Sensitivities of Corporate Investment and Financing Decisions to the Implied Cost of Capital

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Abstract

Most textbooks suggest factor models like Capital Asset Pricing Model and the Fama and French (1992, 1993) model to estimate the cost of equity. Recent studies question this practice. We examine the attributes of the implied cost of capital (ICC) as an alternative cost of equity measure. Our results show that the ICC has negative effects on investment and equity issuance, whereas the factor model estimates have opposite effects on these decisions. We find that such opposite effects of the CAPM and FFM estimates on investment and financing decisions are attributed to the way in which stock prices reflect cash flow news and discount rate news. Moreover, the ICC exhibits the properties of the cost of equity regarding equity dependence, private information, and capital supply shocks, whereas the factor model estimates fail to do so. Our findings lend support for the ICC as the cost of equity in the capital budgeting process.

JEL Classification: G31; G32

Keywords: Implied Cost of Capital; Corporate Investment; Cash Flow News; Discount Rate News

1 Introduction

Among the most fundamental tasks for corporate managers is to decide when to raise capital and which investment project to undertake. Having a good estimate for the cost of capital is an essential component for the capital budgeting decision. The CAPM and the Fama and French (1992, 1993) model (FFM) are currently the standard textbook choice for estimating the cost of equity (COE). Yet, Fama and French (1997) contend that the uncertainty about risk premiums and risk loadings for the CAPM and the FFM implies "woefully imprecise estimates" of the COE.[1] Levi and Welch (2014) show that the CAPM and the FFM fail to adjust for term and risk premia and do not predict subsequent rates of return. They conclude that the CAPM and the FFM are "useless for capital budgeting purposes."

This raises the question of what other COE estimates should be used for capital budgeting.[2] Recently, Frank and Shen (Forthcoming) find that cost of capital based on CAPM predict positively subsequent corporate investment, suggesting that CAPM model prediction is not even directionally correct. They also find that cost of capital estimated based on the implied cost of capital (ICC) approach at least gets the direction right in that it negatively predicts subsequent corporate investment. Their finding leaves open the possibility that ICC can potentially serve as a reasonable COE proxy.

The implied cost of capital is the internal rate of return obtained by equating the stock price to the present value of expected future cash flows. The ICC has been used in various asset pricing contexts.[3] In particular, Lee, So, and Wang (2014) show that the ICC predicts

[1]Their estimates suggest that the 95-percent confidence interval of the market risk premium ranges from less than zero to more than 10%.

[2]Levi and Welch (2014) suggest using the same cost of capital for all projects, which is not very satisfying.

[3]For example, previous papers use the ICC to study: the unconditional equity premium (Claus and

the realized returns better than the CAPM and FFM. Li, Ng, and Swaminathan (2013) also show that the aggregate ICC predicts the future market returns. Both argue that ICC serves as a good proxy for expected returns. Thus, it is useful to see if the ICC would be a good proxy for COE estimate in corporate financial decision.

A useful COE estimate should not only predict future investment negatively, but it should also possess other qualities. The COE proxy should predict future financing activities in addition to future investment. Meanwhile, the sensitivity of investment to the COE should vary depending on the level of equity dependence and the amount of private information. Additionally, a shock in the supply of capital should affect COE. Our paper examines the characteristics of the ICC to see whether it can be a good COE proxy, especially in comparison to the CAPM and FFM estimates.

To that end, we do the following. First, we test the theoretical prediction that firms increase equity financing as well as investment when facing lower cost of equity.[4] Second, while Frank and Shen (Forthcoming) leave it as a puzzle why ICC is at least directionally correct in predicting future investment while CAPM is not, we examine how COE estimates reflect the cash flow news and discount rate news. Third, we examine the sensitivities of investment to COE proxies conditional on the degree of equity dependence. The sensitivity of investment to the COE is expected to be greater for firms with greater equity dependence

Thomas (2001) and Fama and French (2002)); stock market return predictability (Li, Ng, and Swaminathan (2013)); theories on betas (Kaplan and Ruback (1995), Botosan (1997), Gebhardt, Lee, and Swaminathan (2001), Gode and Mohanram (2003), Brav, Lehavy, and Michaely (2005), and Easton and Monahan (2005)); international asset pricing (Lee, Ng, and Swaminathan (2009)); default risk (Chava and Purnanandam (2010)); cross-sectional expected returns (Hou and Van Dijk (2010), Botosan, Plumlee, and Wen (2011)); stock return volatility (Friend, Westerfield, and Granito (1978)); and the cost of equity (Burgstahler, Hail, and Leuz (2006), Botosan and Plumlee (2005), and Hughes, Liu, and Liu (2009)).

[4]Taggart (1977),Marsh (1982) and Baker and Wurgler (2002) suggest that firms prefer to issue equity when equity prices are relatively high.

(Baker, Stein, and Wurgler (2003)). Fourth, we examine the sensitivities of investment to COE proxies conditional on the amount of private information. Chen, Goldstein, and Jiang (2007) and Bakke and Whited (2010) suggest that investment decisions respond to stock prices as firms are informed about their investments from the stock market. In light of these studies, the COE is expected to have a larger impact on investment for firms with greater private information. Finally, we examine the effect of supply shocks in equity capital from natural experiments. A positive (negative) shock in the supply of capital is expected to have a negative (positive) effect on the COE.

We find that the ICC has significantly negative impacts on corporate investment and net equity issuance, while the CAPM and FFM estimates have the opposite effects. We demonstrate that such opposite effects are attributed to the way in which stock prices reflect cash flow and discount rate news. Specifically, the ICC is positively correlated with discount rate news, and negatively with cash flow news. On the contrary, the CAPM and FFM estimates are negatively correlated with discount rate news (a wrong direction) and positively correlated with cash flow news, resulting in their positive effects on investment.

Our results show that the sensitivities of investment to the COE proxies are affected by both equity dependence and private information from the stock market. Specifically, lower ICC induces additional investment for firms with high equity dependence and greater private information. The CAPM and FFM estimates, however, have insignificant effects on investment for firms with high equity dependence and greater private information, while showing positive and significant effect for firms with low equity dependence and less private information. We also find that the ICC tends to increase (decrease), while the CAPM and

FFM estimates tend to decrease (increase), when facing a negative (positive) supply shock in equity capital. These findings indicate that the ICC displays the properties of the COE, whereas the CAPM and FFM estimates do not exhibit such properties.

Our study has important implications for finance instructors and researchers. Managers determine the optimal level of investment through their experience after observing the stock price. What we find out is that the ICC is close to the COE they come up with after considering the market conditions. In contrast, the CAPM and the FFM estimates are neither consistent with the theory nor relevant to the real world practice. Thus, we need to reconsider our practice of teaching students to use the CAPM and the FFM in capital budgeting. Also, applying the CAPM or FFM estimates as the COE in empirical corporate finance research can result in misleading conclusions. In this regard, we demonstrate that the ICC, as a COE estimate, is not only theoretically sound but also relevant to corporate financial decisions.

Our study is also linked to the q-model with the interdependence of investment and financing decisions in Bolton, Chen, and Wang (2011). Bolton, Chen, and Wang (2011) show that external financing costs due to asymmetric information and managerial incentive problems have impact on investment beyond q. Consistent with the prediction of their model, our findings suggest that the ICC is highly informative about the risk of investment opportunities particularly for equity dependent firms.

Our study also contributes to the literature on private information in stock price for investment decisions. For example, previous studies show that the stock market affects corporate investment as it informs managers about real variables (Dow and Gorton (1997), Subrahmanyam and Titman (1999), Dow and Rahi (2003), Chen, Goldstein, and Jiang (2007), and Goldstein and Guembel (2008)) or as irrational movements in stock prices make the effective cost of equity lower relative to other capital sources (Baker, Stein, and Wurgler (2003)).[5] Yet, previous findings do not tell what kind of private information firms gather from the stock market. Our findings suggest that the discount rate implied by the stock price is particularly important information for managers to assess investment and financing decisions. The ICC appears to be informative about the project risk: managers learn about the market's assessment of the firm's project risk, which they incorporate in their investment decisions.

The remainder of the paper proceeds as follows: Section 2 presents the investment model that highlights the role of cost of equity beyond cash flow and Tobins q. In Section 3, we describe the data, sample construction, and the methodology for measuring the COE and return decomposition. Section 4 presents the empirical results on the relation between the COE and corporate investment and financing behaviors, and provides the possible channel through which alternative COE proxies affect corporate investment differently. Section 5 explores the stock market feedback effects. Section 6 examines the effect of supply shocks in equity capital on COE proxies. Section 7 carries out a battery of conventional robustness checks including alternative estimation methods, sub-sample analysis, variable definitions, and control variables. Section 8 concludes.

[5]Bond and Goldstein (2011) provides an excellent review on the real effects of financial markets and their implications.

