ji}$ are dummy variables indicating that the investor is non-taxable, mixed, or public REIT; taxable investor dummy is the omitted variable;

We also estimate the model using the cumulative value of the various cap-ex subcategories over the property's holding period as a right hand-side variable. Finally, we estimate the equation by periods to examine if the results differ in different cycle conditions.

III. Data

We use National Council of Real Estate Investment Fiduciaries' (NCREIF) detailed capital expenditure data at the property level. NCREIF is an association of institutional real estate professionals, established with the objective to provide improved commercial real estate data, performance measurement, investment analysis, information standards, education, and peer group interaction. NCREIF produces several quarterly indexes tracking real estate performance returns, based on data provided by NCREIF's contributing members. In addition NCREIF collects data on operating income and expenses[1]. Detailed income and expense data is available on a quarterly basis from 2000. As previously noted, the availability of data at the property level gives us the unique opportunity to analyze the determinants of the capital expenditures and their impact on investment performance at the property level, which has been argued to be more relevant, since the investment decision is typically done at the project/property level (Bulan et al. 2009). In addition to containing detailed data on capital expenditures and their sub-categories (acquisition cost, building improvements, LCs and TIs), NCREIF's data also contains quarterly statistics on income, expenses, net operating income, occupancy and the appraised market value of the property. The availability of quarterly NOI and market value data implies that we can estimate reliably property cap rates on a quarterly basis.

[1] www.ncreif.org

The original sample contains 369,510 quarterly observations from 2000 until 2011. Since we conduct the analysis on annual basis we calculate annual capital expenditures categories, income, cash-flow and total returns. We require that data for all four quarters in a given year for a given property is available. This yields a sample of 86,032 annual property observations. We further require that data is available for all main variables, used in the regression analysis. We drop observations with missing market value, or market value less than or equal to zero; there are 11,564 such observations. We drop 33 observations where the reported market value is equal to 1. To eliminate the effect of outliers we exclude observations with total annual return of less than 100% or larger than 100%. There are 1696 such observations, of which 1588 have absolute returns larger than 300%. We focus on the four main property types: apartment, industrial, office and retail. Therefore, we eliminate other property types from the sample, which reduces our dataset by 5,971 observations. We further exclude properties with square footage less than 1,000 (3,834 observations). Next, we eliminate properties with absolute annual capital expenditures scaled by market value larger than 100% (41 observations). We also drop observations, where no age (2838) or percentage leased data is available (2754). Finally, we exclude 1,157 properties with leverage less than zero or larger than 100%. Our final sample consists of 56,144 annual property observations for 14,722 unique properties over the period of 2000 – 2011.

Summary statistics of our final sample are presented in Table 1. All variables are defined in Appendix 1. We observe that the mean market value of the properties in the sample is approximately 40 million USD. Properties are on average 18 years old, have approximately 289,000 square feet of improvements, 90.5% occupancy rate and 26.5%

leverage. Capital expenditures are on average 1.9% of market value and are roughly evenly distributed between TI, building improvements and other expenses (which are mostly represented by leasing commissions). Each of these categories is approximately 0.6% of property's market value. The distribution of the sample by investor type shows that most properties in our data are owned by non-taxable investors (73.8%). Industrial properties represent 39.4% of the sample, followed by office (26.3%), apartment (19%) and retail (15.3%). Finally, the annual distribution of properties shows a stable trend of increasing the number of properties in the NCREIF database over time, which can be reflective of the growth in investments in real estate by institutional investors. The largest increase in number of properties is observed between 2005 and 2006, which is at the peak of the real estate bubble. Interestingly, a similarly large increase is noted from 2009 to 2010, which marks the recovery from the financial crisis of 2007 – 2009. The years of 2008 and 2009 are the only ones with flat or slight decrease in number of properties in the sample, which coincides with the period of the recent recession.

In Table 2 we summarize statistics of property capital expenditures, market values, returns and investor types by property types. We observe that office and retail properties in the sample are on average much more expensive than apartment and industrial properties with market values of 61.8 and 60.7 million USD vs. 41.1 and 17.9 million USD, respectively. However, properties across the four main types are approximately the same size between 263 to 306 thousand square feet. Occupancy levels are also very similar for apartment, industrial and retail – approximately 91 – 92.8% on average, while office properties have a lower occupancy rate of approximately 87%. Properties in our sample do not appear to be too different also in terms of their age – between 16 – 20 years on average.

Income returns are on average 4 to 5% for each property type, while some differences emerge in appreciation returns. Apartments record an average annual appreciation return over the sample period of 1.7%, while office properties are associated with a negative return of 1.5%.

Table 3 illustrates differences in property characteristics, capital expenditures and returns by the four main investor types: taxable, non-taxable, mixed and public REITs. We note that non-taxable investors, which are also the predominant investor type, are associated with relatively larger and more expensive properties. They also invest equally across the four different property types and are associated on average with the highest *CAPEX_MV* (capital expenditures to market value) and highest income return. On the other hand, REITs in the sample invest on average in smaller and hence lower market value properties, that are, however, relatively newer (age of 14 years vs. 18-20 years for the rest of property types) and with relatively smaller capital expenditures. Interestingly, REIT properties achieve an impressive 6% annual appreciation return; however, given the small number of REITs in the sample, we cannot generalize this observation to the overall ability of REITs to obtain higher returns than other investor types.

IV. Determinants of Capital Expenditures

In this section we examine the determinants of capital expenditures. We conduct a pooled panel data OLS regression analysis with standard errors adjusted for potential heteroskedasticity. In addition, to account for lack of independence between observations for the same property over time, we cluster the standard errors by property. Before conducting the regression analysis, we examine the pairwise correlations between the main variables used in our models. Table 4 presents the correlation coefficients of the variables used in the analysis. We don't observe any large correlations between the independent variables. We do notice that appreciation return is negatively correlated with the credit spread and positively correlated with the risk-free interest rate, which is intuitive as higher risk-free interest rate is associated with higher inflation, hence higher appreciation return, as well as income return, since lease rates are typically indexed for inflation. On the other hand, higher credit spread reflects unfavorable credit conditions, which leads to the decrease in supply of credit and demand for properties, which affects negatively property prices. Leverage is negatively related to the risk-free rate, as higher interest rates reduce the attractiveness of using debt.

Table 4 further suggests that capital expenditures are negatively correlated with income and appreciation returns, as well as occupancy rate and positively correlated with age. While the positive correlation between capital expenditures and age is intuitive, the negative correlation between capital expenditures and returns is against our expectations. We turn to multivariate regression analysis to disentangle these relationships further.

In Table 5 we present the results from the regression models determining property-level capital expenditures over the period of 2000 – 2011. The dependent variables in Models 1, 2, 3 and 4 are future capital expenditures, tenant improvement, building improvements and building expansions, respectively. Standard errors are corrected for potential heteroskedasticity and clustered by property. All capital expenditures categories are scaled by market value of the property. As previously noted, all variables are defined in the Appendix. We report T-statistics in the parentheses. The models reported are our "best-fit" models using stepwise procedure and based on AIC score. We control for risk-free rate, credit spread, standard deviation of cap rates, income and appreciation returns lagged one and two years, leverage, square footage, age, change in occupancy level, investor type and property type. We also test for the interactive effect of uncertainty and interest rates and returns by using interactions of *SD* (our proxy for industry-level uncertainty) and *RF10* (the yield on 10-year treasury bonds), *INCRET* (property's annual income return) and *APPRET* (property's annual income return), respectively. Note that since we lag all independent variables, the usable sample is first reduced to 42,717 observations; in addition, by controlling for two-year-lagged income and appreciation returns and change in lagged occupancy level the regression sample is further reduced to 32,268 observations.

The results in Table 5 show a consistent negative relation between capital expenditures and risk-free rate, spread and standard deviation of returns. These findings confirm our expectations for negative relationship between interest rate, credit market conditions and industry-level uncertainty and investment.[2] However, the coefficients on one-year lagged income return and one- and two-year lagged appreciation return and capital expenditures are negative in Models 1 – 3. This is against our expectations for positive relationship between returns and investment. Appreciation return is however significantly positively related to investment in building expansion. The two year lagged income return is positively associated to capital expenditures in Models 1 and 2. The size of the coefficients suggests that uncertainty, followed by interest rates are the most important determinants of capital expenditures. Furthermore, the impact of income returns

[2] We also control for two-year lagged *SD* and the interaction between two-year lagged *SD* and property's annual income and appreciation returns. We find mostly insignificant/week positive relationship between two-year lagged *SD* and capital expenditures and insignificant interaction effect of uncertainty and returns. We conclude that firms facing higher uncertainty delay investment only by one year.

on capital expenditures is larger than that of appreciation returns. The coefficient on the interaction variable *SD*APPRET* is negative and significant in Models 1 – 3, which supports our expectation that high uncertainty leads to postponing investment and exercising the option to wait. On the other hand the interaction variable SD*RF10 is significant and positive in Models 1 – 3, which suggests that under high uncertainty and rising interest rates, investors may choose to invest today, as opposed to delay expenditures, since future interest rates may be even higher.

The coefficient on leverage is negative and significant, while the coefficient on age is positive and significant in Models 1 – 3. These results are intuitive; older properties may require larger cost for tenant and building improvements, while properties with higher associated debt will have lower free cash flows for discretionary investment. The negative relationship between the change in occupancy level and capital expenditures observed in Models 1 and 2 suggest that properties with recent increase in occupancy levels are associated with lower future tenant improvement expenditures. This is not surprising, since rise in property occupancy level may be due to higher past TIs.

The coefficients on the three property types (apartments is the omitted property type) suggest that office properties are associated with largest expenses for TIs; apartment properties have significantly higher building improvement expenses, while retail real estate is associated with significantly higher building expansion expenses.

The r-squared statistics for the four models suggests that tenant improvement expenditures are more predictable than building improvement and expansion investments. The r-squared statistics is the lowest for building expansion expenses (0.002), which indicates that the model does not predict most of the variation in this capital expenditures category.

We also test if location is a significant determinant of capital expenditures by controlling for the MSAs, in which properties are located. The adjusted R-squared of these models is negative, illustrating that adding MSA dummy variables does not improve the fit of the model. Using year fixed effects gives rise to multi-collinearity problems due to high correlation with spread and standard deviation of returns. Therefore, we do not include year fixed effects as we are interested in the effect of interest rates and uncertainty on investment. Finally, we also conduct the analysis by periods, by examining the periods of pre-, during- and post-financial crisis. We don't detect any significant differences in the relationships observed during these cycles.

