

REIT Capital Budgeting and Equity Marginal Q^*

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Abstract

Equity marginal q is the change in market value of a company's equity in conjunction with a one-unit unexpected change in its asset base. Hence, it is a profitability index that evaluates a firm's capital budgeting decisions at the margin. In this paper, we estimate the equity marginal q for real estate-managing public corporations, namely, real estate investment trusts (REITs), in an attempt to understand how the various costs and benefits of being a public corporation play a role in managing this important asset class. After controlling for equity issuance and leverage that can mechanically affect the equity marginal q ratio, we find that REITs with greater idiosyncratic volatility and higher stock turnover have a higher equity marginal q , confirming the information and liquidity benefits of public stock markets. In addition, the holdings of institutional investors and their investment horizons are respectively positively related to equity marginal q , suggesting that monitoring power is attributable mostly to institutions with a long-term perspective. Finally, firm size is found to be negatively related to equity marginal q .

Keywords: real estate investment trusts (REITs); capital budgeting; equity marginal q ratio

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1. Introduction

Real estate is an important asset class in the economy. Not only does real estate account for a large fraction of the national wealth and consumption (Mills 1987; Hendershott 1989), but investing in real estate is also known to lead the business cycle (Green 1997). Reflecting real estate's importance in the economy, many investors also utilize this asset class as a portfolio diversification tool due to its low correlation with other assets. Consequently, it is crucial to understand how real estate is invested and managed in the economy.

Given the nature of real estate and real estate investment, its ownership by public corporations (REITs) has both advantages and disadvantages. On one hand, as real estate entails large fixed investment, public corporations may have an advantage over private peers through better access to capital. Furthermore, equity trading in public markets may provide valuable managerial information and foster its production. In addition, REITs offer a readily transferable ownership interest in real estate. On the other hand, however, various agency problems inherent in a public company can create adverse effects. Related, it is also possible that investing in real estate requires area-specific information that is subtle and hard to communicate by nature: A large public corporation may not be as efficient as its private peer in dealing with this type of information.

Consequently, we examine the efficiency of REIT investment in real estate properties. For public corporations, a relatively precise measure of investment efficiency is available because the value of the company is determined and observed in the public securities market. More precisely, by examining the change in market value of those securities in conjunction with a one-unit unexpected change in the REIT asset base, one can measure how outside investors weigh the return on their investment in REITs against the return on their alternative investment opportunities such as direct private investment in real estate. Recognized as the marginal q ratio by Durnev, Morck, and Yeung (2004; DMY hereafter), this metric is the profitability index of the marginal investment from the perspective of outside capital providers. In this paper, we

particularly focus on equity capital providers by positing an equity-maximizing firm with long-term debt outstanding.¹ Specifically, we estimate the equity marginal q ratio for REITs, and associate our estimates with various proxies for the costs and benefits of being a public company in managing assets.

Several unique features of REITs justify our application of equity marginal q. First, REITs are subject to a mandatory payout policy (at least 90% of earnings) and, in return, avoid paying corporate tax. It thus follows that REITs raise capital externally and at the same time have fewer reasons to use debt or prefer it to equity. Therefore, it is instructive to examine how *equity* value changes in response to investment decisions. This also alleviates the problems that arise from the lack of market value information for debt securities.

The absence of corporate tax also makes investment decisions more transparent. In general, one important consideration in the capital budgeting process is the marginal tax rate – i.e., how much tax liabilities increase for a one-dollar extra profit from a new project. Unfortunately, the marginal tax rate is not observable to researchers, so they have difficulty understanding exactly how corporate managers take into account these tax effects (see, e.g., Graham and Mills 2007). With REITs, however, this is not an issue, since REITs do not pay corporate tax. Moreover, the fact that REIT assets are traded (albeit infrequently) in the secondary market and thus their value is observed with relatively greater precision also contributes to the transparency of REIT investment decisions.

It is also noteworthy that since 1990 the U.S. REIT sector has been mostly in a growth stage, suggesting that over-investment could be a potential concern. This observation warrants a marginal, rather than average, metric for an investment efficiency measure. It also facilitates the interpretation of equity marginal q, since growth options justify a q ratio that is higher than one (or other optimal level). In other words, the joint-hypothesis problem is significantly mitigated

¹ For example, Henessy (2004) postulates the same corporate goal.

with REITs. Finally, focusing on this particular industry allows us to utilize the rich firm-level dispersion, while controlling for various (and often unknown) industry-level characteristics.

Using the universe of equity REITs listed on the NYSE, AMEX, or Nasdaq for the period from 1993 to 2005, we find that the equity marginal q ratio for the REIT sector is of the order of 0.45, meaning that a one-dollar unexpected increase in asset base is associated with a 45-cent increase in the market value of equity. Before making any inference, we need to take into consideration several mechanical factors affecting our estimation. First, leverage will likely bias downward the equity marginal q ratio, since an increase in corporate assets first accrues to debt holders before contributing to equity value. Second, equity issuance activities may affect our estimates as we use the total, not per-share, market value of equity. Finally, it should be noted that REITs, at the time of going public, can record their properties either at the then current value or at the historical value, creating a situation in which two otherwise identical REITs have different book asset values. Although not necessarily a bias in a certain direction, this noise will be particularly stronger among young REITs whose asset values are still affected by their asset-recording decision upon IPO.

Analysis of the sub-samples sorted by leverage, equity issuance, or post-IPO age reveals that equity issuance, and firm age to a weaker extent, are positively related to equity marginal q . In contrast, leverage does not appear to affect our q estimates. The lack of a leverage effect is in fact reasonable given the known efforts of REITs to maintain their target capital structure by issuing equity when they have more debt (e.g., Brown and Riddiough 2003): that is, high leverage REITs are subject to two countervailing effects on their equity marginal q .

When we examine the temporal variation in the sector's equity marginal q ratio, we find that it is mostly explained by the sector's equity issuance activities, its growth opportunities, and the general bond market condition as measured by the credit risk premium. Additionally, although we find a significantly lower equity marginal q for diversified REITs, their time-varying presence does not explain the time-variation in the sector's equity marginal q ratio.

After examining the time-variation and the mechanical forces behind the marginal equity q , we begin our in-depth analysis of the estimated equity marginal q ratio by associating it with various proxies for the costs and benefits of being public. We find that the equity marginal q at the individual firm level (i.e., individual deviations from the sector average) is correlated with the proxies for the signaling and monitoring mechanisms of public stock markets. First of all, firm-specific stock return volatility, a common proxy for private information produced in the stock market, is found to be positively related to equity marginal q . This variable is motivated on the grounds that private information held by informed traders tends to be firm-specific rather than market- or industry-wide, and thus a greater contribution of firm-specific shocks to stock return volatility indicates greater presence of informed traders (e.g., Durnev, Morck, and Yeung 2004). Our finding is hence consistent with public stock markets helping managers make better investment decisions by providing managerial information such as the cost of equity capital (Chen, Goldstein, and Jiang 2007). The liquidity benefit of a public company is also confirmed, since the stock turnover is positively related to equity marginal q .

Institutional ownership is similarly positively related to equity marginal q , consistent with the finding of Harzell, Sun, and Titman (2006) that institutions play a monitoring role. Perhaps more important, the investment horizon of the institutional investors is also positively related to equity marginal q , implying that the beneficial monitoring stems mostly from institutions with a long-term perspective. Finally, larger firm size is associated with a lower equity marginal q .

To more directly address the counter-argument that the observed equity marginal q for the sector is at the optimal level and thus any deviation from it should be viewed as a sign of inefficient capital budgeting decisions, we examine the deviation squared rather than the deviation itself. Our results further make this counter-argument implausible, as the estimated coefficients lead to a disturbing interpretation. For example, institutional ownership is positively related to the deviation squared, which would have to be interpreted as having more institutions as equity holders being associated with a poorer investment decisions.