2 An Investment Model with External Financing Costs

Abel and Blanchard (1986) develop a model to show that an increase in expected future cash flows is associated with the higher marginal return on investment today, while an increase in discount rates is associated with the lower marginal return on investment. We use their model to define a firm value as given by the discounted value of maximized net cash flows as follows:

$$V_t = E_t \sum_{j=0}^{\infty} \prod_{i=1}^{j} (1 + r_{t+i})^{-1} C_{t+j}(K_{t+j}, I_{t+j}(1 + \theta_{t+j})), \tag{1}$$

where E_t is the expectation operator conditional on information at time t, r_{t+i} is the discount rate at time $t+i$, K_{t+j} and I_{t+j} are capital stock and investment, $\theta_{t+j} \in (-1, 1)$ is the effect of external financing costs, and $C_{t+j}(K_{t+j}, I_{t+j})$ is cash flow at time $t+j$. The external financing costs are broadly defined to include the effects of asymmetric information and agency problem; i.e., they include the possibility of mispricing or feedback from private information embedded in stock price about the firm's investment opportunities. Bolton, Chen, and Wang (2011) explicitly show that such external financing costs have an impact on investment beyond q. Similar to their approach, we modify the q-model to show that the marginal cost of investment is no longer equal to q in the presence of external financing costs.

The firm value changes when expected cash flows change, or when discount rates change. The firm maximizes V_t subject to the following condition:

$$K_{t+1} = (1 - \delta)K_t + I_t \tag{2}$$

where δ is the depreciation rate. The first order conditions maximizing the firm value at t implies:

$$\frac{\partial L}{\partial K_t} = E_t \sum_{j=0}^{\infty} \left\{ \prod_{i=1}^{j} (1 + r_{t+i})^{-1} \right\} \frac{\partial C_{t+j}}{\partial K_{t+j}} (1-\delta)^j - q_t = 0 \tag{3}$$

$$\frac{\partial L}{\partial I_t} = E_t \frac{\partial C_t}{\partial I_t} (1 + \theta_t) + q_t = 0 \tag{4}$$

where Lagrange multiplier q_t represents the marginal rate of return on investment at time t. The first order conditions imply the following:

$$q_t = E_t \sum_{j=0}^{\infty} \left\{ \prod_{i=1}^{j} R_{t+i} \right\} c_{t+j} \tag{5}$$

$$MCI_t = -E_t \frac{\partial C_t}{\partial I_t} = \frac{q_t}{1+\theta_t} \tag{6}$$

Thus, equation (6) suggests that the marginal cost of investment (MCI_t) can deviate from the expected present value of marginal returns to capital (q_t). In case of no external financing costs ($\theta_t = 0$), we obtain $q_t = MCI_t$.

3 Data and Methodology

3.1 Sample Construction

Our initial sample consists of US firms from the Center for Research in Security Prices (CRSP)/Compustat Merged Database from 1985 to 2013. We obtain the stock price, the number of shares outstanding, the SIC code, and monthly returns from CRSP, firm-level annual accounting data from Compustat, analysts' earnings forecasts from I/B/E/S, and the nominal GDP growth rates from the Bureau of Economic Analysis. We exclude firms operating in regulated utilities (SIC code 4000-4999) and financial (SIC code 6000-6999) industries. We further drop firm-year observations with negative sales or total assets. Since computing ICCs requires analysts' earnings forecasts, the number of firms with valid information are reduced to 40,123 firm-year observations.

3.2 The Proxies for the Cost of Equity

There is no consensus about the computing procedure of the ICC in the literature. Each study makes its own specific assumptions to facilitate the computation of the ICC. We compute three ICCs for each firm, following the procedures utilized by Claus and Thomas (2001), Gebhardt, Lee, and Swaminathan (2001), and Li, Ng, and Swaminathan (2013), respectively. For comparison, we also estimate the COE using the CAPM, the Fama and French (1992, 1993) 3-factor model (FF3M), and the 4-factor model (FF4M, Carhart (1997)). We provide the detailed estimation procedures in Appendix A

3.3 Return Decomposition

In order to examine the relative effects of the discount rate and cash flow on corporate investment, following the methodology of Chen, Da, and Zhao (2013), we decompose the realized return into two components: (1) cash flow news (CFN), defined as the price change holding the discount rate constant, and (2) discount rate news (DRN), defined as the price change holding the cash flow forecasts constant. Specifically, the stock return between month

t and $t+1$ can be written as follows:

$$r_{i,t} = \frac{P_{i,t+1} - P_{i,t}}{P_{i,t}} = \frac{f\left(c_{i,t+1}, d_{i,t+1}\right) - f\left(c_{i,t}, d_{i,t}\right)}{P_{i,t}}$$
$$= CFN_{i,t} - DRN_{i,t} \tag{7}$$

where $f(\cdot)$ is the discounted cash flow function, and $c_{i,t}$, $d_{i,t}$ is the cash flow forecast and the ICC of firm i at month t, respectively. The cash flow news (CFN) and discount rate news (DRN) could be expressed as

$$CFN_{i,t} = \frac{1}{2}\left[\frac{f\left(c_{i,t+1}, d_{i,t+1}\right) - f\left(c_{i,t}, d_{i,t+1}\right)}{P_{i,t}} + \frac{f\left(c_{i,t+1}, d_{i,t}\right) - f\left(c_{i,t}, d_{i,t}\right)}{P_{i,t}}\right] \tag{8}$$

$$DRN_{i,t} = -\frac{1}{2}\left[\frac{f\left(c_{i,t}, d_{i,t+1}\right) - f\left(c_{i,t}, d_{i,t}\right)}{P_{i,t}} + \frac{f\left(c_{i,t+1}, d_{i,t+1}\right) - f\left(c_{i,t+1}, d_{i,t}\right)}{P_{i,t}}\right] \tag{9}$$

We then compound the monthly CFN and DRN to annualize them over the firm's fiscal year. According to the Abel and Blanchard (1986) model, CFN is expected to have positive effect, while DRN is expected to has negative effect, on investment. The return decomposition should shed light on the fundamental question of whether cash flow or discount rate news is the main driver of corporate investment.

We also follow the methodology of Campbell and Shiller (1988) to decompose the return into CFN (related to future dividends) and DRN (related to the discount rate). Particularly, omitting the firm subscript i, the unexpected return can be expressed as

$$r_t - E_{t-1}\left(r_t\right) = CFN_t - DRN_t \tag{10}$$

To estimate the components of equation (10), we assume a system of log-linear dynamic equations for market returns, return on equity and any other variables assumed to affect market returns and return on equity (Callen and Segal (2010)). The VAR system is formulated as follows:

$$r_t = \alpha_1 r_{t-1} + \alpha_2 roe_{t-1} + \alpha_3 bm_{t-1} + \eta_{1t} \tag{11}$$

$$roe_t = \beta_1 r_{t-1} + \beta_2 roe_{t-1} + \beta_3 bm_{t-1} + \eta_{2t} \tag{12}$$

$$bm_t = \gamma_1 bm_{t-1} + \gamma_2 roe_{t-1} + \gamma_3 bm_{t-1} + \eta_{3t}. \tag{13}$$

Following Vuolteenaho (2002), we estimate earnings news residually and discount rate news directly.

3.4 Summary Statistics

Panel A in Table 1 provides the summary statistics for the sample. The average (median) capital expenditure ($CAPX$) and is 6.8% (4.6%) of total assets. The average net equity issuance is 11.2% of total assets and the median is mere 0.8%. Thus, the firms' capital investment activities are fairly active, while equity issuing activities are lumpy and less frequent. The average ICC ranges from 9.8% (ICC-GLS) to 14% (ICC-LNS), while the factor-model-based estimates range from 11% to 12.1%.

(Insert Table 1 about here)

We report the correlations matrix for our estimates in Panel B. The CAPM and FFM estimates and ICCs show positive and significant correlations with one another but ICCs and the factor-model-based estimates are more highly correlated among themselves. ICCs have significant and positive correlations with the discount rate news. The CAPM estimate also shows positive correlation with the discount rate news. However, the FFM estimates show little correlation with the discount rate news.

4 Empirical Results

4.1 The Cost of Equity and Corporate Investment

In order to investigate the effect of each of the cost-of-equity proxies on corporate investment, we start with the following baseline regression model:

$$I_{i,t} = \alpha_0 + \alpha_1 R^e_{i,t-1} + \alpha_2 CF_{i,t} + \alpha_3 q_{i,t-1} + \eta_t + \theta_i + \varepsilon_{i,t}, \tag{14}$$

where i and t represent firm and time, respectively. I is investment (capital expenditure scaled by beginning-of-the-year assets), R^e is the COE proxy, CF is cash flow divided by total assets. We also include firm fixed effects θ_i and year effects η_t in order to control for firm-specific characteristics and general economic trends. Detailed definitions of variables are provided in Appendix B.

Table 2 reports the estimation results of investment regression (14). The coefficient estimates on all ICCs are significant and negative, suggesting that firms invest less when the COE is higher. However, the coefficient estimates on the CAPM and FFM estimates are positive and significant, suggesting that firms invest more when the COE is higher. The results also show that CF and q have significant and positive effects on investment, consistent with previous results.