Since we hypothesize that the relationships between the key variables of interest and capital expenditure categories may be different for the different property types, next we conduct the regression analysis for apartments, industrial, office and retail properties, separately.

Tables 6 through 9 present the regression results for the four main property types: apartment, industrial, office and retail, respectively. Similarly to Table 5, in each table the dependent variables in Models 1, 2, 3 and 4 are future capital expenditures, tenant improvement, building improvements and building expansions, respectively. Standard errors are corrected for potential heteroskedasticity and clustered by property. Overall, the results are similar to those revealed in Table 5, although the observed relationships are generally weaker. For example, in the apartment models risk-free rate and standard deviation are significant and negative only in Models 1 and 3. Income and appreciation returns are significantly related to total capital expenditures in Model 1, but no such patterns emerge in the TI, building improvements and expansion expenditures models. The r-squared statistics also suggest that the models in Table 6 only explain between 1.4 – 3.7% of the variation in capital expenditures.

Table 7 shows that for industrial properties there is no relation between income returns and capital expenditures. Appreciation returns are generally positively associated with capital expenditures. Although two-year lagged appreciation returns have negative coefficients in Models 1 and 2 their effect is much smaller than the positive effect of one-year lagged appreciation returns.

Table 8 presents the results for the office sample. The results show consistently strong negative relationship between risk-free rate, spread and standard deviation of returns. In addition, income returns are associated generally positively with capital expenditures. One-year lagged appreciation returns are also positively associated with capital expenditures, while two-year lagged appreciation returns relate negatively to investment, but their effect is much weaker than that of one-year lagged appreciation returns.

Finally, Table 9 presents the results for retail properties. No consistent relationships are observed other than a weakly negative significant relationship between two-year lagged appreciation returns and capital expenditures.

Based on the results from Tables 6 – 9 we conclude that the patterns observed for the full sample are also present in the office and industrial portfolios. However, these relationships are much weaker in the apartment and retail samples.

The observed negative relationship between returns and capital expenditures is not consistent with our expectations and with the linear relationship between profitability and investment posited by NTI at the firm level. However, NTI assumes that that the investment opportunities that a firm has are independent of its prior investments. Therefore, if the objective at the firm/fund level is to maximize value, profits from properties should be invested in the highest NPV projects, which may not necessarily be the same properties. In addition, real estate capital expenditures are unique, as they are to a large extent dependent on lease renewals (in the case of tenant improvements), or replacement/renovation needs of the property capital components (e.g. roof, HVAC, appliances replacement, etc.). Therefore, increased returns may be correlated with the quality of property capital components. To address this issue we add to the models property fixed effects. The results are reported in Appendix 2. Using fixed effects models addresses the concern for omitted variables that are correlated with our independent variables. Indeed, when controlling for property fixed effects the negative effect of property returns on capital expenditures largely disappears. Adding property fixed effects increases significantly the explanatory power of the models to around 41 – 49%. This demonstrates that capital expenditures are largely determined by idiosyncratic factors or property characteristics, for which we do not control in the original models.

V. Examining the Relationship between Capital Expenditures and Returns

The second objective of our study is to examine whether increased capital expenditures and building expenses at the property level lead to higher return on investment over the holding period. We analyze the impact of investments in TI and building expenses on returns by property type and cycle phases, controlling for property size, leverage and other characteristics. Table 10 presents the summary statistics for the 14,277 unique properties covered during the period of 2000 – 2011. Note that the measured returns and capital expenditures are true holding period measures only in the case when a property appears in the sample for the first time in 2000 or later and is sold prior to or in 2011. However, it is possible that the property was acquired prior to 2000 and/or was not sold by the end of 2011, in which case we will only measure cumulative expenditures and returns from the acquisition year or year 2000, whichever occurs later until year of sale or 2011, whichever occurs first. The distribution of years shows the pattern of sales in the data. The year of 2011 includes actual sales as well as properties, which were not sold until the end of the year; 41% of our sample is represented by sales in 2011 or properties that remained in the NCREIF data after 2011. Total return on average is 20.3% in the sample, with 18.3% attributed to income return. Excess total return, measured as the difference in property's total return and the return on the NCREIF index for the same period, by property sub-type and MSA market, is 16.4%, with 13.2% attributed to income return. We do not control for holding period in the regressions since it is highly correlated with capital expenditures. However, holding period based on the difference min(year sold, 2011)-max(year acquired, 2000) is 3.8 years, while actual average holding period based on min(year sold, 2011)-year acquired is 5.8 years. Average capital expenditures over the holding period are approximately 7.1%; tenant improvements, building improvement, building expansion expenses and other capital expenditures (including LC) are proximately 2.2%, 2.3%, 0.2% and 3.5%, respectively.

Table 11 displays the results from the regression models, determining holding period returns. The dependent variable in Models 1 and 2 is total holding period return, while the dependent variable in Models 3 and 4 is excess total holding period return, defined as the difference between total holding period return and NPI total return for the period by sub-property type and MSA market. Standard errors are corrected for potential heteroskedasticity and clustered by property.

In Models 1 and 3 we control for aggregate capital expenditures, while in Models 2 and 4 we break down capital expenditures to TIs, building improvements, building expansions and other capital expenditures (including LCs). The results in Table 11 show that capital expenditures as well as all capital expenditures sub-categories are significantly and positively related to returns. This is consistent with our expectation. Furthermore, the risk-free rate is consistently positively related to returns as is the average occupancy rate and property square footage. Non-taxable and REIT investors appear to be associated with significantly higher returns. Also retail properties have superior performance, based on our sample compared to other properties. Leverage and standard deviation of cap rates appear to have a negative relationship with returns. This is against our expectation as highly levered properties and higher risk should be associated with higher returns. Recall from the previous section that we established that capital expenditures are significantly and negatively related to the risk free rate, spread, leverage and standard deviation of cap rates. Therefore, we need to account for the endogeneity of capital expenditures. We address this issue in Table 14.

Table 12 presents the results from regression models determining holding period returns by property type when controlling for total capital expenditures, while Table 13 presents the results by property type when controlling for the four capital expenditure sub-categories. The results in Tables 12 and 13 reveal that the relationship between cumulative returns and cumulative expenditures is positive and significant for all property types, but office. In the office sample only other capital expenditures are positively related to cumulative total return.

We also examine the relationship between cumulative capital expenditures and cumulative returns by periods, but do not establish any different patterns.

VI. Robustness Checks

As established in Section 4 capital expenditures are strongly associated with interest rates, credit conditions, uncertainty, leverage and occupancy levels. Including property fixed effects leads to increasing the accuracy of models, predicting capital expenditures, to over 40%. As capital expenditures are largely determined by the same factors that impact returns, we need to control for the endogeneity of capital expenditures when used as a determinant of returns over time. We predict total capital expenditures and capital expenditures sub-categories, based on the models reported in Section 4, controlling for property fixed effects. Table 14 presents the results when using the predicted values of capital expenditures as a right hand side variable. We note that the significance of capital expenditures in both, Models 1 and 2, is increased. Furthermore, the coefficients on standard deviation of cap rate and leverage are positive and significant as expected. REITs are the best performing investor type, while all properties underperform compared to apartments. Tables 15 and 16 report the results by property types, controlling for the predicted value of total capital expenditures and the four capital expenditures sub-categories, respectively. One notable change from the results reported in Tables 12 and 13 is that the relationship between capital expenditures (and their sub-categories) and returns is positive for all property types. Overall, the regressions present compelling evidence that higher capital expenditures are associated with higher returns, after controlling for market conditions and property characteristics.

VII. Conclusion

Using a sample of 56,144 annual property observations during 2000 – 2011 we analyze the determinants of capital expenditures and their sub-components at the property level when accounting for uncertainty. We argue that uncertainty impacts the relationships between interest rates and capital expenditures and that these relationships may differ not only by property type, but also by cap-ex categories.

We find that interest rates, credit spread and standard deviation of cap rates are all strongly negatively associated with capital expenditures. These results are consistent with our prediction that high interest rates, unfavorable credit market conditions and high uncertainty depress property investment. Interestingly, both lagged income return and lagged appreciation return are negatively associated with property investment. In addition, in the presence of uncertainty the effect of appreciation return is even more negative, which suggests that owners exercise their option to delay investment. Two-year-lagged incremental returns are positively associated with property investment, but this effect is smaller in magnitude than the negative effect of one-year-lagged returns. Office and industrial properties tend to have significantly higher tenant improvement expenditures, while apartment and retail properties have on average higher building improvement and building expansion expenses, respectively. Finally, property leverage and occupancy levels are negatively related, while age is positively related to capital expenses.

Our results for the relationship between profitability and investment are not consistent with the linear relationship between profitability and investment posited by NTI at the firm level. However, NTI assumes that that the investment opportunities that a firm has are independent of its prior investments. In addition, real estate capital expenditures are unique, as they are to a large extent dependent on lease renewals (in the case of tenant improvements), or replacement/renovation needs of the property capital components (e.g. roof, HVAC, appliances replacement, etc.). Therefore, increased returns may be correlated with the quality of property capital components. Indeed, if using property fixed effects the negative effect of property returns on capital expenditures disappears.

When examining the relationship between capital expenditures and cumulative returns over the holding period of the property (or the period during which it is present in the data; whichever is shorter) we find persistently strong positive relationship between capital expenditures and cumulative returns. This relationship remains strong for the four main capital expenditures categories – tenant improvements, building improvements, building expansions, and other (including leasing commissions). Finally, the positive relationship between capital expenditures over the holding period and cumulative returns is even more significant, when controlling for the endogeneity of capital expenditures and using 2SLS model.

The NCREIF dataset used provides us with the unique opportunity to analyze the determinants of the capital expenditures and their impact on investment performance at the property level, which has been argued to be more relevant, since the investment decision is typically done at the project/property level.

Our results reveal that while capital expenditures are mostly idiosyncratic and related to unique property characteristics, they are an important determinant of property returns.

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Table 1: Summary Statistics of the Final Sample

Summary statistics of capital expenditures and characteristics of 56,144 annual property observations during 2000 – 2011. All variables are as defined in the Appendix.