In summary, our analysis shows that managing real estate in a public corporation is beneficial under some conditions. More precisely, information emerges as an important consideration, and a good governance system should be in place to mitigate the agency problems. We also find it crucial to engage equity holders with a long-term perspective. This latter implication will be particularly important given the long-lived nature of real estate properties.

This paper proceeds as follows. In the next section, we detail our sample and data. Section 3 first provides the theoretical background of equity marginal q and then reports the equity marginal q estimate for the REIT sector along with a discussion of the associated estimation issues. Section 4 examines the time-series patterns of the sector marginal q ratio, and conducts the cross-sectional analysis using the individual firm level data. Finally, Section 5 concludes the paper.

2. Sample and data

To construct the sample, we begin with all equity REITs ever listed on the NYSE, AMEX, or Nasdaq between 1993 and 2005, as identified by the CRSP/Ziman database. In order to be included in the analysis, we require each REIT to have at least 45 weekly stock returns on CRSP for a given year, along with the accounting data from Compustat needed for marginal q estimation.² Finally, we exclude firm-year observations whose annual change in gross asset (the sum of total assets and depreciation) is greater than 300 percent.³ The first line of Table 1 reports the number of REITs in our sample. The maximum number of REITs in a given year is 181, and no year has fewer than 104. Typically, we have 155 REITs during a year.

² As an alternative to using the accounting book value of assets, we use the net asset value from a different data source, namely the SNL database. These results are discussed in Section 3.2.

³ Truncation of extreme observations is also found in other studies. For example, Gentry and Mayer (2003) and Hartzell, Sun, and Titman (2006) eliminate the observations whose annual asset growth rate is greater than 100 percent. Our use of a higher cutoff (i.e., 300 percent) biases the estimated q ratio upwards by allowing for the stock price response to a larger asset value change. In Section 3.1, we report the marginal q estimates based on alternative truncation cutoff levels.

The second panel of Table 1 reports the summary statistics of the variables required for estimating the equity marginal q . Specifically, E_t is the closing stock price (#199) times the number of shares outstanding (#25) in year t ; A_t is total assets (#6) plus depreciation (#125) in year t ; and D_t is cash dividends (#127) plus stock repurchases (#115) in year t . The sample statistics show that our marginal q estimates are not caused by extreme values of these variables. The annual change in the market value of equity relative to the beginning-of-the-year gross total assets ($\Delta E_t/A_{t-1}$) ranges from -55 percent to 174 percent with the mean of 14 percent. The ratio of equity market value to total assets (E_{t-1}/A_{t-1}) also shows no extreme values; it ranges from 5 percent to 209 percent with the mean value of 62 percent. Finally, disbursements to equity holders account for approximately 6 percent of total assets.

3. Equity marginal q of REIT sector

3.1. Theoretical background of equity marginal q

DMY have the following definition of marginal q ratio:

$$\dot{q} = \frac{\Delta V}{\Delta K} = \frac{1}{C_0} E \left[\sum_{t=1}^{\infty} \frac{cf_t}{(1+r)^t} \right] = 1 + \frac{E[NPV]}{C_0} = E[PI], \quad (1)$$

where cf_t is the cash flows at t from the marginal project, C_0 is its initial capital outlay, and r is the risk-adjusted discount rate. The last term PI stands for the profitability index, and all the expectations (denoted by $E[\cdot]$) are from the perspective of outside investors. To estimate marginal q , the authors rewrite the above equation as follows:

$$\dot{q}_{j,t} = \frac{V_{j,t} - E_{t-1}V_{j,t}}{A_{j,t} - E_{t-1}A_{j,t}} = \frac{V_{j,t} - V_{j,t-1}(1 + \hat{r}_{j,t} - \hat{d}_{j,t})}{A_{j,t} - A_{j,t-1}(1 + \hat{g}_{j,t} - \hat{\delta}_{j,t})}, \quad (2)$$

where V is the market value of firm j and A is its stock of capital goods. E_{t-1} is the expectation operator at time $t-1$ (it does not represent equity), $\hat{r}_{j,t}$ is the expected return from owning the firm, $\hat{d}_{j,t}$ is the disbursements to investors, $\hat{g}_{j,t}$ is the expected rate of spending on capital

goods, and $\hat{\delta}_{j,t}$ is the expected depreciation rate on those capital goods. The authors obtain the regression equation for marginal q estimation by cross-multiplying and simplifying the above equation.

In equation (2), it is possible to use equity value only as the numerator if an equity-maximizing corporate manager is assumed (DMY; p.75). Specifically, this alternative approach implies:

$$\dot{q}_{j,t} = \frac{S_{j,t} - E_{t-1}S_{j,t}}{A_{j,t} - E_{t-1}A_{j,t}} = \frac{S_{j,t} - S_{j,t-1}(1 + \hat{r}_{j,t} - \hat{d}_{j,t})}{A_{j,t} - A_{j,t-1}(1 + \hat{g}_{j,t} - \hat{\delta}_{j,t})}, \quad (3)$$

where S denotes the market value of equity, and $\hat{r}_{j,t}$ and $\hat{d}_{j,t}$ are defined accordingly for equity, not for equity plus debt. With similar cross-multiplications and simplifications, this equation is equivalent to:

$$\frac{S_{j,t} - S_{j,t-1}}{A_{j,t-1}} = -\dot{q}_j(g_j - \delta_j) + \dot{q}_j \frac{A_{j,t} - A_{j,t-1}}{A_{j,t-1}} + r_j \frac{S_{j,t-1}}{A_{j,t-1}} + \zeta_j \frac{D_{j,t}}{A_{j,t-1}} + u_{j,t} \quad (4)$$

or

$$\frac{\Delta S_{j,t}}{A_{j,t-1}} = \alpha + \beta_0 \frac{\Delta A_{j,t}}{A_{j,t-1}} + \beta_1 \frac{S_{j,t-1}}{A_{j,t-1}} + \beta_2 \frac{D_{j,t}}{A_{j,t-1}} + u_{j,t}, \quad (5)$$

where $D_j = S_{j,t-1}d_j$. Equation (5) shows that the coefficient for the asset change isolates the marginal q from the perspective of equity holders.⁴

⁴ We also discuss Hennessy's (2004) version of equity marginal q. By assuming a constant return to scale and a price-taking firm, he starts with firm-value *average* q, which is equivalent to firm-value marginal q with the two assumptions (see Hayashi 1982):

$$Q(K_0, \varepsilon_0) \equiv \frac{S(K_0, \varepsilon_0) + D(K_0, \varepsilon_0)}{K_0}.$$

Hennessy shows the following relationship between average Q and equity's marginal q :

$$q(K_0, \varepsilon_0) = Q(K_0, \varepsilon_0) - \frac{R(K_0, \varepsilon_0)}{K_0},$$

where the second term in the right-hand side represents the normalized current market value of total default recoveries (R). In other words, his version of equity marginal q is the market value of equity (S) plus some of the market value of debt ($D - R$), divided by the capital stock (K). To obtain this ratio at the margin without making the assumptions of constant return to scale and price-taking firm, we need to consider how

3.2. Equity marginal q estimates

To obtain the equity marginal q ratio, we employ the equation (5) (with some modification suggested by Ferreira and Laux (2007)). Specifically for REITs, we estimate:

$$\frac{\Delta E_{j,t}}{A_{j,t-1}} = \alpha + \beta_0 \frac{\Delta A_{j,t}}{A_{j,t-1}} + \beta_1 \frac{E_{j,t-1}}{A_{j,t-1}} + \beta_2 \frac{D_{j,t}}{A_{j,t-1}} + \varepsilon_{j,t}, \quad (6)$$

where $E_{j,t}$ is the market value of REIT j 's common equity at time t , $A_{j,t}$ is the book value of the gross total assets of REIT j at time t , and $D_{j,t}$ is the cash dividends and repurchases of REIT j at time t . The coefficient for $\Delta A_t/\Delta A_{t-1}$ (i.e., β_0) corresponds to the estimated equity marginal q ratio, that is, the change in equity market value in response to the contemporaneous one-unit *unexpected* change in asset base. As detailed in the previous sub-section, the expected change in asset value is lumped together with the marginal q in the intercept. The coefficient for E_t/A_{t-1} (i.e., β_1) corresponds to the expected increase in equity. Finally, β_2 reflects the impact of dividends on changes in equity.