(Insert Table 2 about here)

In order to examine whether the ICC absorbs the explanatory power of the factor-model-based estimates, or vice versa, we simultaneously include both the ICC and the factor-model-based estimates in columns (8)-(10). The results with the ICC-LNS show that both the ICC and the factor-model estimate have independent and opposite effects on investment.

4.2 The Cost of Equity and Net Equity Issuance

In Table 3, we also investigate the effect of the COE on net equity issuance using the same regression model of (14) with the dependent variable replaced by net equity issuance. The coefficient estimates on ICCs are all significant and negative, which suggests that firms issue more shares when the COE is low. In contrast, the coefficient estimates on the CAPM and FFM estimates are positive and significant. The results also suggest that CF and q have positive effects on net equity issuance.

(Insert Table 3 about here)

If the COE serves as the ex-ante required rate of return on equity in the capital budgeting decision, ceteris paribus, the company is expected to increase its equity issuance and investment when the COE is low. Our findings of the negative relations between ICCs and investment/net equity issuance is consistent with this argument. The CAPM and FFM estimates, however, appear to reflect the opposite effects of profitability and the discount rate on investment so as to produce positive association with investment and net equity issuance.

4.3 The Effects of Cash Flow News and Discount Rate News

In order to understand the contradicting effects of the factor-based estimates and ICCs, we examine their relations with the cash flow news (CFN) and discount rate news (DRN). We first examine how CFN and DRN affect investment and net equity issuance based on the following regression model:

$$I_{i,t} = \beta_0 + \beta_1 CF_{i,t} + \beta_2 q_{i,t-1} + \beta_3 CFN_{i,t-1} + \beta_4 DRN_{i,t-1} + \eta_t + \theta_i + \varepsilon_{i,t}. \qquad (15)$$

Table 4 reports the estimation result for both investment and equity issuance. In all regressions, the coefficient estimates on CFN are positive and significant, while those on DRN are negative and significant. The results are similar whether we use the Chen, Da, and Zhao (2013) or Campbell and Shiller (1988) approach for the return composition. Thus, these findings confirm that CFN has positive effects, while DRN having negative effects, on investment and equity issuance decisions.

(Insert Table 4 about here)

We also run the following regressions to examine the relation between alternative COE proxies and CFN/DRN:

$$R^e_{i,t} = \alpha_0 + \alpha_1 CFN_{i,t} + \alpha_2 DRN_{i,t} + \varepsilon_{i,t}. \tag{16}$$

Table 5 reports similar results on Panel A (Chen, Da, and Zhao (2013) return decomposition) and on Panel B (Campbell and Shiller (1988) approach). ICCs reflect both the CFN and DRN. The coefficient estimates on DRN are positive and significant, while those on CFN are negative and significant, which suggests that the higher discount rate is associated with higher ICC. Thus, the negative relation between ICCs and investment is consistent with the idea that investment should be lower when facing a low marginal rate of return on investment and relatively high cost of capital. However, for the FFM estimates, the coefficient estimates on DRN are negative and significant, while those on CFN are positive and significant. For the CAPM estimate, the coefficient estimates on both DRN and CFN are not significant.

(Insert Table 5 about here)

The results in Table 5 suggest that the effects of profitability and discount rate news on investment are partly captured by the CAPM and FFM estimates. The factor-model-based estimates appear to reflect the expected future investments affected by profitability and discount rate news. To add up a bit, note that, subject to the transversality condition, equation (5) implies:

$$E_t(1 + r_{t+1}) = \frac{E_t(q_{t+1} + c_{t+1})}{q_t}. \tag{17}$$

This equation suggests that the expected return is high when the expected future cash flows

(c_{t+1}) and the marginal rate of return on investment (q_{t+1}) are high. Both high expected future cash flows and low discount rate increase the marginal return on investment, which will induce firms to increase investment. Expected increase in investment will also increase expected return. This will show as the positive relation between the cash flow news and the expected return and the negative relation between the discount rate news and the expected return, which is consistent with our findings for the CAPM and FFM estimates.

Thus, the positive effects of the CAPM and FFM estimates can be attributed to their forward-looking nature into future investments. Unlike the CAPM and FFM estimates, the ICC reflects the market's assessment of the firm's discount rate for its long-term cash flows. Thus, the ICC serves as a proper proxy for the COE in the firm's investment and financing decisions. The CAPM and FFM estimates, however, fail to reflect the effect of the COE on investment.

5 Feedback Effects from the Stock Market

The effects of the COE on corporate investment and equity issuance beyond q can reflect feedback from the stock market. The literature documents two channels through which the stock market affects investment. On one hand, Baker, Stein, and Wurgler (2003), Gilchrist, Himmelberg, and Huberman (2005), and Polk and Sapienza (2009) find significant effects of mis-pricing on investment. On the other hand, Chen, Goldstein, and Jiang (2007) and Bakke and Whited (2010) find that firms' investment decisions respond to stock prices as firms are informed about their investments from the stock market. We explore these stock-market-feedback channels below.

5.1 Equity Dependence and Investment Sensitivity

Campbell and Shiller (1988) suggest that "investor sentiment can directly affect discount rates, but cannot directly affect cash flows." Since overpriced stock implies a lower COE for given cash flows, the COE may better reflect the nonfundamental component of the stock price. Baker, Stein, and Wurgler (2003) suggest that equity-dependent firms' investment is especially sensitive to mispricing in the stock market. Thus, the effect of mispricing on investment is more likely to be captured by the sensitivity of investment to the COE for firms with greater equity dependence. This leads to the hypothesis that equity-dependent firms display a more negative sensitivity of investment to the COE than do non-equity-dependent firms.

Based on the above hypothesis, we compare the performance of alternative COE proxies between high and low equity-dependent firms. Following Baker, Stein, and Wurgler (2003), we use the KZ index to measure equity dependence:

$$KZ_{i,t} = -1.002CF_{i,t} - 39.368DIV_{it} - 1.315CASH_{i,t} + 3.139LEV_{i,t}. \tag{18}$$

We define firms with the top 30% KZ index as high equity-dependent and firms with the bottom 30% KZ index as low equity-dependent. We expect to find stronger effects of COE proxies on investment for high equity-dependent firms than for low equity-dependent firms.

Table 6 presents the results. For high equity-dependent firms on Panel A, we find that the coefficient estimates on ICCs are all negative and highly significant, while those on factor-based COE proxies are all insignificant. For low equity-dependent firms on Panel B, the coefficient estimates on ICCs are insignificant, while those on factor-based COE proxies exhibit strong positive effects on corporate investment. To the extent that ICCs are driven by mispricing, our results suggest that equity-dependent firms' investment is particularly sensitive to stock mispricing. In contrast, the CAPM and FFM estimates show significant positive effects only for non-equity-dependent firms.

(Insert Table 6 about here)

5.2 Price Informativeness and Investment Sensitivity

We also examine if COE proxies convey new information about the firm's investment, especially regarding the risk of investment reflected on the discount rate. Such information feedback is expected to be more pronounced for firms with greater private information in their stock prices. Accordingly, we examine the sensitivities of investment to COE proxies, conditional on the amount of private information. We measure the amount of private information by the price nonsynchronicity calculated as one minus R-square from the time-series regression of daily return on market and 3-digit SIC industry portfolio returns over the fiscal year.[6] Chen, Goldstein, and Jiang (2007) suggest that a weak correlation of a firm's stock return with the market and industry returns indicates more firm specific information which is useful for the firm's investment decision. Based on the price nonsynchronicity measure, we

[6]This measure was first suggested by Roll (1988) and later developed by Morck, Yeung, and Yu (2000), Durnev, Morck, Yeung, and Zarowin (2003), Durnev, Morck, and Yeung (2004), and Chen, Goldstein, and Jiang (2007).

define the top 30% as large private information firms and the bottom 30% as small private information firms. For the estimation of price nonsynchronicity, we require that firms have at least 150 days of non-missing returns during the given year.

Table 7 presents the results. The coefficient estimates on ICCs are all negative and significant for firms with large private information on Panel A, whereas the coefficient estimates on ICCs are all insignificant for firms with small private information on Panel B. In contrast, the coefficient estimates on the CAPM and FFM estimates are all insignificant for firms with large private information on Panel A, whereas they are all positive and significant for firms with small private information on Panel B. These findings suggest that a firm's investment is particularly sensitive to the ICC when there is greater amount of private information in the stock price. Thus, the ICC appears to contain information about the market's assessment of project risk beyond what is reflected in q. However, results for the CAPM and FFM estimates suggest that firms with low private information tend to have more investment when the COE is higher.

(Insert Table 7 about here)

Overall, our findings suggest that both mispricing and private information are affecting the investment-ICC sensitivity. The takeaway from this exercise is that lower ICC, whether it is driven by mispricing or reflecting private information, induces additional investment for firms, which is an important property of the COE. In contrast, the CAPM and FFM estimates show significant and positive effects on investment for firms with less mispricing or private information. The CAPM and FFM estimates appear to reflect the positive effect of upcoming investment on the stock price especially when the firm's stock price reflects more fundamental information and moves more synchronously with the industry and market trends.