Variable	Mean	Std. Dev.	Min	Max
MV	40,400,000	82,400,000	42,941	4,630,000,000
CAPEX	789,702	4,352,158	(14,100,000)	499,000,000
CAPEX_TI	214,551	923,352	(14,100,000)	55,400,000
CAPEX_BLDIMP	241,286	2,350,854	(155,000,000)	226,000,000
CAPEX_BLDEXP	46,236	1,676,299	(110,000,000)	99,200,000
CAPEX_OTH	287,629	3,532,771	(89,100,000)	499,000,000
CAPEX_MV	0.0187	0.0480	-0.5196	0.9761
CAPEX_TI_MV	0.0057	0.0175	-0.2063	0.5951
CAPEX_BI_MV	0.0060	0.0327	-0.9142	0.9984
CAPEX_BE_MV	0.0006	0.0240	-0.9807	0.9456
CAPEX_OTH_MV	0.0063	0.0376	-0.9983	0.9714
INCRET	0.0479	0.0288	-0.7780	0.7200
APPRET	0.0001	0.1368	-0.9700	1.1500
TOTRET	0.0533	0.1398	-0.9300	0.9900
RF10	0.0375	0.0095	0.0198	0.0574
SPREAD	0.0163	0.0052	0.0073	0.0263
SDCAPRATE	0.0304	0.0067	0.0152	0.0482
LEVERAGE	0.2650	0.2991	0.0000	1.0000
HOLDING	3.4689	2.5317	1.0000	12.0000
PCTLEASED	0.9049	0.1440	0.0035	1.0000
AGE	18.0339	14.3260	0.0000	140.0000
SQFT	289,019	472,050	1,114	32,600,000
INV_TAX	0.1125	0.3160	0.0000	1.0000
INV_NTAX	0.7381	0.4397	0.0000	1.0000
INV_MIXED	0.1491	0.3562	0.0000	1.0000
INV_REIT	0.0003	0.0174	0.0000	1.0000
APT	0.1900	0.3923	0.0000	1.0000
IND	0.3944	0.4887	0.0000	1.0000
OFFICE	0.2630	0.4403	0.0000	1.0000
RETAIL	0.1526	0.3596	0.0000	1.0000
2000	0.0479	0.2135	0.0000	1.0000
2001	0.0562	0.2304	0.0000	1.0000
2002	0.0627	0.2425	0.0000	1.0000
2003	0.0681	0.2519	0.0000	1.0000
2004	0.0683	0.2523	0.0000	1.0000
2005	0.0768	0.2663	0.0000	1.0000
2006	0.0903	0.2866	0.0000	1.0000
2007	0.1017	0.3023	0.0000	1.0000
2008	0.1025	0.3033	0.0000	1.0000
2009	0.0993	0.2991	0.0000	1.0000
2010	0.1178	0.3224	0.0000	1.0000
2011	0.1083	0.3108	0.0000	1.0000

Table 2: Summary Statistics by Property Type

Summary statistics of property capital expenditures, market values, returns and investor types of 56,144 annual property observations during 2000 – 2011 by property type. All variables are as defined in the Appendix.

	Apartments *N = 10,670*		**Industrial** *N = 22,141*		**Office** *N = 14,765*		**Retail** *N = 8,568*	
Variable	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
MV	41,100,000	70,500,000	17,900,000	27,900,000	61,800,000	104,000,000	60,700,000	123,000,000
CAPEX_MV	0.0157	0.0443	0.0166	0.0490	0.0267	0.0505	0.0137	0.0435
CAPEX_TI_MV	0.0009	0.0048	0.0055	0.0174	0.0109	0.0231	0.0037	0.0142
CAPEX_BI_MV	0.0087	0.0374	0.0045	0.0314	0.0068	0.0303	0.0050	0.0334
CAPEX_BE_MV	0.0006	0.0332	0.0007	0.0246	0.0005	0.0155	0.0008	0.0207
CAPEX_OTH_MV	0.0055	0.0449	0.0060	0.0388	0.0085	0.0322	0.0042	0.0325
INCRET	0.0402	0.0169	0.0485	0.0310	0.0511	0.0311	0.0507	0.0285
APPRET	0.0165	0.1257	0.0009	0.1350	-0.0150	0.1501	0.0041	0.1279
TOTRET	0.0622	0.1291	0.0541	0.1387	0.0415	0.1521	0.0609	0.1320
LEVERAGE	0.3346	0.3078	0.2305	0.2834	0.2382	0.2998	0.3134	0.3054
PCTLEASED	0.9218	0.0790	0.9119	0.1635	0.8688	0.1601	0.9279	0.1075
AGE	15.9743	16.0441	17.5395	11.3818	19.6936	16.0248	19.0165	15.3444
SQFT	306,367	261,369	300,608	639,031	274,013	339,417	263,325	345,800
INV_TAX	0.0455	0.2085	0.1628	0.3692	0.1025	0.3034	0.0835	0.2766
INV_NTAX	0.7801	0.4142	0.6540	0.4757	0.7840	0.4115	0.8238	0.3810
INV_MIXED	0.1739	0.3791	0.1830	0.3866	0.1132	0.3168	0.0924	0.2897
INV_REIT	0.0004	0.0194	0.0003	0.0165	0.0003	0.0165	0.0004	0.0187

Table 3: Summary Statistics by Investor Type

Summary statistics of property capital expenditures, market values, returns and property types of 56,144 annual property observations during 2000 – 2011 by investor type. All variables are as defined in the Appendix.

	Taxable *N = 6,319*		**Non-Taxable** *N = 41,438*		**Mixed** *N = 8,370*		**Public REIT** *N = 17*	
Variable	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
MV	26,500,000	48,700,000	44,100,000	89,600,000	32,700,000	61,000,000	20,300,000	9,507,144
CAPEX_MV	0.0141	0.0384	0.0193	0.0488	0.0187	0.0499	0.0135	0.0672
CAPEX_TI_MV	0.0056	0.0191	0.0059	0.0172	0.0053	0.0176	0.0158	0.0352
CAPEX_BLDIMP_MV	0.0033	0.0334	0.0062	0.0322	0.0069	0.0346	0.0024	0.0043
CAPEX_BLDEXP_MV	0.0001	0.0113	0.0007	0.0244	0.0009	0.0288	0.0000	0.0000
CAPEX_OTH_MV	0.0051	0.0275	0.0066	0.0384	0.0056	0.0400	-0.0047	0.0463
INCRET	0.0450	0.0309	0.0501	0.0287	0.0397	0.0256	0.0430	0.0140
APPRET	-0.0017	0.1369	0.0002	0.1368	0.0012	0.1370	0.0603	0.1139
TOTRET	0.0475	0.1401	0.0556	0.1397	0.0466	0.1398	0.1136	0.1214
PCTLEASED	0.9090	0.1656	0.9043	0.1383	0.9048	0.1534	0.8700	0.1503
AGE	18.4260	12.4312	17.5130	14.0769	20.3258	16.4969	13.6471	7.4828
SQFT	224,965	525,167	311,350	497,815	227,089	223,977	156,511	104,344
APT	0.0769	0.2665	0.2009	0.4007	0.2217	0.4154	0.2353	0.4372
IND	0.5703	0.4951	0.3494	0.4768	0.4840	0.4998	0.3529	0.4926
OFFICE	0.2396	0.4269	0.2794	0.4487	0.1996	0.3998	0.2353	0.4372
RETAIL	0.1132	0.3168	0.1703	0.3759	0.0946	0.2927	0.1765	0.3930

Table 4: Correlation Table

	CAPEX_MV_t+1	*CAPEX_TI_MV*	*CAPEX_BI_MV*	*CAPEX_BE_MV*	*RF10*	*SPREAD*	*SD*	*INCRET*	*INCRET_LAG1*	*APPRET*	*APPRET_LAG1*	*LEVERAGE*	*SQFT*	*AGE*	*PCTLEASED_DT*	*INV_TAX*	*INV_NTAX*	*INV_MIXED*	*INV_REIT*
CAPEX_MV_t+1	1.00																		
CAPEX_TI_MV	0.54	1.00																	
CAPEX_BI_MV	0.48	0.04	1.00																
CAPEX_BE_MV	0.31	-0.01	-0.09	1.00															
RF10	0.00	-0.02	0.00	0.01	1.00														
SPREAD	-0.01	0.00	0.00	0.00	-0.61	1.00													
SD	0.00	-0.01	0.00	0.00	0.02	-0.13	1.00												
INCRET	-0.06	-0.06	-0.03	0.01	0.16	0.02	-0.03	1.00											
INCRET_LAG1	0.00	0.01	-0.02	0.01	0.13	-0.06	-0.03	0.57	1.00										
APPRET	-0.07	-0.08	-0.03	0.01	0.16	-0.31	0.05	0.00	0.06	1.00									
APPRET_LAG1	-0.09	-0.10	-0.04	0.01	0.07	-0.08	-0.03	-0.09	0.01	0.15	1.00								
LEVERAGE	0.00	-0.02	0.01	0.00	-0.12	0.00	-0.02	-0.06	-0.12	-0.03	-0.06	1.00							
SQFT	0.01	-0.01	0.00	0.01	0.03	-0.01	0.01	-0.01	-0.02	0.02	0.02	0.01	1.00						
AGE	0.09	0.04	0.09	0.01	-0.12	0.04	-0.03	-0.01	-0.01	-0.03	-0.04	0.08	0.01	1.00					
PCTLEASED_DT	-0.07	-0.06	-0.02	-0.02	0.00	-0.05	0.02	-0.06	-0.15	0.13	0.03	0.01	0.00	-0.02	1.00				
INV_TAX	-0.02	0.00	-0.04	-0.01	-0.10	0.02	0.00	-0.04	0.00	0.00	-0.01	0.05	-0.05	0.01	0.00	1.00			
INV_NTAX	0.01	0.01	0.01	0.01	0.22	-0.04	0.02	0.12	0.06	0.00	0.01	-0.17	0.08	-0.06	-0.01	-0.60	1.00		
INV_MIXED	0.00	-0.01	0.02	-0.01	-0.18	0.03	-0.02	-0.12	-0.08	0.00	-0.01	0.16	-0.05	0.07	0.01	-0.15	-0.70	1.00	
INV_REIT	0.00	0.00	0.00	0.00	-0.02	0.01	0.00	0.00	0.00	0.01	0.01	0.00	0.00	-0.01	-0.01	-0.01	-0.03	-0.01	1.00

Table 5: Regression Models Determining Property-Level Capital Expenditures

Table 5 reports the regression statistics based on the model specified by equation (1). The dependent variables in Models 1, 2, 3 and 4 are future capital expenditures, tenant improvement, building improvements and building expansions, respectively. All capital expenditures categories are scaled by market value of the property. All variables are defined in the Appendix. Standard errors are corrected for potential heteroskedasticity and clustered by property. T-statistics are reported in the parentheses. *, **, and *** denote statistical significance at the 10, 5, and 1 percent level, respectively.