We estimate equation (6) via three methods to ensure robustness of our estimates. First, we follow the Fama-MacBeth (1973) method by estimating the equation each year and then averaging the yearly estimates over time (while adjusting the test statistics for the serial correlation). Second, we estimate the equation as a panel with year fixed effects (i.e., 12 year dummy variables) while allowing for correlations among observations from the same REIT. Third, we estimate the equation as a pooled GLS with the White (1980) covariance estimator.

S and $D - R$ change respectively in response to a one-unit change in K . In his model setup, $D - R$ is $E \left[\int_0^T e^{-rt} b dt \right]$, where b is the periodic debt payment and T is the point in time when the firm goes bankrupt. Consequently, $D - R$ is not a function of K , and thus his version of equity marginal q without the two assumptions would be consistent with ours, which is:

$$q(K_0, \varepsilon_0) = \frac{\Delta S(K_0, \varepsilon_0)}{\Delta K_0}.$$

Table 2 reports the results. The Fama-MacBeth estimate for equity marginal q is 0.432, meaning that for the one-dollar increase in REIT gross total assets at the margin, the equity market value increases by 43.2 cents. This magnitude is robust across the three estimation methods, as the panel estimate of the equity marginal q is 0.496 and its pooled GLS estimate is 0.467. All three marginal q estimates are statistically different from one (as well as from zero) at the 1 percent level.⁵

The original argument by Tobin (1969) is that a less-than-one equity marginal q ratio implies that the value of the marginal project from the perspective of equity holders is smaller than its costs because the company has exhausted its positive-NPV projects and is now engaging in negative-NPV projects (i.e., over-investment).⁶ Conversely, a higher-than-one equity marginal q implies that equity value increases more than one dollar for the one-dollar investment at the margin; hence, the company is under-investing. This interpretation, however, is not correct if the marginal project is correlated with the company's growth options and the equity value changes in response to changes in these growth prospects. More specifically, as the numerator of the q ratio includes the option value of the project as well as its cash flows, a higher-than-one q ratio can be

⁵ In an unreported result, the alternative cutoff level of 100 percent for annual total asset change yielded a much lower equity marginal q of 0.344 (Fama-MacBeth), 0.352 (panel), and 0.310 (pooled GLS) with a smaller sample of 1,908 firm-year observations over 13 years. With the cutoff level of 500 percent, the three estimation methods produced respectively 0.463, 0.566, and 0.536. Using the cutoff of 1,000 percent, we obtained the similar equity marginal q estimates between 0.440 and 0.499. Finally, without any cutoff, the panel and pooled GLS estimates were respectively 0.612 and 0.593, while the Fama-MacBeth estimate was 0.481.

In an unreported result, we also used the net asset value, which is defined as the value of total assets minus total liabilities, and also includes property management and partnership incomes. Hence, this measure can correctly reflect the recent trend that several large REITs have entered the property management business on behalf of other investment companies such as pension funds. This asset management activity will not appear on the balance sheet (i.e. book value of assets) unless the REIT has a stake in the properties (or the delegating funds themselves). The cost of using the NAV is that the number of REITs is reduced almost by 30 percent. Such limited sample size is the typical cost of using the net asset value versus accounting book value. For example, Hartzell, Sun, and Titman (2006), while acknowledging the potential advantage of using the net asset value, use the accounting book value to maintain the breadth of their sample. They report that the correlation coefficient between net asset-based average q and book value-based average q is as high as 0.92. We found that the NAV-based equity marginal q ratio ranges from 0.138 to 0.311, which are lower than our book value-based q estimates.

⁶ This interpretation assumes that a manager takes projects in the order of their net present values. This assumption is not unrealistic even if one considers the agency problems associated with managerial discretion. As in Stulz (1990), perquisites enjoyed by managers are likely to increase with corporate resources, which will increase with the net present values of the projects that the manager takes.

consistent with efficient investment decision. In the next section, we discuss this consideration and others affecting the optimal level of marginal equity q in greater detail.

Regarding the coefficient for E_t/A_{t-1} (i.e., β_1), since we use the stock price changes net of the disbursement, our estimates reflect the investor's expected capital gain and equity issuance. Across the three estimation methods, we find β_1 to be between 0.017 and 0.035. Given the substantial dividend payouts to REIT shareholders, the estimated increase in equity value of approximately 2 percent to 3 percent per year is not unreasonable. For example, Capozza and Seguin (2003) report that the annual capital gain is of the order of 2 percent.

Finally, the construction of equation (6) suggests that the coefficient for D_t/A_{t-1} (i.e., β_2) should equal -1.0 in principle, since a one-dollar dividend mechanically reduces the stock price by the same amount. However, as is noted by DMY, different tax brackets across REIT shareholders may make this coefficient different from one. Uniquely, REITs also pay as much as 90 percent of their earnings as dividend and, as a consequence, frequently issue new equity. Hence, our estimate is likely to be different from minus one. The signs of our coefficient estimates for this variable turn out to be all positive, although they are not significant.

3.3. Estimation issues

3.3.1. Downward biases in equity marginal q

Several mechanical factors may affect the equity marginal q ratio. Among others, leverage could introduce a downward bias, since debt holders have a senior claim on the firm's assets. In other words, any increase in corporate assets will accrue to equity holders only after debt holder claims are satisfied; hence, it is possible that our seemingly low equity marginal q estimate reflects the use of leverage by REITs. To understand the leverage effect, it is instructive to refer to equation (1). In the original firm-value q ratio, the numerator represents the cash flows accruing to all capital providers (i.e., equity holders and debt holders) discounted at the weighted average costs of capital. It is a textbook result that this "firm value" is the same as the "equity

value” which is the cash flows accruing to equity holders discounted at the cost of equity capital, as long as the default probability is zero. Intuitively, this is expected as the value of debt is positively bounded, so any incremental cash flows belong to equity holders as long as the debt payments are covered. As a result, as long as a non-zero default probability exists, the equity marginal q will be lower than the firm-value marginal q . Also, its optimal level cannot be one; instead, it should be below one (Hennessy 2004).

Another mechanical factor behind the equity marginal q is the equity issuance activities. Note that we use the total market value of equity, as opposed to the per-share price, to estimate equity marginal q . Consequently, an increase in the number of shares can mechanically raise the q ratio even if the stock price does not change.

In fact, leverage and equity issuance are closely related. Prior studies have shown that REITs maintain their target capital structure, meaning that greater equity is issued by high-leverage firms (e.g., Brown and Riddiough 2003). Hence, on one hand, higher leverage represents a greater claim by debt holders to corporate cash flows and thus reduces equity marginal q . On the other hand, high leverage causes more equity to be issued, making the equity marginal q higher.