6 Effects of Capital Supply Shocks

In this section, we further evaluate the validity of COE proxies based on another property of the COE: i.e., the COE will be higher (lower) when there is a negative (positive) supply shock in equity capital. To this end, we examine the effects of negative supply shocks during recessions and positive supply shocks following legislation granting capital gains tax cuts.

6.1 Behavior of the Cost of Equity Estimates during Recessions

We plot the time trends of the COE proxies in Figure 1. ICCs tend to increase during the highlighted recession periods, while the CAPM and FFM estimates show the opposite trend. Thus, ICCs indicate that the COE becomes higher during recessions, whereas the CAPM and FFM estimates indicate that the COE becomes lower during recessions. ICCs appear to reflect the hightened uncertainty and risk aversion of investors during recessions (González-Hermosillo (2008), Coudert and Gex (2007), and Frank and Goyal (2009)), whereas the CAPM and FFM estimates appear to reflect diminishing profitability and high discount rate. The results for the CAPM and FFM estimates are consistent with the forward-looking nature of the expected return.

(Insert Figure 1 about here)

6.2 Natural Experiment

Taxpayer Relief Act of 1997 (TRA) and the Jobs and Growth Tax Relief Reconciliation Act of 2003 (JGTRRA) provide tax cuts in capital gains, raising the effective after-tax return for equity investors and thereby the supply of equity capital (Dai, Shackelford, Zhang, and Chen (2013)). The effect of the tax cut on the COE will depend on the elasticity of capital demand: with perfectly inelastic demand, the COE will be reduced by the tax cut; with perfectly elastic demand, the COE will not change. Using financial constraint as a proxy for the demand elasticity of equity capital, we hypothesize that financially constrained firms have low demand elasticity of equity capital and experience a larger reduction in the COE following the tax cuts.

We test the hypothesis with the following difference-in-difference (DID) regression:

$$R^e_{i,t} = \alpha_0 + \alpha_1 Post_t + \alpha_2 HFC_i + \alpha_3 Post_t \times HFC_i + \varepsilon_{it}, \tag{19}$$

where $Post$ is a dummy variable that takes 1 if it is the third quarter of 1997 or 2003, and 0 if it is the first quarter of 1997 or 2003 (skipping the announcement quarter). HFC is a dummy variable which takes value of 1 if the firm is on the top 30% of financial constraint at the beginning of the year, defined as in Hadlock and Pierce (2010):[7]

$$FC_{i,t} = \Pr(\text{Financial Constraint}) = 1 - \frac{1}{1 + \exp(\beta' X_{i,t} - 0.454)}, \tag{20}$$

[7] We also try the KZ index as an alternative measure of financial constraint. The results are similar and not reported.

where

$$\beta' X_{i,t} = 0.737 \times \text{Size}_{i,t} + 0.043 \times \text{Size}_{i,t}^2 - 0.04 \times \text{Firmage}_{i,t}. \tag{21}$$

Table 8 presents the estimation results of the DID regressions. The coefficient estimates on *Post* are negative and significant for all three ICC measures, indicating that the COE becomes lower following the positive supply shock in equity capital. The significant and negative coefficient estimates on $Post * HFC$ for ICC measures also suggest that after the adoption of TRA and JGTRRA, the COE decreased significantly more for low demand elasticity firms than for high demand elasticity firms. For factor-model-based estimates, however, the coefficient estimates on *Post* and $Post * HFC$ are all significant and positive, suggesting that the COE is higher following positive supply shocks in equity capital and especially for low demand elasticity firms. To recapitulate, using exogenous shocks from tax reforms, we show that the ICC demonstrate the property of the COE, while the CAPM and FFM estimates show the property of the forward-looking expected return.

(Insert Table 8 about here)

7 Robustness Checks

7.1 Erickson and Whited Error-in-Variable GMM

Erickson and Whited (2000, 2002, 2012) suggest that the measurement error in Tobin's q has a significant effect on coefficient estimates. It is possible that our results for the COE proxies are also driven by measurement errors. Accordingly, we implement their measurement-error consistent GMM technique to correct for measurement errors in q and the COE estimates. The results (Table A1 in the Online Appendix) show that our findings remain quantitatively and qualitatively the same. Thus, we rule out the potential effect of measure error for our findings.

7.2 Controlling for Fundamentals

Morck, Shleifer, and Vishny (1990) suggest that the positive correlation between stock price and investment reflects fundamentals. We examine if the effect of the COE on investment still holds when we incorporate firm fundamentals in q. Cummins, Hassett, and Oliner (2006) suggest that Tobin's q constructed using analysts' forecast earnings better reflects fundamentals important for investment spending. In particular, using the analysts' forecast earnings-based q, they find no evidence that investment is sensitive to cash flow. Consequently, we also examine if our results are altered when the fundamental q is used.

The results (in Table A2 in the Online Appendix) show that all coefficient estimates on ICCs remain negative and highly significant, whereas those on the CAPM and FFM expected returns are still positive and significant. The ICC appears to inform firms about the risk of investment, beyond q and CF.

7.3 Is the Result Driven by Growth Firms?

Growth firms may face higher COEs and have large investment opportunities. This may result in the positive association between the COE and investment. To examine this possibility, we run regressions of capital expenditures on COE proxies excluding growth firms.

The results (in Table A3 in the Online Appendix)excluding firms with B/M ratios in the bottom 30%. The results remain qualitatively the same. Specifically, on one hand, the coefficient estimates on ICCs are all significant and negative except for the result on ICC-CT. On the other hand, factor-based COE proxies are all significant and positive.

7.4 Other Firm Characteristics

We also investigate the effect of the COE on corporate investment while controlling for other firm characteristics, which should mitigate the concern that our COE proxies simply capture some firm characteristics not reflected in q. For this exercise, we estimate regression (14) including the following additional control variables: leverage (Lev), firm size ($Size$), cash dividend (Div), fixed assets (FA), and cash holdings ($Cash$). Table 9 reports the results. The signs and significance of all coefficient estimates for COE proxies remain the same as previously reported results.

(Insert Table 9 about here)

7.5 Recession Periods

Given the opposite patterns between ICCs and factor-model-based estimates during recession periods in Figure 1, We check if their opposite effects on investment are driven by recession periods. To this end, we run separate regressions for recession and non-recession periods.

The results (in Table A4 in the Online Appendix) show that the coefficient estimates on ICCs are significant and positive for non-recession periods, but none of the estimates are significant during recession periods. The insignificant results for the recession periods may reflect the distortion of firms' investment activities due to uncertainty shocks (Bloom, Floetotto, Jaimovich, Saporta-Eksten, and Terry (2014)). The coefficient estimates on the CAPM and FFM estimates show mixed results. Thus, we verify that the negative effect of the ICC on corporate investment is not driven by its particular behavior during recession periods.

7.6 Research and Development (R&D) and Mergers and Acquisitions (M&A)

For our main results, our sample did not include firms with R&D and M&As. In this section, we examine the relation between COE proxies and corporate investment including, R&D and M&As. Specifically, we estimate our investment regressions with the dependent variable defined as the sum of capital expenditure (CAPX) plus R&D and M&A scaled by beginning-of-the-year total assets. The results (in Table A5 in the Online Appendix) show that all coefficient estimates on ICC measures remain negative and highly significant, whereas those on the CAPM and FFM expected returns all become insignificant. These findings reinforce the preponderance of the ICC as a measure of the COE.

7.7 Long-term Effects

Given that some capital projects involve long-term planning and implementation, there may be a time gap between the time of estimating the COE and the actual investment for a project. In order to check the potential effect of this time gap, we try longer (up to two-year) lags of the COE proxies.

The estimation results with the second-year lags of the COE proxies (in Table A6 in the Online Appendix) show that the long-term effects are not significant except for the two-year lagged FF4M expected return which has positive and significant effect. Thus, our findings suggest that the long-term effects of the proxies are limited.

8 Conclusion

When the market assesses low risk for a firm's investment opportunities, the effective cost of equity (COE) becomes lower. As a result, the firm is likely to take on more investment. One of the puzzling result from empirical literature on the effect of the COE on investment is the apparent positive relation between investment and the COE, as proxied by the CAPM and the Fama-French model. We find strong empirical evidence that the implied cost of capital is negatively related to both investment and equity issuance. We also show that cash flow news has a positive effect on investment and equity issuance, whereas discount rate news has a negative effect on these decisions. The ICC, reflecting discount rate news and cash flow news properly, show unequivocally negative effect on investment and equity issuance. The CAPM and FFM expected returns, reflecting the effects of cash flow and discount rate news on investment and financing, tend to show mixed or positive effect on investment and equity issuance. Moreover, the ICC exhibits stronger effect on corporate investment for firms with more equity dependence and greater private information, which is consistent with the prediction that firms invest more when the market perceives lower COE whether rationally or irrationally. Furthermore, our results suggest that the ICC increases (decreases) following negative (positive) supply shocks in equity capital, particularly when the demand is not elastic, whereas the CAPM and FFM estimates have the opposite effects.