	Model (1)	**Model (2)**	**Model (3)**	**Model (4)**
VARIABLES	*CAPEX_MV_t+1*	*CAPEX_TI_MV _t+1*	*CAPEX_BI _MV_t+1*	*CAPEX_BE_MV_t+1*
RF10	-0.3843***	-0.1111*	-0.2570***	-0.0208
	(-2.78)	(-1.95)	(-2.72)	(-0.30)
SPREAD	-0.1143*	-0.0675**	0.0419	0.0183
	(-1.74)	(-2.32)	(0.94)	(0.76)
SD	-0.8056***	-0.2099***	-0.5635***	-0.0543
	(-4.11)	(-2.59)	(-4.23)	(-0.56)
INCRET	-0.1072**	-0.0583***	-0.0483***	0.0019
	(-2.43)	(-3.39)	(-2.65)	(0.17)
INCRET_LAG1	0.0324**	0.0205***	0.0082	-0.0060
	(2.15)	(3.14)	(1.19)	(-0.60)
APPRET	-0.0095***	-0.0053***	-0.0039**	0.0014**
	(-3.67)	(-5.86)	(-2.07)	(2.02)
APPRET_LAG1	-0.0225***	-0.0113***	-0.0078***	0.0013
	(-11.05)	(-11.96)	(-4.02)	(0.76)
*SD*RF10*	0.1935***	0.0514***	0.1314***	0.0096
	(4.39)	(2.77)	(4.23)	(0.44)
*SD*INCRET*	0.0652	-0.1221	0.2436	0.3807*
	(0.07)	(-0.36)	(0.64)	(1.73)
*SD*APPRET*	-0.2439***	-0.0491***	-0.0828**	-0.0213
	(-4.27)	(-2.82)	(-1.99)	(-1.22)
LEVERAGE	-0.0016*	-0.0006*	-0.0014**	0.0004
	(-1.75)	(-1.74)	(-2.33)	(1.01)
SQFT	0.0000*	-0.0000	0.0000	0.0000
	(1.68)	(-1.03)	(0.03)	(1.54)
AGE	0.0002***	0.0000***	0.0001***	0.0000
	(9.98)	(3.73)	(10.03)	(1.00)
PCTLEASED_DT	-0.0149***	-0.0055***	-0.0021	-0.0020
	(-6.25)	(-4.36)	(-1.07)	(-1.40)
INV_NTAX	0.0017*	0.0007*	0.0012*	0.0005***
	(1.85)	(1.87)	(1.70)	(3.54)
INV_MIXED	0.0019*	0.0003	0.0024***	0.0002
	(1.96)	(0.69)	(3.19)	(1.15)
IND	0.0037***	0.0050***	-0.0022***	0.0002
	(6.66)	(24.18)	(-5.91)	(0.94)
OFFICE	0.0135***	0.0107***	-0.0009**	0.0000
	(18.87)	(37.70)	(-1.99)	(0.08)
RETAIL	-0.0003	0.0030***	-0.0032***	0.0005*
	(-0.32)	(13.62)	(-5.54)	(1.70)
CONST	0.0287***	0.0075***	0.0162***	0.0000
	(4.55)	(2.93)	(3.60)	(0.00)
Observations	**32,268**	**32,268**	**32,268**	**32,268**
R-squared	**0.055**	**0.080**	**0.018**	**0.002**

Table 6: Regression Models Determining Property-Level Capital Expenditures for Apartments

Table 6 reports the regression statistics for our apartment sub-sample based on the model specified by equation (1). The dependent variables in Models 1, 2, 3 and 4 are future capital expenditures, tenant improvement, building improvements and building expansions, respectively. All capital expenditures categories are scaled by market value of the property. All variables are defined in the Appendix. Standard errors are corrected for potential heteroskedasticity and clustered by property. T-statistics are reported in the parentheses. *, **, and *** denote statistical significance at the 10, 5, and 1 percent level, respectively.

	Model (1)	**Model (2)**	**Model (3)**	**Model (4)**
VARIABLES	*CAPEX_MV_t+1*	*CAPEX_TI_MV _t+1*	*CAPEX_BI _MV_t+1*	*CAPEX_BE_MV_t+1*
RF10	-0.7273**	0.0323	-0.4196**	0.2644
	(-2.44)	(0.67)	(-2.22)	(1.20)
SPREAD	0.0491	-0.0032	0.2617**	0.0200
	(0.44)	(-0.23)	(2.07)	(0.14)
SD	-1.5907***	0.0962	-1.2071***	0.4995
	(-3.37)	(1.27)	(-2.79)	(1.22)
INCRET	0.0273	0.0161**	-0.0139	-0.0254
	(0.59)	(2.07)	(-0.42)	(-0.70)
INCRET_LAG1	-0.0481**	-0.0008	-0.0693	0.0251
	(-2.07)	(-0.19)	(-1.58)	(0.59)
APPRET	-0.0052*	-0.0004	-0.0028	-0.0000
	(-1.65)	(-1.23)	(-1.03)	(-0.05)
APPRET_LAG1	-0.0041**	0.0005	-0.0106	0.0088
	(-2.07)	(1.54)	(-1.18)	(0.99)
*SD*RF10*	0.3744***	-0.0220	0.2801***	-0.1180
	(3.35)	(-1.24)	(2.75)	(-1.22)
*SD*INCRET*	0.3370	-0.0952	0.5241**	0.0681
	(1.40)	(-0.98)	(2.52)	(0.58)
*SD*APPRET*	-0.1244***	0.0039	-0.0465	-0.0152
	(-2.70)	(1.04)	(-1.06)	(-0.97)
LEVERAGE	0.0009	0.0003	-0.0025	0.0009
	(0.66)	(1.13)	(-1.56)	(0.70)
SQFT	0.0000*	0.0000	0.0000	0.0000
	(1.93)	(0.05)	(0.72)	(0.65)
AGE	0.0003***	0.0000***	0.0001***	0.0000
	(4.70)	(4.57)	(2.92)	(0.75)
PCTLEASED_DT	-0.0158**	-0.0003	0.0013	-0.0177
	(-2.33)	(-0.61)	(0.08)	(-1.07)
INV_NTAX	0.0039	0.0005***	0.0045**	-0.0005
	(1.54)	(3.60)	(2.48)	(-0.65)
INV_MIXED	0.0029	0.0004	0.0055***	-0.0007
	(1.03)	(1.28)	(2.91)	(-1.13)
CONST	0.0350***	-0.0024	0.0197**	-0.0118
	(2.59)	(-1.18)	(2.32)	(-1.22)
Observations	**6,110**	**6,110**	**6,110**	**6,110**
R-squared	**0.037**	**0.025**	**0.016**	**0.014**

Table 7: Regression Models Determining Property-Level Capital Expenditures for Industrial Properties

Table 7 reports the regression statistics for our industrial sub-sample based on the model specified by equation (1). The dependent variables in Models 1, 2, 3 and 4 are future capital expenditures, tenant improvement, building improvements and building expansions, respectively. All capital expenditures categories are scaled by market value of the property. All variables are defined in the Appendix. Standard errors are corrected for potential heteroskedasticity and clustered by property. T-statistics are reported in the parentheses. *, **, and *** denote statistical significance at the 10, 5, and 1 percent level, respectively.

VARIABLES	**Model (1)** *CAPEX _MV_t+1*	**Model (2)** *CAPEX_TI _MV _t+1*	**Model (3)** *CAPEX_BI _MV_t+1*	**Model (4)** *CAPEX_BE _MV_t+1*
RF10	-0.9291***	-0.2922**	-0.4343**	-0.0754
	(-4.02)	(-2.41)	(-2.45)	(-1.29)
SPREAD	0.1910*	0.0906*	0.1121*	0.0847
	(1.65)	(1.80)	(1.69)	(1.49)
SD	-1.2482***	-0.3458**	-0.6155***	-0.2085
	(-4.20)	(-2.17)	(-3.46)	(-1.61)
INCRET	0.0300	-0.0206	0.0545	-0.0200
	(0.32)	(-0.35)	(0.89)	(-0.51)
INCRET_LAG1	0.0153	0.0095	0.0098	-0.0170
	(0.60)	(0.90)	(1.08)	(-0.85)
APPRET	0.0412**	0.0238***	0.0049	0.0017
	(2.53)	(2.70)	(0.51)	(0.40)
APPRET_LAG1	-0.0134***	-0.0070***	-0.0055***	0.0017*
	(-4.70)	(-4.54)	(-2.99)	(1.65)
*SD*RF10*	0.3976***	0.1317***	0.1878***	0.0438*
	(5.66)	(3.76)	(4.15)	(1.77)
*SD*INCRET*	-1.8376	-0.7607	-1.9262	1.4038
	(-0.79)	(-0.53)	(-1.35)	(1.27)
*SD*APPRET*	-1.6258***	-0.8284***	-0.3199	-0.0342
	(-3.64)	(-3.53)	(-1.21)	(-0.28)
LEVERAGE	0.0025*	0.0002	0.0009	0.0010
	(1.73)	(0.23)	(1.14)	(1.42)
SQFT	0.0000	-0.0000	-0.0000	0.0000
	(0.83)	(-1.39)	(-0.98)	(0.83)
AGE	0.0002***	0.0000	0.0002***	0.0000*
	(7.76)	(1.59)	(9.46)	(1.66)
PCTLEASED_DT	-0.0093***	-0.0043***	-0.0004	-0.0002
	(-3.72)	(-2.99)	(-0.25)	(-0.45)
INV_NTAX	0.0032***	0.0011**	0.0020***	0.0006**
	(3.31)	(2.19)	(2.93)	(2.55)
INV_MIXED	0.0045***	0.0007	0.0035***	0.0001**
	(3.87)	(1.06)	(4.45)	(2.00)
CONST	0.0304***	0.0100*	0.0107	0.0014
	(3.13)	(1.88)	(1.48)	(0.45)
Observations	**12,716**	**12,716**	**12,716**	**12,716**
R-squared	**0.023**	**0.021**	**0.018**	**0.006**

Table 8: Regression Models Determining Property-Level Capital Expenditures for Office Properties

Table 8 reports the regression statistics for our office sub-sample based on the model specified by equation (1). The dependent variables in Models 1, 2, 3 and 4 are future capital expenditures, tenant improvement, building improvements and building expansions, respectively. All capital expenditures categories are scaled by market value of the property. All variables are defined in the Appendix. Standard errors are corrected for potential heteroskedasticity and clustered by property. T-statistics are reported in the parentheses. *, **, and *** denote statistical significance at the 10, 5, and 1 percent level, respectively.