Finally, in estimating the equity marginal q , we rely on the accounting book value of assets. REITs, at the time of going public, record their properties either at the then current value or at the historical value, creating a situation in which two otherwise identical REITs have different book asset values. For example, if the historical value is lower than the market value, then REITs that recorded the IPO assets at historical value will have a lower asset base and thus a higher equity marginal q . If the historical value is higher, then we would have the opposite result. In either case, this effect will be more pronounced among young REITs, since their decisions at the time of the IPO have the lingering effect on the book value of their assets.

To address the above three factors, we construct sub-samples sorted by leverage, equity issuance, or post-IPO age, and examine whether equity marginal q is different in these

dimensions. Specifically, we estimate the following equation using leverage- or equity issuance-sorted sub-samples:

$$\frac{\Delta E_{j,t}}{A_{j,t-1}} = \alpha + \sum_{k=m,h} \alpha_k D_k + \beta_0 \frac{\Delta A_{j,t}}{A_{j,t-1}} + \sum_{k=m,h} \beta_{0,k} D_k \frac{\Delta A_{j,t}}{A_{j,t-1}} + \beta_2 \frac{D_{j,t}}{A_{j,t-1}} + \varepsilon_{j,t}, \quad (7)$$

where D_k is the dummy variable for one of the three sub-sample k (either m (median) or h (high)). In this specification, the “low” sub-sample serves as the baseline. In other words, β_0 is the equity marginal q for the low-leverage sub-sample, and $(\beta_0 + \beta_{0,k})$ is the equity marginal q for the sub-sample k (m or h). The test statistic associated with $\beta_{0,k}$ thus determines the statistical difference in equity marginal q between the sub-sample k and the benchmark sub-sample. We do not have such concern with post-IPO age-sorted sub-samples, so we estimate the following equation:

$$\frac{\Delta E_{j,t}}{A_{j,t-1}} = \alpha + \sum_{k=m,h} \alpha_k D_k + \beta_0 \frac{\Delta A_{j,t}}{A_{j,t-1}} + \sum_{k=m,h} \beta_{0,k} D_k \frac{\Delta A_{j,t}}{A_{j,t-1}} + \beta_1 \frac{E_{j,t-1}}{A_{j,t-1}} + \beta_2 \frac{D_{j,t}}{A_{j,t-1}} + \varepsilon_{j,t}. \quad (8)$$

Table 3 reports β_0 , $\beta_0 + \beta_{0,m}$, and $\beta_0 + \beta_{0,h}$ from the three estimation methods, along with the number of REITs in each sub-sample and their average of the sorting variable. In the left panel of the table, it is quite striking that the leverage ratio-sorted sub-samples show little difference in their equity marginal q. Even though their leverage ratios are meaningfully different (24 percent, 45 percent, and 65 percent respectively for the low-, medium-, and high-leverage ratio sub-samples), their equity marginal q ratios are relatively similar. Specifically, the low-leverage ratio sub-sample has an equity marginal q ratio between 0.388 and 0.482, depending on the estimation method. Similarly, the equity marginal q ratios for the medium- and high-leverage ratio sub-samples are, respectively, between 0.475 and 0.508 and between 0.434 and 0.513.

The no-result for leverage-sorted sub-samples is likely to be due to the fact that high leverage REITs issue more equity, undoing the leverage effect on equity marginal q. As in prior studies, we confirm that leverage and equity issuances are positively correlated. Hence, the middle panel reports the q ratio for the equity issuance-sorted sub-samples. We observe a clear difference in equity marginal q between the sub-samples, especially between low- and high-issuance sub-

samples. This result not only confirms our conjecture of the equity issuance effect, but also helps rationalize the leverage effect.

In the right panel, we report the results for age-sorted sub-sample. Although not as strong as the issuance-sorted sub-samples, there is a difference in q ratio in the dimension of post-IPO age. Specifically, older REITs seem to have a higher q ratio, emphasizing the need to control for firm age in the subsequent analysis.

3.3.2. Optimal level of equity marginal q

It is typically assumed that the optimal marginal q is one. Applying this to equity marginal q ratio, it means that the one-dollar marginal investment is worth just one dollar to equity holders, making the profitability index unity. In practice, however, various complications can cause the optimal level to deviate from one, besides the obvious effect of leverage. As detailed by DMY (p. 77), it is virtually impossible to consider all the complications ex ante and adjust the optimal level. However, the authors identify several important complications including the role of taxes, the aggregation of investment projects, and the impact of growth options.

First, we consider the effect of taxes. A company can retain and reinvest earnings, converting dividends income into capital gains. In this case, the differential between income and capital gain tax rates can affect both the optimal level of q and its empirical estimates. Using a capital gain tax rate of 14 percent and a dividend tax rate of 33 percent and also assuming that the marginal investor is tax-exempt half of the time, DMY estimate the tax effect to be approximately 1.15.⁷ In other words, if the estimated equity marginal q is, say, 0.8, then equity holders in fact perceive the one-dollar marginal investment to be worth 92 cents (0.8 times 1.15). In addition, the optimal level of marginal q is elevated to 1.15. With REIT, however, most of the cash flows accruing to equity holders are in the form of dividends, so the differential tax rates will not be economically important.

⁷ $\frac{1}{2} * 1 + \frac{1}{2} * [(1-0.14)/(1-0.33)] \Leftrightarrow 1.15.$

Second, since we use the annual changes in total assets as a measure of investment, it is possible that marginal and non-marginal projects are lumped together. As the company is likely to take the projects with higher net present values first, this aggregation will inflate the estimated marginal q . To illustrate, suppose that the marginal project has zero-NPV (i.e., marginal q is 1) and the previous project had a slightly positive NPV (its marginal q is, say, 1.1). If we aggregate the two projects, then our q estimate will be between 1 and 1.1, which is higher than the true marginal q of 1. The implication is that our marginal q estimate is *higher* than the true marginal q of the sector. Hence, this consideration alone would not allow us to argue that the REIT sector is operating at its optimum.

Finally, stock market valuations may reflect changes in the value of growth options as well as that of the marginal investment. This scenario is particularly plausible when the marginal project (or aggregated investment projects) is correlated with future growth options. As a result, the optimal marginal q level does not have to be one when growth options are present and their value changes. Although it is generally unclear how this consideration affects the optimal level of the q ratio and its empirical estimate, REITs uniquely allow us to conjecture the direction of the biases associated with this option feature for the following two reasons. First, REITs have been mostly in the growth stage. Second, due to irreversibility of real estate investment, growth option value is particularly important in REIT valuation. Consequently, the optimal q ratio for the REIT sector is likely to be higher than the case of regular, industrial firms.

In summary, it is generally assumed that there exists an optimal level of q (e.g., unity) and any deviation from it indicates inefficient investment. This creates a joint-hypothesis problem, since a researcher first has to find the optimal q level in spite of various real world complications. REITs uniquely help avoid this joint-hypothesis problem, since the sector has been growing most of the sample period and real estate investment, due to its nature, entails the option feature. For example, a higher equity marginal q than the sector average can be interpreted as a healthy sign of capital budgeting.

4. Sector-wide and firm-level analysis of equity marginal q of REIT sector

In this section, we first examine the time-series trend in the REIT sector equity marginal q. Since we have a short time-series (13 years), the sector-wide temporal variation in equity marginal q is not our main interest. However, an understanding of how it varies over time and what factors affect such temporal changes is a prerequisite for our later analysis of equity marginal q at the individual firm level. Following the sector-wide time-series analysis, we introduce the cross-section dispersion, with emphasis on the effect of the signaling and monitoring mechanisms of public stock markets on individual equity marginal q ratios.

4.1. Time-series and cross-sectional patterns of equity marginal q

To first detect time-trends, we estimate yearly marginal q ratios. Specifically, we estimate equation (6) every year to obtain the year-specific equity marginal q ratio. In the left panel of Table 4, the year-by-year equity marginal q ratio declines significantly from 0.840 at the beginning of the sample period to 0.154 by 2000. It then rebounds somewhat by the end of the sample period. The 2005 estimate of equity marginal q of 0.363 is, however, approximately less than one half of its initial level.