In conclusion, our results lend strong support for the application of the ICC in the capital budgeting process. The preponderance of the ICC over the traditional factor-model-based proxies comes from the fact that ICC captures cash flow news and discount rate news in the way that is consistent with the theoretical prediction.

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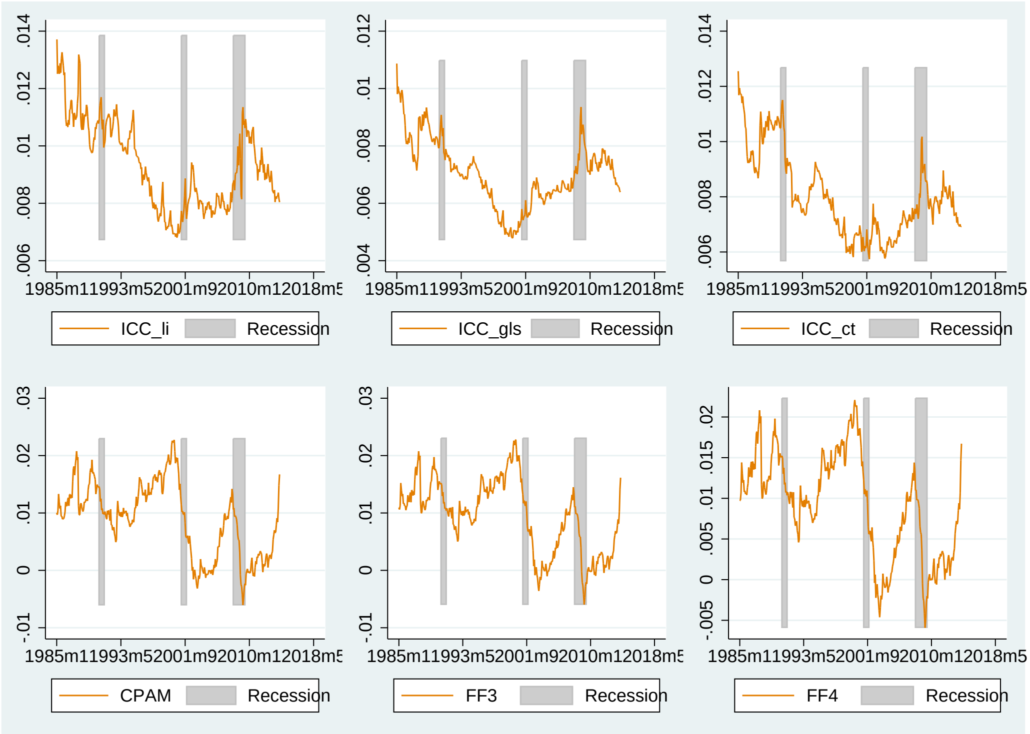

Figure 1: Times Series Patterns of the Cost-of-Equity Proxies

Table 1: Descriptive Statistics and Variable Correlations

The Panel A of Table 1 provides the summary statistics for the variables used in the study. The sample consists of US firms from 1985 to 2013. For each variable, we report the number of observations (N), mean (Mean), standard deviation (Std), 25th percentile, median and 75th percentile. The Panel B of Table 1 provides Pearson correlation matrix of cost-of-equity proxies and return components. ICC-LNS, ICC-GLS and ICC-CT are the implied cost of equity estimates following the methods of Li, Ng, and Swaminathan (2013), Claus and Thomas (2001), and Gebhardt, Lee, and Swaminathan (2001), respectively. Eret-CAPM, Eret-FF3, and Eret-FF4 are expected returns based on the CAPM, the FF3M, and the FF4M. CFN-Chen and DRN-Chen are cash flow news and discount rate news following the method of Chen, Da, and Zhao (2013). Detailed definitions of the variables are provided in Appendix B. ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Panel A. Summary Statistics

Variable	N	Mean	Std	25%	Median	75%
CAPX	40,053	0.068	0.071	0.024	0.046	0.084
CAPX + R&D	40,053	0.109	0.098	0.041	0.081	0.144
Issuance	37,929	0.112	0.332	-0.003	0.008	0.038
CF	40,053	0.097	0.112	0.054	0.102	0.153
Q	40,057	1.843	1.166	1.120	1.468	2.112
1-R^2	40,123	0.753	0.209	0.634	0.812	0.919
ICC-LNS	40,123	0.140	0.071	0.093	0.120	0.170
ICC-GLS	40,123	0.098	0.029	0.079	0.095	0.113
ICC-CT	40,123	0.110	0.063	0.078	0.097	0.123
Eret-CAPM	40,123	0.110	0.094	0.028	0.112	0.170
Eret-FF3	40,123	0.121	0.098	0.054	0.114	0.181
Eret-FF4	40,123	0.110	0.108	0.039	0.104	0.175
CFN-Chen	39,752	0.067	0.608	-0.390	0.090	0.584
CFN-CS	37,751	0.045	0.613	-0.424	0.092	0.531
DRN-Chen	39,752	-0.027	0.626	-0.566	-0.048	0.498
DRN-CS	37,751	-0.004	0.534	-0.224	0.019	0.178

Panel B. Correlation

	ICC-LNS	ICC-GLS	ICC-CT	Eret-CAPM	Eret-FF3	Eret-FF4	CFN-Chen	DRN-Chen
ICC-LNS	1.00							
ICC-GLS	0.50*	1.00						
ICC-CT	0.57*	0.58*	1.00					
Eret-CAPM	0.12*	0.09*	0.12*	1.00				
Eret-FF3	0.08*	0.06*	0.07*	0.59*	1.00			
Eret-FF4	0.03*	0.01	0.05*	0.47*	0.85*	1.00		
CFN-Chen	0.15*	-0.03*	0.03*	0.00	0.00	0.00	1.00	
DRN-Chen	0.21*	0.06*	0.08*	0.02*	0.00	0.00	0.84*	1.00

Table 2: Estimation Results of Investment Regressions

This table provides estimation results from panel regressions. The sample consists of US firms from 1985 to 2013. The dependent variables are capital expenditures (CAPX) scaled by beginning-of-year total assets (AT). ICC-LNS, ICC-GLS and ICC-CT are the implied cost of equity estimates following the methods of Li, Ng, and Swaminathan (2013), Claus and Thomas (2001), and Gebhardt, Lee, and Swaminathan (2001), respectively. Eret-CAPM, Eret-FF3, and Eret-FF4 are expected returns based on the CAPM, the FF3M, and the FF4M. All the cost-of-equity proxies are measured at the beginning of the year. Q is Tobin's q at the beginning of the year and CF is concurrent free cash flow. All regressions include year and firm fixed effects. Detailed definitions of variables are provided in Appendix B. The robust standard errors adjusted for firm-level clustering are reported in parentheses. ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
CF	0.102***	0.107***	0.106***	0.105***	0.105***	0.104***	0.104***	0.110***	0.109***	0.109***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Q	0.007***	0.006***	0.006***	0.007***	0.007***	0.007***	0.007***	0.006***	0.006***	0.006***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
ICC-LNS		-0.036***						-0.034***	-0.034***	-0.034***
		(0.01)						(0.01)	(0.01)	(0.01)
ICC-GLS			-0.065***							
			(0.02)							
ICC-CT				-0.012*						
				(0.01)						
Eret-CAPM					0.031***			0.034***		
					(0.01)			(0.01)		
Eret-FF3						0.012**			0.016***	
						(0.00)			(0.01)	
Eret-FF4							0.014***			0.015***
							(0.00)			(0.00)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	40050	38093	38180	37503	37176	37176	37176	35420	35420	35420
Adj-R^2	0.154	0.162	0.161	0.161	0.155	0.155	0.155	0.163	0.163	0.163

Table 3: Estimation Results of Net Equity Issuance Regressions

This table provides estimation results from panel regression. The sample consists of US firms from 1985 to 2013. The dependent variable is Issuance, defined as the difference of log adjusted shares outstanding between fiscal year t and $t-1$. ICC-LNS, ICC-GLS and ICC-CT are the implied cost of equity estimates following the methods of Li, Ng, and Swaminathan (2013), Claus and Thomas (2001), and Gebhardt, Lee, and Swaminathan (2001), respectively. Eret-CAPM, Eret-FF3, and Eret-FF4 are expected returns based on the CAPM, the FF3M, and the FF4M. All the cost-of-equity proxies are measured at the beginning of the year. Q is Tobin's q at the beginning of the year and CF is concurrent free cash flow. All regressions include year and firm fixed effects. Detailed definitions of variables are provided in Appendix B. The robust standard errors adjusted for firm-level clustering are reported in parentheses. ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Dependent Variable: Net Equity Issuance						
	(1)	(2)	(3)	(4)	(5)	(6)
CF	0.489***	0.480***	0.480***	0.473***	0.470***	0.470***
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Q	0.030***	0.031***	0.033***	0.031***	0.031***	0.031***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
ICC-LNS	-0.182***					
	(0.03)					
ICC-GLS		-0.214**				
		(0.09)				
ICC-CT			-0.046*			
			(0.03)			
Eret-CAPM				0.087*		
				(0.04)		
Eret-FF3					0.093***	
					(0.03)	
Eret-FF4						0.082***
						(0.02)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
N	36103	36188	35563	35238	35238	35238
Adj-R^2	0.068	0.066	0.067	0.064	0.064	0.064