	Model (1)	**Model (2)**	**Model (3)**	**Model (4)**
VARIABLES	*CAPEX_MV_t+1*	*CAPEX_TI_MV _t+1*	*CAPEX_BI _MV_t+1*	*CAPEX_BE_MV_t+1*
RF10	-3.2497**	-1.4965**	-1.9652**	0.0425
	(-2.05)	(-2.43)	(-2.32)	(0.25)
SPREAD	-0.3792**	-0.1856**	-0.1646	0.0339
	(-2.19)	(-2.21)	(-1.61)	(1.13)
SD	-3.2655*	-1.4836**	-2.2557**	0.0282
	(-1.71)	(-1.99)	(-2.31)	(0.14)
INCRET	0.1802**	0.0360	0.0766*	0.0034
	(2.51)	(0.95)	(1.68)	(0.69)
INCRET_LAG1	0.0629***	0.0358***	0.0211*	-0.0017
	(2.58)	(2.98)	(1.91)	(-0.50)
APPRET	0.0820***	0.0305**	0.0429**	-0.0008
	(2.71)	(1.97)	(2.56)	(-0.44)
APPRET_LAG1	-0.0413***	-0.0216***	-0.0110***	-0.0003
	(-7.83)	(-7.94)	(-3.68)	(-0.54)
*SD*RF10*	0.9616**	0.4242**	0.5845**	-0.0034
	(2.15)	(2.40)	(2.41)	(-0.07)
*SD*INCRET*	-10.5856***	-3.7542***	-3.5003**	-0.1008
	(-5.56)	(-3.84)	(-2.45)	(-0.62)
*SD*APPRET*	-3.0257***	-1.1872***	-1.4270***	0.0491
	(-3.56)	(-2.67)	(-3.02)	(0.79)
LEVERAGE	-0.0053***	-0.0019**	-0.0030***	-0.0001
	(-2.78)	(-2.08)	(-2.74)	(-0.38)
SQFT	0.0000	0.0000	-0.0000	0.0000*
	(0.41)	(0.34)	(-0.44)	(1.88)
AGE	0.0002***	0.0000	0.0002***	-0.0000
	(5.06)	(1.49)	(6.53)	(-0.66)
PCTLEASED_DT	-0.0287***	-0.0116***	-0.0069**	-0.0014
	(-4.98)	(-3.86)	(-2.27)	(-1.44)
INV_NTAX	-0.0020	0.0008	-0.0018	0.0002*
	(-0.82)	(1.02)	(-0.93)	(1.84)
INV_MIXED	-0.0021	0.0004	-0.0006	-0.0001
	(-0.77)	(0.42)	(-0.27)	(-0.40)
CONST	0.1460**	0.0683***	0.0846**	-0.0025
	(2.17)	(2.62)	(2.39)	(-0.35)
Observations	**8,718**	**8,718**	**8,718**	**8,718**
R-squared	**0.068**	**0.053**	**0.031**	**0.002**

Table 9: Regression Models Determining Property-Level Capital Expenditures for Retail Properties

Table 9 reports the regression statistics for our retail sub-sample based on the model specified by equation (1). The dependent variables in Models 1, 2, 3 and 4 are future capital expenditures, tenant improvement, building improvements and building expansions, respectively. All capital expenditures categories are scaled by market value of the property. All variables are defined in the Appendix. Standard errors are corrected for potential heteroskedasticity and clustered by property. T-statistics are reported in the parentheses. *, **, and *** denote statistical significance at the 10, 5, and 1 percent level, respectively.

	Model (1)	**Model (2)**	**Model (3)**	**Model (4)**
VARIABLES	*CAPEX_MV_t+1*	*CAPEX_TI_MV _t+1*	*CAPEX_BI _MV_t+1*	*CAPEX_BE_MV_t+1*
RF10	0.4546	0.4598	0.1873	0.3303
	(0.51)	(1.59)	(0.29)	(1.12)
SPREAD	0.4634**	0.1750***	0.2362	-0.0259
	(2.06)	(2.61)	(1.29)	(-0.44)
SD	-0.1182	0.4795	-0.8359	0.6713
	(-0.07)	(0.94)	(-0.71)	(1.33)
INCRET	-0.2962	-0.0685	-0.4428*	0.0642
	(-0.95)	(-0.58)	(-1.69)	(1.08)
INCRET_LAG1	-0.0169	-0.0029	-0.0089	0.0002
	(-0.90)	(-0.38)	(-0.65)	(0.03)
APPRET	0.0035	-0.0103	0.0257	-0.0169
	(0.08)	(-0.72)	(0.93)	(-1.24)
APPRET_LAG1	-0.0208*	-0.0040**	-0.0107*	-0.0034
	(-1.81)	(-2.04)	(-1.92)	(-0.58)
*SD*RF10*	-0.0104	-0.1242	0.0223	-0.1441
	(-0.03)	(-1.17)	(0.10)	(-1.31)
*SD*INCRET*	2.8257	0.1773	10.8833	-2.8713
	(0.28)	(0.04)	(1.29)	(-1.30)
*SD*APPRET*	-0.2320	0.2162	-0.9666	0.6307
	(-0.16)	(0.47)	(-1.04)	(1.35)
LEVERAGE	-0.0062**	-0.0003	-0.0023	-0.0013
	(-2.07)	(-0.42)	(-1.07)	(-1.19)
SQFT	0.0000*	0.0000	0.0000	0.0000**
	(1.76)	(1.15)	(0.63)	(2.24)
AGE	0.0001***	0.0000	0.0001***	-0.0000
	(2.81)	(1.55)	(3.02)	(-1.43)
PCTLEASED_DT	0.0065	0.0111*	0.0018	-0.0013
	(0.52)	(1.87)	(0.21)	(-0.50)
INV_NTAX	0.0016	-0.0015	0.0042*	0.0013
	(1.06)	(-1.14)	(1.96)	(1.54)
INV_MIXED	0.0014	-0.0013	0.0047*	0.0009
	(0.64)	(-0.93)	(1.90)	(0.99)
CONST	-0.0000	-0.0125	0.0163	-0.0150
	(-0.00)	(-0.89)	(0.50)	(-1.04)
Observations	**4,724**	**4,724**	**4,724**	**4,724**
R-squared	**0.028**	**0.023**	**0.018**	**0.006**

Table 10: Summary Statistics of over the Holding Period

Summary statistics of returns, capital expenditures and characteristics of 14,722 property observations during 2000 – 2011 for the entire holding period or sample period, whichever period is smaller. All variables are as defined in the Appendix.

Variable	Mean	Std. Dev.	Min	Max
TOTRET_H	0.2034	0.3320	-1.3331	6.7297
INCRET_H	0.1828	0.1813	-0.8443	3.9543
APPRET_H	0.0006	0.2498	-1.8590	2.3943
EXTOTRET_H	0.1643	0.3014	-1.3331	6.6310
EXINCRET_H	0.1322	0.1500	-0.9332	3.7408
EXAPPRET_H	0.0120	0.2330	-1.7300	2.5091
CAPEX_MV_H	0.0712	0.1208	-0.6310	1.8378
CAPEX_TI_MV_H	0.0219	0.0451	-0.2063	0.8316
CAPEX_BLDIMP_MV_H	0.0228	0.0718	-0.9142	1.3548
CAPEX_BLDEXP_MV_H	0.0024	0.0483	-0.9807	1.1687
CAPEX_MV_HAT_H	0.0354	0.0468	-0.4484	0.2754
CAPEX_TI_MV_HAT_H	0.0122	0.0165	-0.0593	0.1265
CAPEX_BI_MV_HAT_H	0.0116	0.0203	-0.1128	0.2564
CAPEX_BE_MV_HAT_H	0.0008	0.0113	-0.2049	0.0818
RF10_AVE	0.0365	0.0083	0.0198	0.0574
SPREAD_AVE	0.0169	0.0029	0.0076	0.0263
SD_AVE	0.0313	0.0060	0.0152	0.0482
LEVERAGE_AVE	0.2689	0.2996	0.0000	1.0000
PCTLEASED_AVE	0.9004	0.1365	0.0035	1.0000
AGE_AVE	18	15	0	139
SQFT_AVE	267,501	393,529	1,393	21,800,000
INV_TAX	0.1479	0.3551	0.0000	1.0000
INV_NTAX	0.6589	0.4741	0.0000	1.0000
INV_MIXED	0.1924	0.3942	0.0000	1.0000
INV_REIT	0.0007	0.0261	0.0000	1.0000
APT	0.1827	0.3864	0.0000	1.0000
IND	0.4317	0.4953	0.0000	1.0000
OFFICE	0.2361	0.4247	0.0000	1.0000
RETAIL	0.1495	0.3566	0.0000	1.0000
2000	0.0281	0.1651	0.0000	1.0000
2001	0.0354	0.1848	0.0000	1.0000
2002	0.0521	0.2222	0.0000	1.0000
2003	0.0494	0.2167	0.0000	1.0000
2004	0.0506	0.2192	0.0000	1.0000
2005	0.0337	0.1804	0.0000	1.0000
2006	0.0422	0.2010	0.0000	1.0000
2007	0.0367	0.1881	0.0000	1.0000
2008	0.0439	0.2048	0.0000	1.0000
2009	0.0738	0.2614	0.0000	1.0000
2010	0.1411	0.3481	0.0000	1.0000
2011	0.4131	0.4924	0.0000	1.0000

Table 11: Regression Models Determining Holding Period Return

Table 11 reports the regression statistics for our full sample of 14,722 properties over 2000 – 2011 based on the model specified by equation (2). The dependent variable in Models 1 and 2 is total holding period return; the dependent variable in Models 3 and 4 is excess total holding period return, defined as the difference between total holding period return and NPI total return for the period by sub-property type and market. All capital expenditures categories are scaled by market value of the property. All variables are defined in the Appendix. Standard errors are corrected for potential heteroskedasticity and clustered by property. T-statistics are reported in the parentheses. *, **, and *** denote statistical significance at the 10, 5, and 1 percent level, respectively.