In the right panel, we estimate the equity marginal q for each of the property types. Their equity marginal q ratios are estimated through the panel and the pooled GLS versions of equation (6) by adding the interactive terms between the dummy variables for each property focus and the percentage changes in gross total assets.⁸ Interestingly, there is no meaningful (and statistically significant) difference in equity marginal q across different property types. The only exception is the group of diversified REITs whose q ratio is significantly lower than the sector average. It may appear surprising that most property types have similar equity marginal q ratios. However,

⁸ We do not use the Fama-MacBeth method due to the limited number of observations within a year for each investment style or property type.

our results can be interpreted that there are no arbitrage opportunities as different property types are similarly profitable at the margin.

As discussed in the previous section, there are at least three variables that can potentially explain the observed time-variation of the sector's equity marginal q ratio. One is the growth opportunities of the REIT sector, since the equity marginal q will reflect the option value as well as the cash flows from the marginal project. Another factor is the equity issuance activity, because it mechanically increases the number of shares (and thus the total market value of equity assuming no change in the per-share price). The third one is the credit quality of the REIT sector, as it represents the default likelihood (which reduces the equity marginal q ratio for the sector).

We construct each of the three variables at the sector level. Specifically, the growth opportunity and equity issuance are respectively the cross-sectional averages of the lagged equity market value scaled by lagged assets and of the individual equity issuances. For credit quality, unfortunately only a few REITs have this information available. However, Brown and Riddiough (2003) show that the REIT bond market is integrated into the broader bond market. Based on this finding, we use the credit risk premium at the general bond market level (Moody's Baa yield in excess of 10-year Treasury yield) as a proxy for REIT sector credit quality. In addition to these three variables, we include the number of diversified REITs, since we observed that they have a significantly lower equity marginal q. Hence, it is possible that some of the time-variation is attributable to the varying presence of diversified REITs.

Before proceeding further, we stress, again, that we do not attempt to make any meaningful inference from our results, since there are only 13 observations. Instead, we just want to make sure that we have an understanding of the temporal variation in equity marginal q during the sample period, so that we can focus on firm-level variation in the subsequent analysis without missing information in other dimensions.

The first panel of Table 5 reports the correlation coefficients between the four variables. As might be expected, the credit risk premium, albeit obtained from the general bond market, is

significantly and negatively correlated with the growth opportunity variable. Other correlations are not significant, except for those with the number of diversified REITs; this variable is significantly correlated with all other three variables.

In the second panel, we estimate a regression of year-by-year sector q ratios (those that are reported in the left panel of Table 4) on the above variables. Consistent with Table 3 results, the equity issuance variable enters the regression with a positive and significant coefficient. Growth opportunities, measured at the beginning of a given year, are also positively related to equity marginal q that is estimated during the year. The credit default premium is negatively, albeit statistically marginally, related to the sector's q ratio, confirming that role of default likelihood in determining equity marginal q ratio. Given the small number of observations and only a few explanatory variables, the R-squared is quite impressive. Across the four specifications, the R-squared is around 50 percent. Hence, it seems to be justified that we focus on firm-level variation as long as we control for equity issuance, growth opportunities, and credit quality.

4.2. Equity marginal q and public stock markets -- Variables

Public corporations and their (dis)advantage over the private peers is not a new research topic. Back in the 1980s, going private transactions (leveraged buyouts) triggered numerous studies, and the recent de-listings and privatization led by private equity funds has re-ignited this line of research. Augmented with the IPO studies, we now have a good theoretical guidance for the costs and benefits of being a public corporation (e.g., Bharath and Dittmar 2007; Boot, Gopalan, and Thakor 2006). We thus build on those studies to identify proxies for the costs and benefits of being public that are suited for REITs.

Bharath and Dittmar (2007) show that information and liquidity are two most important considerations in remaining public (i.e., not choosing to be private), and they are particularly relevant for REITs. Regarding information, it is well documented that uncertainty plays an important role in real estate investment due to its irreversibility and “delayability” (Holland et al.

2000). Hence, information generated outside the company will help make sound capital budgeting decisions by resolving uncertainty associated with real estate investment. Here, the relevant information is the one that is not held by corporate manager. Based on this discussion, we first employ the idiosyncratic stock return volatility, defined as $1 - R^2$. We obtain the R^2 from the year-by-year regression of the weekly stock returns of individual REITs on the value-weighted portfolio of common (i.e., non-REIT) stocks and the value-weighted portfolio of all sample REITs.⁹ This variable represents the proportion of REIT stock returns that is not explained by the general stock market-wide or the REIT sector-wide shocks. It is also equivalent to the volatility of the regression residuals divided by the volatility of the REIT stock returns. Recent studies establish this variable as a measure of the amount of private information generated in the stock market (e.g., Durnev, Morck, and Yeung 2004; Chen, Goldstein, Jiang 2007). The rationale is that private information held by informed traders tends to be firm-specific rather than market- or industry-wide; consequently, a greater contribution of firm-specific shocks to stock return volatility can indicate greater participation of informed traders and thus greater amount of their private information in the stock price.

Institutional ownership can be another proxy for information. At the same time, however, it will gauge how much monitoring is at work for the corporate manager. As public corporations naturally have diffused ownership (oftentimes held by uninformed, passive investors) and thus are subject to agency problems associated with managerial discretion, institutional investors can exert monitoring power and help improve the governance of REIT management (Hartzell, Sun, and Titman 2006). Along this line, we also include insider ownership as measured by the company common shares held by the top executives (CEO, CFO, COO, and presidents).

A related issue is the investment horizon of equity holders, because their horizons have an impact on the managerial horizon and thus the investment decisions (e.g., Shleifer and Vishny

⁹ At least 45 weekly returns are used for this yearly regression, since we already screen the sample using this requirement.

1990). Recently, Gaspar, Massa, and Mantos (2004) devise a measure of investor short-termism using the institutional holdings data, and find that their short-termism measure is related to the frequency and premium of corporate takeovers in the U.S. We thus borrow their measure to see whether investor horizon is related to equity marginal q ratio of REITs. Given the long-lived nature of real estate properties, this horizon issue is potentially important.

Regarding liquidity, we use the daily average of stock turnover. In general, a public corporation is desirable due to its readily transferable ownership. This benefit will be particularly useful if the assets managed by the company are otherwise hard to access but an exposure to them is valuable. Real estate properties meet these two conditions, and thus the liquidity of REITs will be one important determinant of the evaluation of REIT investments by equity holders. We also use the bid-ask spread of REIT stock prices as another liquidity measure. However, this variable can also be interpreted as a measure of the efficiency in REIT stock valuation. As a widely accepted proxy for information asymmetries among investors, a stock with a smaller bid-ask spread can be considered to have a more reliable stock price that is closer to its fundamental value.

Along with the stock market-related firm characteristics, we control for leverage and debt maturity. Viewed as a call option on corporate cash flows, equity value will be affected by the debt amount and its maturity. We thus include these two variables in the firm-level analysis. For the maturity variable, the limited data availability forces us to only calculate the fraction of total debt that is due in more than one year. As discussed earlier, equity value as a call option on corporate cash flows is particularly sensitive to the default probability, so we need to include the credit quality for individual REITs. Unfortunately, this information is only scantily available. As an alternative, we use a variable that is commonly used for credit rating decision, namely, interest coverage ratio as measure by: $(\text{net income} + \text{depreciation and amortization} + \text{interest expenses}) / (\text{interest expenses} + \text{preferred dividends})$.