Table 4: Sensitivities of Investments and Net Equity Issuance to Cash Flow and Discount Rate News

This table provides estimation results from panel regression. The sample consists of US firms from 1985 to 2013. The dependent variables are capital expenditures (CAPX) scaled by beginning-of-year total assets (AT); and Issuance, defined as the difference of log adjusted shares outstanding between fiscal year t and $t-1$. CFN-Chen and DRN-Chen are cash flow news and discount rate news, respectively, according to the Chen, Da, and Zhao (2013)'s approach. CFN-CS and DRN-CS are cash flow news and discount rate news, respectively, according to Campbell and Shiller (1988) approach. All the cost of equity proxies are measured at the beginning of the year. Q is Tobin's q at the beginning of the year and CF is concurrent free cash flow. All regressions include year and firm fixed effects. Detailed definitions of variables are provided in Appendix B. The robust t-statistics adjusted for firm-level clustering are reported in parentheses. ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

	(1) CAPX	(2) Issuance	(3) CAPX	(4) Issuance
CF	0.105***	0.425***	0.094***	0.382***
	(0.01)	(0.03)	(0.01)	(0.03)
Q	0.006***	0.021***	0.006***	0.021***
	(0.00)	(0.00)	(0.00)	(0.00)
CFN-Chen	0.009***	0.145***		
	(0.00)	(0.01)		
DRN-Chen	-0.008***	-0.143***		
	(0.00)	(0.01)		
CFN-CS			0.014***	0.132***
			(0.00)	(0.01)
CFN-CS			-0.014***	-0.118***
			(0.00)	(0.01)
Year FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
N	37774	35802	37698	35672
Adj-R^2	0.164	0.084	0.160	0.076

Table 5: Sensitivities of Cost-of-Equity Proxies to Cash Flow News and Discount Rate News

This table provides estimation results from Fama-Macbeth regression. The sample consists of US firms from 1985 to 2013. The dependent variables include implied cost of capital measures ICC-LNS, ICC-GLS, ICC-CT and factor-based COE proxies Eret-CAPM, Eret-FF3 and Eret-FF4. Explanatory variables are cash flow news $CFN-Chen$ and discount rate news $DRN-Chen$ following Chen, Da, and Zhao (2013) in Panel A and cash flow news $CFN-CS$ and discount rate news $DRN-CS$ following Campbell and Shiller (1988) in Panel B. Detailed variable definitions are provided in the Appendix B. The reported R^2 the the time-series average of R^2 from cross-sectional regressions. The robust t-statistics adjusted for autocorrelation up to 12 years are reported in parentheses. ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Panel A. Chen, Da, and Zhao (2013) Return Decomposition

	(1) ICC-LNS	(2) ICC-GLS	(3) ICC-CT	(4) Eret-CAPM	(5) Eret-FF3	(6) Eret-FF4
CFN-Chen	-0.010***	-0.012***	-0.011***	0.000	0.004**	0.008***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
DRN-Chen	0.031***	0.012***	0.017***	-0.001	-0.005***	-0.008***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
N	39752	39752	39752	39752	39752	39752
R^2	0.047	0.027	0.012	0.009	0.003	0.003

Panel B. Campbell and Shiller (1988) Return Decomposition

	(1) ICC-LNS	(2) ICC-GLS	(3) ICC-CT	(4) Eret-CAPM	(5) Eret-FF3	(6) Eret-FF4
CFN-CS	-0.024***	-0.017***	-0.015***	-0.003	0.006***	0.008***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
DRN-CS	0.024***	0.017***	0.015***	0.004	-0.007*	-0.011***
	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
N	37751	37751	37751	37751	37751	37751
R^2	0.017	0.046	0.010	0.012	0.006	0.007

Table 6: Equity Dependence and Investment Sensitivity to COE Proxies

This table provides estimation results from panel regression. The sample consists of US firms from 1985 to 2013. The dependent variable is capital expenditures (CAPX) scaled by beginning-of-year total assets (AT). Panel A includes firms with equity dependence index on the top 30%, and Panel B includes firms with equity dependence index on the bottom 30%. The equity dependence is measured by KZ index, defined as

$$KZ_{i,t} = -1.002CF_{i,t} - 39.368DIV_{it} - 1.315CASH_{i,t} + 3.139LEV_{i,t}$$

ICC-LNS, ICC-GLS and ICC-CT are the implied cost of equity estimates following the methods of Li, Ng, and Swaminathan (2013), Claus and Thomas (2001), and Gebhardt, Lee, and Swaminathan (2001), respectively. Eret-CAPM, Eret-FF3, and Eret-FF4 are expected returns based on the CAPM, the FF3M, and the FF4M. All the cost-of-equity proxies are measured at the beginning of the year. Q is Tobin's q at the beginning of the year and CF is concurrent free cash flow. All regressions include year and firm fixed effects. Detailed definitions of variables are provided in Appendix B. The robust standard errors adjusted for firm-level clustering are reported in parentheses. ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Panel A: High Equity-dependent Firms						
	(1)	(2)	(3)	(4)	(5)	(6)
CF	0.121***	0.122***	0.124***	0.133***	0.132***	0.132***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)
Q	0.022***	0.020***	0.021***	0.020***	0.021***	0.021***
	(0.01)	(0.00)	(0.00)	(0.01)	(0.01)	(0.01)
ICC-LNS	-0.040***					
	(0.01)					
ICC-GLS		-0.121***				
		(0.04)				
ICC-CT			-0.023**			
			(0.01)			
Eret-CAPM				0.025		
				(0.02)		
Eret-FF3					-0.003	
					(0.01)	
Eret-FF4						-0.002
						(0.01)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
N	10247	10234	10045	9850	9850	9850
Adj-R^2	0.157	0.155	0.154	0.151	0.151	0.151

Panel B: Low Equity-dependent Firms						
	(1)	(2)	(3)	(4)	(5)	(6)
CF	0.080***	0.078***	0.071***	0.069***	0.068***	0.068***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Q	0.004***	0.004***	0.005***	0.004***	0.004***	0.004***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
ICC-LNS	-0.009					
	(0.01)					
ICC-GLS		0.025				
		(0.03)				
ICC-CT			0.012			
			(0.01)			
Eret-CAPM				0.047***		
				(0.01)		
Eret-FF3					0.025***	
					(0.01)	
Eret-FF4						0.026***
						(0.01)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
N	9916	9954	9792	9725	9725	9725
Adj-R^2	0.171	0.171	0.171	0.165	0.164	0.165

Table 7: Price Informativeness and Investment Sensitivity

This table provides estimation results from panel regressions. The sample consists of US firms from 1985 to 2013. The dependent variable is capital expenditures (CAPX) scaled by beginning-of-year total assets (AT). Panel A includes firms with price nonsynchronicity measure in the top 30%, and Panel B includes firms with price non-synchronicity measure in the bottom 30%. The price nonsynchronicity is calculated as 1-R^2, where R^2 is the R-square of time-series regression of daily stock returns on market and 3-digit SIC industry returns at year t. ICC-LNS, ICC-GLS and ICC-CT are the implied cost of equity estimates following the methods of Li, Ng, and Swaminathan (2013), Claus and Thomas (2001), and Gebhardt, Lee, and Swaminathan (2001), respectively. Eret-CAPM, Eret-FF3, and Eret-FF4 are expected returns based on the CAPM, the FF3M, and the FF4M. All the cost-of-equity proxies are measured at the beginning of the year. Q is Tobin's q at the beginning of the year, and CF is concurrent free cash flow. All regressions include year and firm fixed effects. Detailed definitions of variables are provided in Appendix B. The robust standard errors adjusted for firm-level clustering are reported in parentheses. ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Panel A: Large Private Information Firms						
	(1)	(2)	(3)	(4)	(5)	(6)
CF	0.110***	0.109***	0.105***	0.102***	0.102***	0.102***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Q	0.005***	0.005***	0.006***	0.005***	0.005***	0.005***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
ICC-LNS	-0.039***					
	(0.01)					
ICC-GLS		-0.065**				
		(0.03)				
ICC-CT			-0.017*			
			(0.01)			
Eret-CAPM				0.020		
				(0.02)		
Eret-FF3					0.008	
					(0.01)	
Eret-FF4						0.013
						(0.01)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
N	8471	8482	8263	8448	8448	8448
Adj-R^2	0.096	0.096	0.094	0.090	0.090	0.091