VARIABLES	**Model (1)** *TOTRET_H*	**Model (2)** *TOTRET_H*	**Model (3)** *EXTOTRET_H*	**Model (4)** *EXTOTRET_H*
RF10_AVE	2.4048***	2.4177***	2.0280***	2.0357***
	(9.04)	(9.06)	(7.92)	(7.92)
SPREAD_AVE	-28.2363***	-28.1157***	-19.0796***	-18.9931***
	(-30.35)	(-29.96)	(-22.12)	(-21.82)
CAPEX_MV_H	0.2606***		0.2037***	
	(5.94)		(4.99)	
CAPEX_TI_MV_H		0.4009***		0.3033***
		(3.49)		(2.90)
CAPEX_BLDIMP_MV_H		0.1793***		0.1154**
		(2.90)		(1.98)
CAPEX_BLDEXP_MV_H		0.1615**		0.1374**
		(2.37)		(2.12)
CAPEX_OTH_MV_H		0.2822***		0.2440***
		(5.88)		(5.37)
SDCAPRATE_AVE	-2.8862***	-2.8018***	-6.1032***	-6.0331***
	(-4.52)	(-4.35)	(-10.36)	(-10.17)
LEVERAGE_AVE	-0.0556***	-0.0551***	-0.0364***	-0.0363***
	(-6.79)	(-6.75)	(-4.80)	(-4.78)
PCTLEASED_AVE	0.5813***	0.5843***	0.5318***	0.5333***
	(31.91)	(31.62)	(31.11)	(30.90)
AGE_AVE	-0.0001	-0.0001	0.0000	0.0001
	(-0.64)	(-0.41)	(0.14)	(0.40)
SQFT_AVE	0.0000***	0.0000***	0.0000***	0.0000***
	(3.54)	(3.54)	(3.58)	(3.56)
INV_NTAX	0.0714***	0.0711***	0.0533***	0.0531***
	(10.19)	(10.16)	(8.05)	(8.04)
INV_MIXED	0.0088	0.0096	0.0061	0.0069
	(1.13)	(1.23)	(0.83)	(0.94)
INV_REIT	0.1342***	0.1315***	0.0981***	0.0959**
	(3.06)	(2.96)	(2.58)	(2.51)
IND	-0.0009	-0.0058	0.0596***	0.0553***
	(-0.08)	(-0.51)	(5.89)	(5.32)
OFFICE	-0.0228**	-0.0305**	0.0501***	0.0438***
	(-2.05)	(-2.54)	(4.88)	(3.95)
RETAIL	0.0283***	0.0249**	0.0861***	0.0833***
	(2.71)	(2.34)	(8.85)	(8.36)
CONST	0.1021***	0.0962***	0.0252	0.0218
	(3.12)	(2.86)	(0.82)	(0.69)
Observations	14,722	14,722	14,722	14,722
R-squared	0.173	0.173	0.137	0.138

Table 12: Regression Models Determining Holding Period Return by Property Type

Table 12 reports the regression statistics for the four sub-samples of apartment, industrial, office and retail properties based on the model specified by equation (2). The dependent variable in Models 1 and 2 is total holding period return; the dependent variable in Models 3 and 4 is excess total holding period return, defined as the difference between total holding period return and NPI total return for the period by sub-property type and MSA. All capital expenditures categories are scaled by market value of the property. All variables are defined in the Appendix. Standard errors are corrected for potential heteroskedasticity and clustered by property. T-statistics are reported in the parentheses. *, **, and *** denote statistical significance at the 10, 5, and 1 percent level, respectively.

	Apartment	**Industrial**	**Office**	**Retail**
VARIABLES	*TOTRET_H*	*TOTRET_H*	*TOTRET_H*	*TOTRET_H*
RF10_AVE	1.9369***	3.9156***	-0.5864	1.4005
	(3.34)	(7.12)	(-0.99)	(1.44)
SPREAD_AVE	-20.3447***	-29.9493***	-30.5868***	-32.5473***
	(-11.23)	(-16.36)	(-17.77)	(-13.53)
CAPEX_MV_H	0.4726***	0.3804***	0.0621	0.2644*
	(5.48)	(5.07)	(0.94)	(1.80)
SDCAPRATE_AVE	6.7554**	-3.0776**	3.9091*	-2.4751
	(2.38)	(-2.36)	(1.86)	(-1.45)
LEVERAGE_AVE	-0.1018***	0.0149	-0.0755***	-0.1951***
	(-5.13)	(1.10)	(-4.51)	(-9.73)
PCTLEASED_AVE	0.7485***	0.4542***	0.6990***	0.9181***
	(9.71)	(20.19)	(17.89)	(11.77)
AGE_AVE	-0.0008**	-0.0007**	-0.0006*	0.0016***
	(-2.18)	(-2.15)	(-1.68)	(3.33)
SQFT_AVE	0.0000	0.0000*	0.0000***	0.0000*
	(0.85)	(1.71)	(4.13)	(1.93)
INV_NTAX	0.0739***	0.0632***	0.0491***	0.0643***
	(3.79)	(6.15)	(2.97)	(3.61)
INV_MIXED	0.0449**	-0.0137	0.0256	0.0391
	(2.00)	(-1.45)	(1.23)	(1.39)
INV_REIT	0.1169	0.1353**	0.0777**	0.1404
	(1.28)	(2.39)	(2.00)	(0.71)
CONST	-0.3648***	0.2035**	-0.0592	-0.0691
	(-3.67)	(2.44)	(-0.74)	(-0.75)
Observations	2,689	6,356	3,476	2,201
R-squared	0.131	0.193	0.188	0.222

Table 13: Regression Models Determining Holding Period Return by Property Type Controlling for Capital Expenditure Categories

Table 13 reports the regression statistics for the four sub-samples of apartment, industrial, office and retail properties based on the model specified by equation (2), but breaking capital expenditures into four categories – tenant improvements, building improvements, building expansion expenditures and other capital expenditures (including leasing commissions).The dependent variable in Models 1 and 2 is total holding period return; the dependent variable in Models 3 and 4 is excess total holding period return, defined as the difference between total holding period return and NPI total return for the period by sub-property type and MSA. All capital expenditures categories are scaled by market value of the property. All variables are defined in the Appendix. Standard errors are corrected for potential heteroskedasticity and clustered by property. T-statistics are reported in the parentheses. *, **, and *** denote statistical significance at the 10, 5, and 1 percent level, respectively.

	Apartment	**Industrial**	**Office**	**Retail**
VARIABLES	*TOTRET_H*	*TOTRET_H*	*TOTRET_H*	*TOTRET_H*
RF10_AVE	1.8763***	3.9506***	-0.5514	1.4675
	(3.25)	(7.13)	(-0.94)	(1.51)
SPREAD_AVE	-20.2146***	-29.6628***	-30.6388***	-32.0750***
	(-11.38)	(-15.90)	(-17.79)	(-13.41)
CAPEX_TI_MV_H	2.6733***	0.6351***	0.1436	0.9236***
	(5.68)	(3.69)	(0.91)	(3.07)
CAPEX_BLDIMP_MV_H	0.7320***	0.1545	-0.1565	0.2304
	(6.97)	(1.54)	(-1.38)	(1.27)
CAPEX_BLDEXP_MV_H	0.1160	0.3233***	0.2813	0.0484
	(0.99)	(3.17)	(1.52)	(0.17)
CAPEX_OTH_MV_H	0.3912***	0.4039***	0.1867*	0.1136
	(4.85)	(4.60)	(1.88)	(0.74)
SDCAPRATE_AVE	6.2382**	-2.9751**	4.1804**	-2.4745
	(2.24)	(-2.25)	(1.99)	(-1.46)
LEVERAGE_AVE	-0.1063***	0.0141	-0.0746***	-0.1919***
	(-5.52)	(1.04)	(-4.43)	(-9.55)
PCTLEASED_AVE	0.7454***	0.4601***	0.6979***	0.9411***
	(9.88)	(20.18)	(17.79)	(11.86)
AGE_AVE	-0.0013***	-0.0006*	-0.0004	0.0016***
	(-3.70)	(-1.77)	(-1.21)	(3.39)
SQFT_AVE	0.0000	0.0000*	0.0000***	0.0000*
	(1.05)	(1.75)	(4.05)	(1.93)
INV_MIXED	0.0662***	0.0641***	0.0465***	0.0655***
	(3.39)	(6.21)	(2.85)	(3.64)
INV_NTAX	0.0382*	-0.0121	0.0254	0.0375
	(1.70)	(-1.27)	(1.22)	(1.32)
INV_REIT	0.1208	0.1339**	0.0740**	0.1299
	(1.26)	(2.23)	(2.09)	(0.60)
CONST	-0.3488***	0.1837**	-0.0711	-0.1087
	(-3.57)	(2.11)	(-0.87)	(-1.18)
Observations	2,689	6,356	3,476	2,201
R-squared	0.152	0.196	0.192	0.227

Table 14: Robustness Checks Regression Models Determining Holding Period Return

The dependent variable is total holding period return. Capital expenditure variables are based on prediction from the models reported in Table 5. All variables are defined in the Appendix. Standard errors are corrected for potential heteroskedasticity. T-statistics are reported in the parentheses. *, **, and *** denote statistical significance at the 10, 5, and 1 percent level, respectively.