Finally, we include firm size, post-IPO age, and a dummy variable for diversified REITs. Since REIT size has increased significantly over time, we scale it by the inflation index (base year: 1992).

4.3. Equity marginal q and public stock markets -- Summary statistics

Table 6 reports the above variables, along with the firm-level equity marginal q. It is difficult to directly estimate the firm-level equity marginal q ratio, so we follow Ferreira and Laux (2007) by using the individual deviations from the sector marginal q as a measure of individual marginal q. Specifically, we use the residuals from the pooled GLS version of equation (6) as a measure of equity marginal q at the individual firm level.¹⁰

The first line of Table 6 reports the residuals from the sector equity marginal q estimation. By construction, the mean value of the residuals is zero. However, they have extreme values at both ends: the minimum value is -1.721 and the maximum is 3.885. To prevent these outliers from affecting our results, we truncate the residuals at the 1st and the 99th percentiles; consequently, the residuals used in the second-step regression range from -0.680 to 0.775.

Summary statistics of other variables are also reported in Table 6. For leverage, institutional ownership, and insider ownership, we treat as missing if the value is greater than one. The coverage ratio cannot be calculated when the company has no debt and does not pay any preferred dividend (note that some of our sample REITs have no debt.) Thus, we winsorize this variable at 10. Also, we winsorize it at 0 for REITs that have negative earnings.

Table 7 reports the correlation coefficient between the variables. Not surprisingly, most of them are highly correlated. Among them, leverage and coverage ratio have a correlation coefficient as high as -0.675, so having them together in one regression can be problematic. Similarly, firm size is highly correlated with many of other firm characteristics. Hence, we will

¹⁰ We do not use the year fixed-effect panel method, since we want to directly observe and control for the time effects.

examine whether the regression coefficients are sensitive to including firm size. We additionally attempt to mitigate the multicollinearity by first estimating the univariate regressions.

4.4. Equity marginal q and public stock markets -- Analysis

Table 8 reports the univariate regression results. As mentioned earlier, this is to address the potential multicollinearity due to high correlation between the variables. However, the univariate results should be interpreted with caution, since the true effect of a certain variable can be isolated only when the effects of other variables are correctly controlled for.

Of the 13 variables that we initially consider, leverage, insider ownership, bid-ask spread, and the dummy for diversified REITs do not appear promising. The p-values of the coefficients for those variables, all based on the White (1980) covariance estimator, range from 0.377 to 0.958. In contrast, equity issuance, investor short-termism, turnover, age, and coverage ratio are highly significantly related to equity marginal q ratio at the individual firm level. Firm size, debt maturity, institutional ownership, and idiosyncratic volatility are marginally significantly related to equity marginal q ratio.

The coefficient sign for each of the variables is intuitive. A positive coefficient for equity issuance is expected, as it increases the number of shares and thus raises the equity marginal q ratio. The investor short-termism measure carries a negative coefficient, meaning that institutions with a short-term perspective have an adverse effect on capital budgeting decisions. Stock turnover is positively related to equity marginal q, confirming the liquidity benefit of being public. Coverage ratio enters the regression with a positive sign, since a greater value for this variable means a lower likelihood of default (i.e., greater cash flows accruing to equity holders and thus a higher equity marginal q). A weakly negative coefficient for firm size suggests that larger REITs over-invest compared to their smaller peers. A negative coefficient for debt maturity means that REITs with short-term debt make better investment decisions. Finally, a positive coefficient for

institutional ownership and idiosyncratic volatility implies that there is a monitoring effect and that information generated in stock markets helps managers make good investment decisions.

Table 9 reports the multivariate regression results. In Model (1), the variables that were significant in the univariate regression continue to be significantly related to equity marginal q.¹¹ In addition, institutional ownership and idiosyncratic volatility dramatically increase their statistical significance with the same positive coefficient. When firm size is added (Model (2)), the coefficients for other variables hardly change, and firm size itself enters the regression with a significant and negative coefficient. These variables combined explain about 21 percent of the variation of the dependent variable.

To better understand in which dimension those variables have the explanatory power, we employ three more specifications. As noted at the bottom of the table, we first introduce firm fixed effects to focus on the explanatory power of the variables for the within-firm variation. We then replace the firm fixed effects with year fixed effects to turn our attention to within-year, cross-sectional variation. Finally, we include both sets of fixed effects as the final regression specification.

Comparing Models (3) and (4), we find that idiosyncratic volatility, stock turnover, and firm age explain the within-firm variation, but not the within-year, cross-sectional dispersion of equity marginal q ratios. In contrast, coverage ratio only explains the within-year variation. Firm size, equity issuance, institutional ownership, and investor short-termism are significantly related to equity marginal q in both specifications. Finally, Model (5) includes both firm and year fixed effects, so that the coefficients are estimated based on the entire firm-year observations while their firm- or year-specific effects are taken into account. In this specification, firm size and the investor short-termism measure continue to be negatively related to equity marginal q. Equity

¹¹ In estimating the multivariate regressions, we drop several variables that are not significant univariately but are highly correlated with other potentially useful variables. Specifically, we choose to drop leverage and debt maturity due to its correlation with the coverage ratio. Firm size is highly correlated with most of other variables, so we estimation two specifications, one with firm size and the other without.

issuance and institutional ownership also maintain their statistical significance with a positive coefficient. However, idiosyncratic volatility and stock turnover become only marginally significant, suggesting that they explain the time-series change in equity marginal q for a given REIT.¹²

5. Conclusions

In this paper, we estimate the equity marginal q ratio for the REIT sector to examine whether the REIT capital budgeting decisions are well aligned with the interests of shareholders. In particular, we examine how the various signaling and monitoring mechanisms of public stock markets are related to the degree of such alignment. REITs are a good setting for this investigation since the type of assets under their management, namely, real estate properties, allow for a more precise estimate for asset value and thus for q ratio. In addition, since REITs are publicly traded securitization vehicles for assets that are important in asset allocation and portfolio diversification, the results have the potential to provide broader implications for the portfolio choice problem.

Our analysis shows that the equity marginal q at the individual firm level (i.e., individual deviations from the sector average) is correlated with the proxies for the signaling and monitoring mechanisms of public stock markets. Specifically, after controlling for equity issuance and leverage that can mechanically affect the equity marginal q ratio, we find that REITs with greater idiosyncratic volatility and higher stock turnover have a higher equity marginal q , confirming the information and liquidity benefits of public stock markets. In addition, the holdings of institutional investors and their investment horizons are respectively positively related to equity

¹² In an unreported result, we examined the deviation squared in an attempt to more directly address the counter-argument that the observed equity marginal q for the sector is at the optimal level and thus any deviation from it should be viewed as a sign of inefficient capital budgeting decisions. We found that most of our variables preserve the sign of their coefficient and oftentimes lead to disturbing interpretations. For example, institutional ownership is positively related to the deviation squared, which would have to be interpreted as having more institutions as equity holders being associated with a poorer investment decision.

marginal q , suggesting that monitoring power is attributable mostly to institutions with a long-term perspective. Finally, firm size is found to be negatively related to equity marginal q .