Panel B: Small Private Information Firms						
	(1)	(2)	(3)	(4)	(5)	(6)
CF	0.160***	0.158***	0.157***	0.166***	0.161***	0.161***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Q	0.007***	0.007***	0.007***	0.007***	0.007***	0.007***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
ICC-LNS	-0.023					
	(0.01)					
ICC-GLS		0.023				
		(0.04)				
ICC-CT			0.006			
			(0.02)			
Eret-CAPM				0.096***		
				(0.02)		
Eret-FF3					0.039***	
					(0.01)	
Eret-FF4						0.032***
						(0.01)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
N	8954	8991	8882	8514	8514	8514
Adj-R^2	0.209	0.207	0.207	0.208	0.204	0.204

Table 8: Difference-in-Difference Estimation for Cost-of-Equity Proxies

This table provides estimation results of the difference-in-difference (DID) regression. The sample consists of US firms in 1997 and 2003. The dependent variables are six cost-of-equity measures. ICC-LNS, ICC-GLS and ICC-CT are the implied cost of equity estimates following the method of Li, Ng, and Swaminathan (2013), Claus and Thomas (2001) and Gebhardt, Lee, and Swaminathan (2001), respectively. Factor-based COE proxies are Eret-CAPM, Eret-FF3 and Eret-FF4, where beta and expected factor premiums are both estimated using rolling regression in five-year window. We estimate the following DID regression:

$$R^e_{i,t} = \alpha_0 + \alpha_1 Post_t + \alpha_2 HFC_i + \alpha_3 Post_t \times HFC_i + \varepsilon_{it},$$

where Post is a dummy variable that takes 1 if it is the third quarter of 1997 or 2003, and 0 if it is the first quarter of 1997 or 2003. HFC is a dummy variable which takes value of 1 if the firm is on the top 30% of financial constraint in the last year. The measure of financial constraint is defined as

$$FC_{i,t} = \Pr\left(\text{Financial Constraint}\right) = 1 - \frac{1}{1 + \exp\left(\beta' X_{i,t} - 0.454\right)}$$

and

$$\beta' X_{i,t} = 0.737 \times \text{Size}_{i,t} + 0.043 \times \text{Size}^2_{i,t} - 0.04 \times \text{Firmage}_{i,t}$$

Detailed variables definitions are provided in the Appendix B. The robust t-statistics adjusted for firm-level clustering are reported in parentheses. ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

	(1) ICC-LNS	(2) ICC-GLS	(3) ICC-CT	(4) Eret-CAPM	(5) Eret-FF3	(6) Eret-FF4
Post	-0.004*	-0.007***	-0.009***	0.021***	0.026***	0.034***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
HFC	0.028***	0.014***	0.014***	-0.026***	-0.027***	-0.037***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.01)
Post*HFC	-0.008**	-0.005***	-0.007**	0.010***	0.031***	0.035***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
N	2638	2638	2638	2638	2638	2638
Adj-R^2	0.032	0.082	0.018	0.022	0.044	0.046

Table 9: Estimation Results of Investment Regressions with Additional Controls

This table provides estimation results from panel regressions. The sample consists of US firmss from 1985 to 2013. The dependent variable is capital expenditures (CAPX) scaled by beginning-of-year total assets (AT). ICC-LNS, ICC-GLS and ICC-CT are the implied cost of equity estimates following the methods of Li, Ng, and Swaminathan (2013), Claus and Thomas (2001), and Gebhardt, Lee, and Swaminathan (2001), respectively. Eret-CAPM, Eret-FF3, and Eret-FF4 are expected returns based on the CAPM, the FF3M, and the FF4M. All the cost-of-equity proxies are measured at the beginning of the year. Q is Tobin's q at the beginning of the year, CF is concurrent free cash flow. Additional control variables include: Lev = Book value of debt/ market value of asset, where the book value of debt equals long-term debt (DLTT) plus debt in current liabilities(DLC) and the market value of asset (MVA) equals total asset (AT) plus closing stock price (PRCC) times common shares outstanding(CSHO) minus common equity(CEQ) minus deferred taxes(TXDB); MB = Market-to-book asset ratio defined as the market value of assets divided by the book value of assets; $SIZE$ =Natural log of total assets, where total assets is inflated to 1996 dollars using the GDP deflator; Div = Cash dividend divided by total assets; FA = Net plant, property, and equipment scaled by total assets; and $Cash$ = Cash and short-term investments over total assets. Detailed definitions of variables are provided in Appendix B. The robust standard errors adjusted for firm-level clustering are reported in parentheses. ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
CF	0.096***	0.095***	0.094***	0.094***	0.093***	0.094***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Q	0.006***	0.006***	0.006***	0.006***	0.006***	0.006***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Lev	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Size	-0.011***	-0.011***	-0.011***	-0.010***	-0.010***	-0.010***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Div	-0.029***	-0.032***	-0.032***	-0.023*	-0.023*	-0.023*
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
FA	0.033***	0.033***	0.032***	0.020**	0.020**	0.020**
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Cash	0.001	0.002	0.002	0.001	0.001	0.001
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
ICC-LNS	-0.040***					
	(0.01)					
ICC-GLS		-0.072***				
		(0.02)				
ICC-CT			-0.019***			
			(0.01)			
Eret-CAPM				0.033***		
				(0.01)		
Eret-FF3					0.012**	
					(0.00)	
Eret-FF4						0.014***
						(0.00)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
N	37956	38042	37368	37012	37012	37012
Adj-R^2	0.183	0.181	0.181	0.171	0.170	0.170

Appendix A. Estimation Procedures for the Cost of Equity

A.1. Factor Model Cost-of-Equity Proxies

Our factor-model-based COE proxies include the expected returns estimated by the CAPM (Eret-CAPM), the FF3M (Eret-FF3) and the FF4M (Eret-FF4).[8] Specifically, at the end of each month for each firm, the expected monthly return is estimated as

$$\hat{E}_t\left[r_{i,t+1}\right] = r_{f,t+1} + \sum_{j=1}^{J} \hat{\beta}_i \hat{E}_t\left[f_{j,t}\right] \tag{22}$$

$\hat{E}_t\left[r_{i,t+1}\right]$ is expected return for $t+1$, $r_{f,t+1}$ is the risk-free rate for $t+1$, $\hat{\beta}_i$ is the factor loadings and $\hat{E}_t\left[f_{j,t}\right]$ is the expected factor premiums at time t, and $J = 1, 3, 4$ according to different model specifications. The factor loadings are estimated through time-series regression using past five years of monthly stock returns. Factor premiums are the means of factor returns over the same five-year period. Finally, the monthly expected returns are compounded into an annual return for a given fiscal year.

A.2. Implied Cost of Capital

Following Li, Ng, and Swaminathan (2013), we assume that the steady-state earning growth rate (g_t) will be a rolling average of annual GDP growth rate after 15 years: e.g. $g_t =$

[8]For the FF3M ((Fama and French, 1993)) and the FF4M ((Carhart, 1997)) monthly factor premiums, $R_M - R_f$, SMB, HML, and UMD, are obtained from Ken French's data library.

$ICC_t \times b_t$, where b_t is the constant retention ratio after year 15. Given the first two years' forecast earnings (FE), the initial growth rate (g_{t+2}) is given by: $g_{t+2} = \frac{FE_{t+2}}{FE_{t+1}} - 1$. This implies that $g_{t+2} \exp\{g_t^g \times 15\} = g_t$ with g_t^g being the growth rate of growth rate g_{t+2}, which yields $g_t^g = \ln\left(\frac{g_t}{g_{t+2}}\right)/15$. Now we can construct FE_{t+k} for the next 15 years as $FE_{t+k} = FE_{t+2} \times (1 + g_{t+2} \exp\{g_t^g \times (k-2)\})$ for $3 \leq k \leq 16$.

The retention rate is assumed to revert linearly to the constant rate $b_t = \frac{g_t}{ICC_t}$ by year 16. Thus, we have $b_{t+k} = b_{t+1} - \frac{(b_{t+1} - \frac{g_t}{ICC_t})}{15} \times (k-1)$ for $2 \leq k \leq 16$. The initial retention ratio is estimated as $b_{t+1} =$ [1- Cash Dividend$_t$ /Net Income$_t$].

Now we construct the stream of dividends as $D_{t+k} = FE_{t+k} \times (1 - b_{t+k})$ for $1 \leq k \leq 15$. For the terminal value of remaining cash dividends after year 15, we have: $FE_{t+16} \times (1 - b_t)/(ICC_t - g_t)$. Putting all terms together, we estimate ICC-LNS from the following equation.

$$P_t = \sum_{k=1}^{15} \frac{FE_{t+k} \times [1 - b_{t+1} + \frac{(b_{t+1} - \frac{g_t}{ICC_t})}{15} \times (k-1)]}{(1 + ICC_t)^k} + \frac{FE_{t+15} \times (1 - b_t)}{(ICC_t - g_t)(1 + ICC_t)^{15}}. \tag{23}$$

This equation is equivalent to equation (4) in Following Li, Ng, and Swaminathan (2013).