	Model (1)	**Model (2)**
VARIABLES	*TOTRET_H*	*TOTRET_H*
RF10_AVE	3.1265***	2.5892***
	(12.03)	(10.19)
SPREAD_AVE	-18.2059***	-18.5102***
	(-23.99)	(-25.20)
CAPEX_MV_HAT_H	3.4395***	
	(48.51)	
CAPEX_TI_MV_HAT_H		4.7412***
		(7.91)
CAPEX_BLDIMP_MV_HAT_H		5.4307***
		(13.92)
CAPEX_BLDEXP_MV_HAT_H		2.2897**
		(2.06)
SDCAPRATE_AVE	6.8478***	7.0807***
	(11.24)	(10.12)
LEVERAGE_AVE	0.0301***	-0.0004
	(4.12)	(-0.05)
PCTLEASED_AVE	0.4765***	0.4788***
	(25.51)	(25.49)
AGE_AVE	0.0014***	0.0006***
	(8.44)	(3.08)
SQFT_AVE	0.0000***	0.0000***
	(5.88)	(5.24)
INV_MIXED	0.0242***	-0.0162
	(3.87)	(-1.59)
INV_NTAX	-0.0124*	-0.0453***
	(-1.82)	(-4.70)
INV_REIT	0.1979***	0.1580***
	(4.52)	(3.83)
IND	-0.1142***	-0.1140***
	(-11.27)	(-9.79)
OFFICE	-0.1857***	-0.1025***
	(-18.47)	(-10.18)
RETAIL	-0.0898***	-0.0471***
	(-9.70)	(-4.59)
CONST	-0.3230***	-0.2775***
	(-11.21)	(-9.45)
Observations	14,722	14,722
R-squared	0.363	0.364

Table 15: Robustness Checks Regression Models Determining Holding Period Return by Property Type

The dependent variable is total holding period return. Capital expenditure variables are based on prediction from the models reported in Table 5. All variables are defined in the Appendix. Standard errors are corrected for potential heteroskedasticity. T-statistics are reported in the parentheses. *, **, and *** denote statistical significance at the 10, 5, and 1 percent level, respectively.

	Apartment	**Industrial**	**Office**	**Retail**
VARIABLES	*TOTRET_H*	*TOTRET_H*	*TOTRET_H*	*TOTRET_H*
RF10_AVE	2.7184***	4.0586***	-0.5822	0.0975
	(5.71)	(7.56)	(-1.00)	(0.12)
SPREAD_AVE	-9.9756***	-16.6399***	-27.3983***	-18.8766***
	(-7.32)	(-11.75)	(-16.65)	(-9.40)
CAPEX_MV_HAT_H	5.8101***	4.4739***	0.8589***	5.3871***
	(27.16)	(36.00)	(9.13)	(26.23)
SDCAPRATE_AVE	4.5105**	8.3598***	10.8625***	7.8695***
	(2.11)	(7.48)	(5.07)	(5.26)
LEVERAGE_AVE	0.0390**	0.0008	-0.0040	0.0661***
	(2.41)	(0.07)	(-0.24)	(3.69)
PCTLEASED_AVE	0.4256***	0.3503***	0.6699***	0.7507***
	(6.55)	(15.88)	(16.78)	(10.55)
AGE_AVE	-0.0026***	0.0009***	0.0003	0.0030***
	(-8.58)	(3.05)	(0.75)	(6.97)
SQFT_AVE	-0.0000**	0.0000***	0.0000***	-0.0000***
	(-2.13)	(3.90)	(9.13)	(-3.04)
INV_MIXED	0.0647***	-0.0076	0.0417**	0.0506***
	(3.74)	(-0.82)	(2.55)	(3.24)
INV_NTAX	0.0568***	-0.0321***	0.0185	0.0051
	(2.94)	(-3.86)	(0.91)	(0.22)
INV_REIT	0.2214**	0.1583***	0.1633***	0.2762*
	(2.42)	(3.10)	(3.25)	(1.88)
CONST	-0.3266***	-0.4224***	-0.4314***	-0.6048***
	(-3.80)	(-6.34)	(-5.18)	(-7.56)
Observations	2,689	6,356	3,476	2,201
R-squared	0.458	0.39	0.232	0.486

Table 16: Robustness Checks Regression Models Determining Holding Period Return by Property Type and Controlling for Capital Expenditure Categories

The dependent variable is total holding period return. Capital expenditure variables are based on prediction from the models reported in Table 5. All variables are defined in the Appendix. Standard errors are corrected for potential heteroskedasticity. T-statistics are reported in the parentheses. *, **, and *** denote statistical significance at the 10, 5, and 1 percent level, respectively.

VARIABLES	**Apartment** *TOTRET_H*	**Industrial** *TOTRET_H*	**Office** *TOTRET_H*	**Retail** *TOTRET_H*
RF10_AVE	2.7781***	1.2870**	-0.2265	-0.2394
	(6.05)	(2.24)	(-0.40)	(-0.29)
SPREAD_AVE	-13.4738***	-18.0088***	-24.8239***	-20.5488***
	(-10.25)	(-12.46)	(-15.64)	(-9.99)
CAPEX_TI_MV_HAT_H	150.5254***	8.3589***	0.8468***	5.8703***
	(15.01)	(30.21)	(3.38)	(4.53)
CAPEX_BLDIMP_MV_HAT_H	-4.2123***	1.0021***	4.1041***	8.2345***
	(-4.42)	(4.16)	(8.01)	(10.71)
CAPEX_BLDEXP_MV_HAT_H	6.0118***	49.1436***	-12.5609***	5.7027***
	(5.25)	(14.87)	(-8.38)	(8.05)
SDCAPRATE_AVE	7.5269***	6.2280***	12.1792***	8.0767***
	(3.65)	(5.76)	(5.78)	(5.19)
LEVERAGE_AVE	0.0025	-0.1600***	-0.0082	0.0079
	(0.16)	(-9.71)	(-0.50)	(0.41)
PCTLEASED_AVE	0.3644***	0.3060***	0.6648***	0.7914***
	(5.88)	(14.61)	(16.43)	(10.56)
AGE_AVE	-0.0014***	0.0006*	0.0002	0.0012***
	(-4.46)	(1.92)	(0.43)	(2.73)
SQFT_AVE	0.0000	0.0000***	0.0000***	-0.0000***
	(1.36)	(3.99)	(3.50)	(-2.82)
INV_MIXED	-0.0182	0.0621***	-0.0570***	0.0522***
	(-0.96)	(6.70)	(-2.91)	(3.28)
INV_NTAX	-0.0504**	0.0130*	-0.0727***	0.0210
	(-2.29)	(1.73)	(-3.30)	(0.88)
INV_REIT	0.1737*	0.2108***	0.0765	0.2556*
	(1.94)	(3.06)	(1.41)	(1.74)
CONST	-0.2605***	-0.2222***	-0.4294***	-0.5481***
	(-3.24)	(-3.47)	(-5.31)	(-6.64)
Observations	2,689	6,356	3,476	2,201
R-squared	0.51	0.438	0.265	0.453

Appendix 1: Variable Definitions

MV	Reported market value by NCREIF
CAPEX	Total annual capital expenditures
CAPEX_TI	Annual tenant improvement expenditures
CAPEX_BLDIMP	Annual building improvement expenditures
CAPEX_BLDEXP	Annual building expansion expenditures
CAPEX_OTH	Other annual capital expenditures including leasing commissions
CAPEX_MV	Total annual capital expenditures scaled by market value
CAPEX_TI_MV	Annual tenant improvement expenditures scaled by market value
CAPEX_BI_MV	Annual building improvement expenditures scaled by market value
CAPEX_BE_MV	Annual building expansion expenditures scaled by market value
CAPEX_MV_HAT	Predicted annual capital expenditures scaled by market value, based on the models reported in Section 4, controlling for property fixed effects
CAPEX_TI_MV_HAT	Predicted annual tenant improvement expenditures scaled by market value, based on the models reported in Section 4, controlling for property fixed effects
CAPEX_BI_MV_HAT	Predicted annual building improvement expenditures scaled by market value, based on the models reported in Section 4, controlling for property fixed effects
CAPEX_BE_MV	Annual building expansion expenditures scaled by market value
CAPEX_OTH_MV	Other annual capital expenditures including leasing commissions scaled by market value
INCRET	Annual income return as defined by NCREIF
INCRET_LAG1	Lagged annual income return
APPRET	Annual appreciation return as defined by NCREIF
APPRET_LAG1	Lagged annual appreciation return
TOTRET	Annual total return as defined by NCREIF
RF10	The 10-year Treasury bond yield
SPREAD	The spread between Moody's AAA rated bonds and the 10-year Treasury bond yield
SD	The cross-sectional standard deviation of cap rates by property type
*SD*RF10*	Interaction variable between *SD* and *RF10*

*SD*INCRET*	Interaction variable between *SD* and *INCRET*
*SD*APPRET*	Interaction variable between *SD* and *APPRET*
LEVERAGE	Property's leverage defined as loan balance/market value
HOLDING	The property's holding period
PCTLEASED	Percentage property leased
PCTLEASED_DT	Change in percentage property leased
AGE	Age of the structure in years
SQFT	The total square footage of the structure
*INV_**	Dummy variables indicating that the investor is taxable (*TAX*), non-taxable (*NTAX*), mixed (*MIXED*), or public REIT (*REIT*)
APT	Dummy variable indicating an apartment property
IND	Dummy variable indicating an industrial property
OFFICE	Dummy variable indicating an office property
RETAIL	Dummy variable indicating a retail property
2000-2011 (YRn)	Dummy variable indicating the year of the transaction
*_AVE	Average level of a variable over the holding period
*_H	Cumulative return or expense over the holding period
*EX**	Excess return over NPI total return for the period by sub-property type and market

Appendix 2: Regression Models Determining Property-Level Capital Expenditures by Property Type Controlling for Property Fixed Effects

Panel 1: Apartments

Appendix 2 reports the regression statistics for our sub-samples based on the model specified by equation (1) and controlling for property fixed effects. The dependent variables in Models 1, 2, 3 and 4 are future capital expenditures, tenant improvement, building improvements and building expansions, respectively. All capital expenditures categories are scaled by market value of the property. All variables are defined in the Appendix. Standard errors are corrected for potential heteroskedasticity and clustered by property. T-statistics are reported in the parentheses. *, **, and *** denote statistical significance at the 10, 5, and 1 percent level, respectively.