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Table 1. Summary statistics

This table reports summary statistics of the variables that are used for marginal q estimation, as well as the number of sample REITs. The sample consists of all equity REITs that have ever been traded on NYSE, Nasdaq, or AMEX (identified by CRSP/Ziman). We require that a REIT has at least 45 weekly stock returns available on CRSP/Ziman during a year. All variables needed for q estimation are also required to be available on Compustat. Specifically, E_t is the equity value (closing stock price (#199) \times number of shares outstanding (#25)) in year t , A_t is the gross total asset (total asset (#6) + depreciation (#125)) in year t , and D_t is the sum of cash dividends (#127) and stock repurchase (#115) in year t . Observations whose annual change in the gross total asset is greater than 300% are excluded. The summary statistics below are the average over the sample period from 1993 to 2005.

	min	q1	median	q3	max	mean	std
# of REITs	104	143	154	169	181	155	21
$\Delta E_t/A_{t-1}$	-0.55	0.00	0.09	0.21	1.74	0.14	0.27
E_{t-1}/A_{t-1}	0.05	0.40	0.58	0.79	2.09	0.62	0.34
$\Delta A_t/A_{t-1}$	-0.63	0.01	0.11	0.29	2.07	0.21	0.37
D_t/A_{t-1}	0.00	0.03	0.05	0.08	0.44	0.06	0.05

Table 2. Equity marginal q of REIT sector

This table reports the estimated marginal q (coefficient for $\Delta A_t/A_{t-1}$) along with coefficients for other variables in the equation. With $\Delta E_t/A_{t-1}$ as dependent variable, the estimated marginal q is the *equity* marginal q . In Fama-MacBeth estimation, we use 6 lags to account for serial-correlations. In year fixed-effect panel estimation, we allow for correlations among observations from the same REIT. In pooled regression, we use the White (1980) covariance estimator. Numbers in brackets are the t -statistics.

dependent variable: $\Delta E_t/A_{t-1}$	coefficient for:			
	intercept	$\Delta A_t/A_{t-1}$	E_{t-1}/A_{t-1}	D_t/A_{t-1}
Fama-MacBeth (13 years)	0.020 [1.71]	0.432 [6.74]	0.019 [0.84]	0.104 [0.50]
Year-FE Panel (2,016 firm-years)	-0.040 [-1.53]	0.496 [13.38]	0.035 [0.97]	0.027 [0.18]
Pooled GLS (2,016 firm-years)	0.015 [1.00]	0.467 [11.54]	0.017 [0.49]	0.161 [0.98]

Table 3. Marginal q of REIT sector – Sub-samples sorted by leverage, equity issuance, or post-IPO age

This table reports the equity marginal q ratio for three sub-samples that are constructed each year by lagged leverage ratio (long-term debt (#9) + current liabilities (#34) / gross total assets), equity issuance ((1–current leverage ratio) – (1–lagged leverage ratio)), or the number of years after IPO. With the leverage or equity issuance-sorted sub-samples, we do not include E_{t-1}/A_{t-1} in the marginal q estimation. In Fama-MacBeth estimation, we use 6 lags to account for serial-correlations. In year fixed-effect panel estimation, we allow for correlations among observations from the same REIT. In pooled regression, we use the White (1980) covariance estimator. In all three estimation, we drop the lagged equity value term. Numbers in parentheses are the p -value for the difference from the Low-leverage sub-sample.

	Lagged leverage-sorted sub-samples			Equity issuance-sorted sub-samples			Post-IPO age-sorted sub-samples		
	Low-leverage (β_0)	Medium-leverage ($\beta_0 + \beta_{0,m}$)	High-leverage ($\beta_0 + \beta_{0,h}$)	Low-issuance (β_0)	Medium-issuance ($\beta_0 + \beta_{0,m}$)	High-issuance ($\beta_0 + \beta_{0,h}$)	Young (β_0)	Mid-aged ($\beta_0 + \beta_{0,m}$)	Old ($\beta_0 + \beta_{0,h}$)
# of REITs	51 24%	52 45%	52 65%	51 -9%	52 -1%	52 7%	48 3	56 7	51 20

Fama-MacBeth (13 years)	0.388	0.499 (0.129)	0.434 (0.148)	0.347	0.473 (0.001)	0.557 (0.006)	0.402	0.398 (0.922)	0.441 (0.375)
Year-FE Panel (2,016 firm-years)	0.482	0.508 (0.780)	0.513 (0.646)	0.394	0.454 (0.460)	0.651 (0.000)	0.458	0.436 (0.747)	0.596 (0.080)
Pooled GLS (2,016 firm-years)	0.455	0.475 (0.842)	0.483 (0.730)	0.354	0.353 (0.989)	0.650 (0.000)	0.420	0.416 (0.962)	0.586 (0.069)

Table 4. Equity marginal q by year or by property type

This table reports the estimated marginal q for the REIT sector by year and property type. For the year-by-year results, we estimate the equation each year. For the property type results, we utilize either the year fixed-effect model or the pooled GLS.

By year		By property type		
year	OLS	Property type	Year-FE Panel	Pooled GLS
1993 (n=104)	0.840	Industrial/Office (n=43)	0.553	0.524
1994 (n=146)	0.294	Health Care (n=12)	0.445	0.399
1995 (n=181)	0.535	Lodging/Resort (n=12)	0.528	0.528
1996 (n=176)	0.686	Residential (n=27)	0.553	0.531
1997 (n=164)	0.727	Retail (n=38)	0.460	0.431
1998 (n=169)	0.260	Diversified (n=17)	0.234	0.199
1999 (n=180)	0.185	Unclassified (n=6)	0.498	0.384
2000 (n=166)	0.154			
2001 (n=154)	0.569			
2002 (n=143)	0.357			
2003 (n=143)	0.475			
2004 (n=142)	0.171			
2005 (n=148)	0.363			
Average	0.432	Average	0.496	0.467

Table 5. Analysis of temporal variation in equity marginal q

The first panel of this table reports the correlation coefficients between the explanatory variables for the temporal variation in REIT sector equity marginal q. **Credit** is the difference between the yield on Moody's Baa long-term bonds and the yield on 10-year Treasury bonds. E_{t-1}/A_{t-1} and **Eissue** are respectively the year-by-year average of those variables over the sample REITs. **Diver** is the number of REITs whose property type is categorized as "diversified." The second panel of this table reports regression results of the year-by-year REIT sector marginal q on explanatory variables.

<i>Correlation coefficients</i>	Credit	E_{t-1}/A_{t-1}	E_issuance	
E_{t-1}/A_{t-1}	-0.825 (0.001)			
Eissue	0.291 (0.335)	-0.354 (0.235)		
Diver	-0.692 (0.009)	0.607 (0.028)	-0.518 (0.070)	

<i>Regression analysis</i>	Dependent variable: Annual equity marginal q			
	(1)	(2)	(3)	(4)
Intercept	-0.775 (0.054)	-0.153 (0.699)	0.016 (0.920)	0.862 (0.005)
Credit	0.106 (0.199)	0.041 (0.661)		-0.155 (0.095)
E_{t-1}/A_{t-1}	0.985 (0.035)	0.980 (0.044)	0.848 (0.027)	
Eissue	0.100 (0.001)	0.088 (0.001)	0.088 (0.001)	0.079 (0.005)
Diver	0.030 (0.148)			
R^2	55%	53%	52%	42%
adj. R^2	33%	37%	43%	30%
# obs.	13	13	13	13

Table 6. Summary statistics for explanatory variables for deviation from sector equity marginal q

This table reports the summary statistics of several firm characteristics. **Sz** is the lagged gross total asset in 1992 dollar terms (in million). **Lvg** is the lagged total debt divided by the lagged gross total asset. **D1** is the fraction of the lagged total debt whose maturity is longer than one year. **Eissue** is the difference between (1–current leverage ratio) and (1–lagged leverage ratio). **IO** is the quarter-end institutional holdings averaged over the year. **Myopic** is a measure of investor short-termism as suggested by Gaspar, Massa, and Mantos (2004). **Insider** is the insider (CEO, CFO, COO, and presidents) ownership of company stock. **1– R^2** is the relative measure of idiosyncratic stock return volatility. **Tov** is the average daily turnover. **Spr** is the average daily relative spread. **Age** is the number of years since IPO. **Diver** is a 0/1 dummy variable for REITs whose property type is categorized as “diversified.” **Cover** is the interest and preferred dividend coverage ratio: (net income + depreciation and amortization + interest expenses) / (interest expenses + preferred dividends).