	Model (1)	**Model (2)**	**Model (3)**	**Model (4)**
VARIABLES	*CAPEX_MV_t+1*	*CAPEX_TI_MV _t+1*	*CAPEX_BI _MV_t+1*	*CAPEX_BE_MV_t+1*
RF10	-0.0681	0.0551	-0.2295	0.3408
	(-0.16)	(0.85)	(-1.26)	(0.95)
SPREAD	0.1479	0.0129	0.0842	0.1013
	(0.90)	(0.71)	(0.63)	(0.85)
SD	-0.4129	0.1181	-0.4832	0.4830
	(-0.65)	(1.23)	(-1.23)	(1.03)
INCRET	-0.0071	0.0157	-0.0146	-0.0186
	(-0.17)	(1.30)	(-0.42)	(-0.86)
INCRET_LAG1	-0.0585*	-0.0058	-0.0456*	-0.0054
	(-1.74)	(-0.87)	(-1.80)	(-0.51)
APPRET	-0.0003	0.0002	-0.0005	-0.0002
	(-0.09)	(0.53)	(-0.20)	(-0.17)
APPRET_LAG1	0.0004	0.0005	-0.0010	0.0018
	(0.10)	(1.00)	(-0.44)	(0.92)
*SD*RF10*	0.0980	-0.0265	0.1112	-0.1144
	(0.65)	(-1.16)	(1.20)	(-1.03)
*SD*INCRET*	0.1550	-0.1783*	0.3326	0.0719
	(0.60)	(-1.80)	(1.42)	(0.83)
*SD*APPRET*	-0.0850	0.0055	-0.0285	-0.0158
	(-1.58)	(1.33)	(-0.65)	(-0.74)
LEVERAGE	-0.0079**	-0.0001	0.0004	-0.0037
	(-2.04)	(-0.26)	(0.21)	(-1.07)
SQFT	0.0000	-0.0000	-0.0000	0.0000
	(1.57)	(-0.07)	(-0.47)	(0.56)
AGE	0.0002	0.0000	0.0001	-0.0001
	(1.13)	(0.47)	(0.61)	(-1.25)
PCTLEASED_DT	-0.0082	0.0007	-0.0149***	0.0008
	(-1.18)	(0.58)	(-3.26)	(0.15)
INV_NTAX	-0.0041	0.0001	-0.0088	-0.0005
	(-1.61)	(0.63)	(-1.24)	(-1.02)
INV_MIXED	-0.0049*	-0.0000	-0.0112	0.0006
	(-1.68)	(-0.03)	(-1.57)	(0.78)
CONST	0.0165	-0.0024	0.0262**	-0.0118
	(0.96)	(-0.86)	(2.49)	(-0.83)
Property Fixed Effects	yes	yes	yes	yes
Observations	**6,110**	**6,110**	**6,110**	**6,110**
R-squared	**0.478**	**0.461**	**0.670**	**0.722**

Panel 2: Industrial

VARIABLES	Model (1) *CAPEX_MV_t+1*	Model (2) *CAPEX_TI_MV _t+1*	Model (3) *CAPEX_BI _MV_t+1*	Model (4) *CAPEX_BE_MV_t+1*
RF10	-0.5497*	-0.1656	-0.2894	-0.0287
	(-1.87)	(-1.13)	(-1.33)	(-0.29)
SPREAD	-0.1883	-0.2520*	0.0903	0.1246
	(-0.83)	(-1.96)	(0.68)	(1.23)
SD	-0.2226	0.1289	-0.3237	-0.0716
	(-0.62)	(0.60)	(-1.17)	(-0.75)
INCRET	0.1008	-0.0367	0.0937	0.0568
	(0.76)	(-0.48)	(1.14)	(0.98)
INCRET_LAG1	0.0321	0.0231*	0.0134	-0.0190
	(0.96)	(1.83)	(1.12)	(-0.67)
APPRET	0.0346	0.0220**	0.0026	0.0028
	(1.58)	(2.12)	(0.16)	(0.48)
APPRET_LAG1	-0.0027	-0.0031*	-0.0015	0.0032
	(-0.68)	(-1.70)	(-0.57)	(1.43)
*SD*RF10*	0.1418	-0.0182	0.1243*	0.0383
	(1.44)	(-0.34)	(1.79)	(1.07)
*SD*INCRET*	-2.8589	0.0432	-2.5849	-0.5338
	(-1.02)	(0.02)	(-1.34)	(-0.67)
*SD*APPRET*	-1.3208**	-0.7790***	-0.1438	-0.0601
	(-2.24)	(-2.87)	(-0.34)	(-0.38)
LEVERAGE	0.0058	0.0021	0.0022	0.0016
	(1.54)	(1.33)	(1.15)	(0.67)
SQFT	-0.0000	-0.0000	0.0000	-0.0000
	(-1.23)	(-0.80)	(0.86)	(-1.10)
AGE	-0.0002	-0.0004**	0.0002	0.0001
	(-0.81)	(-2.19)	(0.92)	(1.07)
PCTLEASED_DT	-0.0131***	-0.0064***	-0.0010	-0.0002
	(-4.26)	(-3.77)	(-0.51)	(-0.36)
INV_NTAX	0.0075	-0.0046	0.0191**	0.0003
	(0.96)	(-1.39)	(2.51)	(0.59)
INV_MIXED	0.0114	-0.0032	0.0210***	0.0006
	(1.45)	(-0.94)	(2.76)	(1.30)
CONST	0.0220	0.0253***	-0.0127	-0.0058
	(1.45)	(2.97)	(-1.20)	(-0.94)
Property Fixed Effects	yes	yes	yes	yes
Observations	**12,716**	**12,716**	**12,716**	**12,716**
R-squared	**0.408**	**0.375**	**0.279**	**0.384**

Panel 3: Office

VARIABLES	Model (1) *CAPEX_MV_t+1*	Model (2) *CAPEX_TI_MV _t+1*	Model (3) *CAPEX_BI _MV_t+1*	Model (4) *CAPEX_BE_MV_t+1*
RF10	-1.1495	-0.5717	-0.9125	0.0258
	(-0.61)	(-0.80)	(-1.13)	(0.13)
SPREAD	-0.8944**	-0.6644***	-0.1386	0.0585
	(-2.40)	(-4.15)	(-0.53)	(1.08)
SD	-0.4250	-0.0603	-0.9708	-0.0140
	(-0.18)	(-0.07)	(-0.98)	(-0.05)
INCRET	0.0083	-0.0745	0.0403	0.0080
	(0.10)	(-1.61)	(0.73)	(1.19)
INCRET_LAG1	0.0247	0.0047	0.0313	0.0018
	(0.53)	(0.29)	(1.25)	(0.35)
APPRET	0.0458	0.0134	0.0228	0.0009
	(1.36)	(0.69)	(1.16)	(0.50)
APPRET_LAG1	-0.0234***	-0.0145***	-0.0038	-0.0003
	(-4.06)	(-4.39)	(-1.29)	(-0.65)
*SD*RF10*	0.1749	0.0163	0.2547	0.0073
	(0.32)	(0.08)	(1.03)	(0.12)
*SD*INCRET*	-4.7822**	-0.6068	-1.8828	-0.1627
	(-2.36)	(-0.55)	(-1.18)	(-1.05)
*SD*APPRET*	-1.6501*	-0.5876	-0.7022	-0.0018
	(-1.77)	(-1.06)	(-1.27)	(-0.04)
LEVERAGE	-0.0092	-0.0015	-0.0030	-0.0015
	(-1.60)	(-0.47)	(-1.04)	(-1.23)
SQFT	-0.0000***	-0.0000	-0.0000*	-0.0000
	(-2.69)	(-0.82)	(-1.85)	(-1.04)
AGE	-0.0004	-0.0005**	0.0001	0.0000
	(-0.52)	(-2.34)	(0.23)	(0.36)
PCTLEASED_DT	-0.0337***	-0.0159***	-0.0065	-0.0008
	(-4.75)	(-4.23)	(-1.62)	(-1.06)
INV_NTAX	-0.0022	-0.0100	0.0055*	-0.0028
	(-0.59)	(-1.38)	(1.69)	(-0.91)
INV_MIXED	-0.0059	-0.0093	0.0024	-0.0033
	(-1.40)	(-1.38)	(0.71)	(-0.91)
CONST	0.1103	0.0699**	0.0446	0.0025
	(1.35)	(2.21)	(1.24)	(0.36)
Property Fixed Effects	yes	yes	yes	yes
Observations	**8,718**	**8,718**	**8,718**	**8,718**
R-squared	**0.412**	**0.358**	**0.397**	**0.286**

Panel 4: Retail

VARIABLES	Model (1) *CAPEX_MV_t+1*	Model (2) *CAPEX_TI_MV _t+1*	Model (3) *CAPEX_BI _MV_t+1*	Model (4) *CAPEX_BE_MV_t+1*
RF10	0.8841	0.5028	0.2845	0.4402
	(0.87)	(1.34)	(0.38)	(1.24)
SPREAD	0.2885	0.1501	0.2158	-0.1699
	(0.98)	(1.39)	(0.74)	(-0.99)
SD	0.9324	0.6162	-0.8932	0.9750
	(0.61)	(1.02)	(-0.70)	(1.37)
INCRET	-0.3097	-0.1510	-0.5116*	0.0133
	(-0.98)	(-1.01)	(-1.70)	(0.19)
INCRET_LAG1	0.0037	0.0039	0.0067	-0.0068
	(0.20)	(0.48)	(0.47)	(-0.99)
APPRET	-0.0015	-0.0112	0.0127	-0.0285
	(-0.03)	(-0.65)	(0.43)	(-1.13)
APPRET_LAG1	-0.0075	-0.0007	-0.0058	-0.0014
	(-0.82)	(-0.27)	(-0.80)	(-0.23)
*SD*RF10*	-0.3002	-0.1835	-0.0101	-0.2425
	(-0.85)	(-1.41)	(-0.04)	(-1.49)
*SD*INCRET*	6.5246	3.1216	14.7655	-0.8358
	(0.61)	(0.61)	(1.51)	(-0.34)
*SD*APPRET*	0.1369	0.2956	-0.4304	0.9999
	(0.09)	(0.54)	(-0.49)	(1.18)
LEVERAGE	-0.0225*	0.0004	-0.0053	-0.0089
	(-1.94)	(0.20)	(-0.89)	(-1.32)
SQFT	0.0000	0.0000	0.0000	-0.0000
	(1.62)	(0.87)	(0.77)	(-0.01)
AGE	-0.0001	-0.0000	0.0003	-0.0003
	(-0.56)	(-0.46)	(0.60)	(-0.80)
PCTLEASED_DT	0.0017	0.0121	-0.0030	-0.0008
	(0.11)	(1.37)	(-0.16)	(-0.21)
INV_NTAX	-0.0038	-0.0009	-0.0018	0.0007
	(-0.98)	(-0.42)	(-0.55)	(0.26)
INV_MIXED	-0.0053	-0.0003	-0.0036	-0.0000
	(-1.10)	(-0.15)	(-0.89)	(-0.01)
CONST	-0.0047	-0.0122	0.0176	-0.0051
	(-0.11)	(-0.74)	(0.56)	(-0.32)
Property Fixed Effects	yes	yes	yes	yes
Observations	**4,724**	**4,724**	**4,724**	**4,724**
R-squared	**0.487**	**0.375**	**0.407**	**0.347**