variable	min	p1	q1	median	q3	p99	max	mean	std
<i>q residual</i>	-1.721	-0.680	-0.108	-0.002	0.099	0.775	3.885	0.000	0.262
<i>log(Sz)</i>	0.75	2.16	5.17	6.20	7.02	9.24	9.95	6.05	1.50
Lvg	0.00	0.00	0.35	0.46	0.57	0.89	0.99	0.45	0.20
D1	0.00	0.00	0.86	0.97	1.00	1.00	1.00	0.86	0.26
Eissue	-0.52	-0.29	-0.05	-0.01	0.02	0.27	0.91	-0.01	0.09
IO	0.00	0.00	0.16	0.40	0.64	0.94	1.00	0.40	0.28
Myopic	0.00	0.00	0.11	0.15	0.17	0.27	0.43	0.14	0.06
Insider	0.00	0.00	0.00	0.00	0.02	0.40	0.94	0.02	0.07
1 – R^2	0.11	0.16	0.55	0.78	0.92	1.00	1.00	0.71	0.24
Tov	0.000	0.000	0.001	0.003	0.004	0.008	0.030	0.003	0.002
Spr	0.01	0.01	0.02	0.02	0.02	0.12	0.34	0.02	0.02
<i>log(Age)</i>	0.00	0.00	1.10	1.95	2.56	3.58	4.38	1.88	0.96
Diver	0.00	0.00	0.00	0.00	0.00	1.00	1.00	0.11	0.31
Cover	0.00	0.00	2.01	2.62	3.45	10.00	10.00	3.28	2.31

Table 7. Correlation coefficient matrix

This table reports the correlation coefficient between firm characteristics whose exact definitions are in Table 6.

	$\log(Sz)$	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
(1) Lvg	0.252 (0.000)											
(2) D1	0.371 (0.000)	0.404 (0.000)										
(3) Eissue	0.027 (0.220)	0.307 (0.000)	0.059 (0.008)									
(4) IO	0.683 (0.000)	0.108 (0.000)	0.272 (0.000)	-0.026 (0.237)								
(5) Myopic	0.371 (0.000)	0.047 (0.035)	0.151 (0.000)	-0.085 (0.000)	0.429 (0.000)							
(6) Insider	-0.055 (0.014)	0.139 (0.000)	0.053 (0.017)	0.048 (0.032)	-0.119 (0.000)	-0.078 (0.001)						
(7) $1 - R^2$	-0.674 (0.000)	-0.076 (0.001)	-0.240 (0.000)	0.009 (0.675)	-0.619 (0.000)	-0.240 (0.000)	0.065 (0.003)					
(8) Tov	0.458 (0.000)	0.150 (0.000)	0.194 (0.000)	0.034 (0.126)	0.565 (0.000)	0.207 (0.000)	-0.070 (0.002)	-0.403 (0.000)				
(9) Spr	-0.312 (0.000)	0.088 (0.000)	-0.045 (0.045)	0.017 (0.438)	-0.285 (0.000)	-0.186 (0.000)	-0.012 (0.606)	0.255 (0.000)	-0.062 (0.005)			
(10) $\log(\text{Age})$	0.066 (0.003)	0.108 (0.000)	0.027 (0.223)	0.141 (0.000)	-0.115 (0.000)	-0.117 (0.000)	0.062 (0.006)	-0.133 (0.000)	-0.110 (0.000)	0.067 (0.003)		
(11) Diver	-0.148 (0.000)	0.081 (0.000)	-0.012 (0.577)	0.014 (0.543)	-0.204 (0.000)	-0.123 (0.000)	-0.009 (0.695)	0.117 (0.000)	-0.154 (0.000)	0.093 (0.000)	0.229 (0.000)	
(12) Cover	-0.321 (0.000)	-0.675 (0.000)	-0.460 (0.000)	0.056 (0.011)	-0.186 (0.000)	-0.073 (0.001)	-0.089 (0.000)	0.108 (0.000)	-0.186 (0.000)	-0.122 (0.000)	-0.034 (0.123)	-0.062 (0.006)

Table 8. Univariate regressions of deviation from sector equity marginal q on firm characteristics

This table reports regression results of the residuals between the 1st and 99th percentiles on firm characteristics.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Intercept	0.024 (0.203)	-0.003 (0.804)	0.022 (0.206)	0.009 (0.034)	-0.014 (0.045)	0.027 (0.023)	-0.003 (0.511)	-0.020 (0.095)	-0.020 (0.017)	0.001 (0.875)	-0.030 (0.008)	-0.003 (0.570)	-0.041 (0.000)
<i>log</i> (Sz)	-0.005 (0.116)												
Lvg		-0.001 (0.958)											
D1			-0.030 (0.119)										
Eissue				0.912 (0.000)									
IO					0.027 (0.083)								
Myopic						-0.222 (0.003)							
Insider							-0.027 (0.658)						
1 - R ²								0.023 (0.156)					
Tov									5.771 (0.042)				
Spr										-0.203 (0.377)			
<i>log</i> (Age)											0.014 (0.006)		
Diver												-0.010 (0.457)	
Cover													0.011 (0.000)
R-squares	0.1%	0.0%	0.2%	17.2%	0.1%	0.5%	0.0%	0.1%	0.3%	0.0%	0.5%	0.0%	1.8%
# of obs.	1976	1970	1975	1975	1973	1976	1966	1976	1976	1976	1976	1976	1976

Table 9. Multivariate regressions of deviation from sector equity marginal q on firm characteristics

This table reports regression results of the residuals between the 1st and 99th percentiles on firm characteristics.

	(1)	(2)	(3)	(4)	(5)
Intercept	-0.147 (0.000)	-0.054 (0.226)	-0.057 (0.449)	0.000 (0.996)	-0.011 (0.898)
<i>log</i> (Sz)		-0.013 (0.007)	-0.064 (0.000)	-0.010 (0.034)	-0.044 (0.000)
Eissue	0.882 (0.000)	0.895 (0.000)	0.882 (0.000)	0.786 (0.000)	0.778 (0.000)
IO	0.101 (0.000)	0.120 (0.000)	0.217 (0.000)	0.081 (0.000)	0.127 (0.001)
Myopic	-0.261 (0.001)	-0.225 (0.004)	-0.193 (0.030)	-0.164 (0.015)	-0.211 (0.008)
Insider	-0.036 (0.506)	-0.040 (0.472)	-0.032 (0.624)	-0.033 (0.507)	-0.030 (0.580)
1 – R ²	0.105 (0.000)	0.075 (0.002)	0.186 (0.000)	-0.036 (0.156)	0.048 (0.103)
Tov	7.922 (0.015)	8.959 (0.006)	21.944 (0.000)	1.745 (0.610)	7.251 (0.100)
Spr	-0.202 (0.393)	-0.339 (0.143)	-0.384 (0.170)	-0.132 (0.536)	-0.134 (0.618)
<i>log</i> (Age)	0.012 (0.015)	0.014 (0.006)	0.044 (0.000)	0.004 (0.355)	0.005 (0.621)
Diver	-0.007 (0.590)	-0.009 (0.465)			
Cover	0.011 (0.000)	0.009 (0.000)	0.001 (0.824)	0.006 (0.007)	0.000 (0.977)
Firm FE	No	No	Yes	No	Yes
Year FE	No	No	No	Yes	Yes
R-squares	21.0%	21.4%	35.0%	45.2%	55.0%
# of obs.	1962	1962	1926	1926	1926