We consider an alternative model following the Claus and Thomas (2001) approach. For this, we can obtain the initial forecast value of equity as $BE_{t+1} = BE_t + FE_{t+1} \times (1 - b_{t+1})$, where BE_t is the book equity value per share at t. We then obtain ICC-CT based on the economic profit for shareholders as in the following equation:

$$P_t = BE_t + \sum_{k=1}^{5} \frac{FE_{t+k} - ICC_t \times BE_{t+k-1}}{(1+ICC_t)^k} + \frac{(FE_{t+5} - ICC_t \times BE_{t+4})(1+g_t)}{(ICC_t - g_t)(1+ICC_t)^5} \quad (24)$$

where the growth rate after 5 years, g, is estimated by inflation rate. The advantage of using the Claus and Thomas (2001) approach relative to the previous approach is that it does not require future payout ratios. However, this approach is sensitive to the estimated growth rate g.

As the last approach, we follow the Gebhardt, Lee, and Swaminathan (2001) and estimate ICC-GLS as follows:

$$P_t = BE_t + \sum_{k=1}^{12} \frac{(ROE_{t+k} - ICC_t)BE_{t+k-1}}{(1+ICC_t)^k} + \frac{(ROE_{t+12} - ICC_t)BE_{t+11}}{ICC_t(1+ICC_t)^{12}} \quad (25)$$

where ROE_{t+k} is the return on equity at $t+k$ which is assumed to fade linearly to the median industry ROE (based on 10 years of past data for 48 Fama and French industries, excluding firms with losses) by year $t+12$. The book value of equity is given by $BE_{t+k} = BE_{t+k-1} + FE_{t+k} \times (1 - b_{t+k})$. This approach mitigates the sensitivity of the ICC to the estimated growth rate in the Claus and Thomas (2001) approach.

The sample includes firms with I/B/E/S earnings forecasts for up to five years and a long-term growth forecast. We also require non-missing data for the prior year's book value, earnings, and dividends. When explicit forecasts are unavailable, we obtain forecasts by projecting the long-term growth rate on the prior year's earnings forecast.

Appendix B. Variable Definitions

Variable	Definitions
Dependent Variables	
$CAPX$	Capital expenditure (CPAX) over beginning-of-year total assets (AT)
$CAPX + R\&D$	Capital expenditure plus R&D (XRD) over beginning-of-year total assets (AT)
$CAPX + R\&D + M\&A$	Capital expenditure plus R&D (XRD) and M&A (AQC) over beginning-of-year total assets (AT)
$Issuance$	Log difference of adjusted shares outstanding between year t and $t-1$, where adjusted shares outstanding is shares outstanding (SHROUT) divided by total factor (CFACSHR).
Explanatory Variables	
$ICC - LNS$	Internel rate of return that equates a stock's current price to the present value of its expected future free cash flows. Following the methodology of Li, Ng, and Swaminathan (2013))
$ICC - GLS$	Following the methogology of Gebhardt, Lee, and Swaminathan (2001))
$ICC - CT$	Following the methogology of Claus and Thomas (2001))
$Eret - CAPM$	Monthly expected returns estimated by CAPM. $Ret_{i,t+1}^{CAPM} = R_{f,t+1} + \hat{\beta}_1 E\left[Mktrf_t\right]$. β is the slope coefficient of time-series regression using past five years of monthly stock returns, and $Mktrf$ is the expected factor risk premium calculated as the average value in the past five years.
$Eret - FF3$	Monthly expected returns estimated by Fama-French three-factor model. $Ret_{i,t+1}^{FF3} = R_{f,t+1} + \hat{\beta}_1 E\left[Mktrf_t\right] + \hat{\beta}_2 E\left[SMB_t\right] + \hat{\beta}_3 E\left[HML_t\right]$. β is estimated by past five years of monthly stock return, and $Mktrf$, SMB, HML are the expected factor risk premiums calculated as the average value in the past five years.
$Eret - FF4$	Monthly expected returns estimated by Fama-French-Carhart four-factor model. $Ret_{i,t+1}^{CAPM} = R_{f,t+1} + \hat{\beta}_1 E\left[SMB_t\right] + \hat{\beta}_2 E\left[HML_t\right] + \hat{\beta}_3 E\left[HML_t\right] + \hat{\beta}_4 E\left[UMD_t\right]$. β is estimated by past five years of monthly stock return, and $Mktrf$, SMB, HML ,UMD are the expected factor risk premiums calculated as the average value in the past five years.
$Tobin's\ Q$	Total assets (AT) plus market capitalization (CSHO*PRC) minus common equity (CEQ) over total assets (AT)
CF	Income before extraordinary items (IB) + depreciation and amortization (DP) over total assets (AT)
B/M	Book-to-market ratio, defined as BE/ME, where the market value of equity ME is close price (PRCC)*common shares outstanding (CSHO), and the book value of equity BE is total assets (AT) plus deferred taxes and investment (TXDITC) minus preferred stock (PSTKL).
$1 - R^2$	Price nonsynchronicity, calculated as 1-R^2, where R^2 is the R-square of time-series regression of daily stock returns on market and 3-digit SIC industry returns at year t.
$Equity\ Dependence$	Measured by KZ Index, which is calculated as $KZ_{i,t} = -1.002CF_{i,t} - 39.368DIV_{it} - 1.315CASH_{i,t} + 3.139LEV_{i,t}$
FC	Following Hadlock and Pierce (2010), financial constraint is defined as $FC_{i,t} = \Pr(\text{Financial Constraint}) = 1 - \frac{1}{1+\exp\left(\beta' X_{i,t} - 0.454\right)}$ and $\beta' X_{i,t} = 0.737 \times \text{Size}_{i,t} + 0.043 \times \text{Size}_{i,t}^2 - 0.04 \times \text{Firmage}_{i,t}$.
$Size$	Natural log of total assets (AT)
Lev	[long-term debt (DLTT) + debt in current liabilities(DLC)] / [long-term debt (DLTT) + debt in current liabilities(DLC)+ Stockholders' Equity (SEQ)
Div	Cash dividend (DV) / total assets (AT)
FA	Net plant, property, and equipment (PPENT) / total assets (AT)
$Cash$	Cash and short-term investments (CHE) / total assets (AT)

Unpublished Online Appendix

Table A1: Erickson & Whited Errors-in-Variables GMM

This table provides estimation results from Erickson-Whited Errors-in-Variables GMM regression. The sample consists of US firms from 1985 to 2013. The dependent variable is capital expenditures (CAPX) scaled by beginning-of-year total assets (AT). ICC-LNS, ICC-GLS and ICC-CT are the implied cost of equity estimates following the methods of Li, Ng, and Swaminathan (2013), Claus and Thomas (2001), and Gebhardt, Lee, and Swaminathan (2001), respectively. Eret-CAPM, Eret-FF3, and Eret-FF4 are expected returns based on the CAPM, the FF3M, and the FF4M. All the cost-of-equity proxies are measured at the beginning of the year. Q is Tobin's q at the beginning of the year and CF is concurrent free cash flow. All regressions include year and firm fixed effects. Detailed definitions of variables are provided in Appendix B. We treat Tobin's q and cost-of-equity proxies as misspecified variables, and use fifth-order cumulants. We performance within transformation at both firm and year dimension before estimation. The robust standard errors adjusted for firm-level clustering are reported in parentheses. ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Dependent Variable: CAPX						
	(1)	(2)	(3)	(4)	(5)	(6)
CF	0.119***	0.125***	0.118***	0.127***	0.130***	0.124***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Q	0.005***	0.003***	0.006***	0.002***	0.001	0.003**
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
ICC-LNS	-0.037**					
	(0.02)					
ICC-GLS		-0.128***				
		(0.04)				
ICC-CT			-0.048**			
			(0.02)			
Eret-CAPM				0.102***		
				(0.02)		
Eret-FF3					0.117***	
					(0.02)	
Eret-FF4						0.032
						(0.03)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
N	38093	38180	37503	37176	37176	37176
rho	0.085	0.076	0.082	0.080	0.072	0.073

Table A2: Controlling for Cummins, Hassett, and Oliner (2006)'s Real Q

This table provides estimation results from panel regression. The sample consists of US firms from 1985 to 2013. The dependent variable is capital expenditures (CAPX) scaled by beginning-of-year total assets (AT). ICC-LNS, ICC-GLS and ICC-CT are the implied cost of equity estimates following the methods of Li, Ng, and Swaminathan (2013), Claus and Thomas (2001), and Gebhardt, Lee, and Swaminathan (2001), respectively. Eret-CAPM, Eret-FF3, and Eret-FF4 are expected returns based on the CAPM, the FF3M, and the FF4M. All the cost-of-equity proxies are measured at the beginning of the year. *Real Q* is Cummins, Hassett, and Oliner (2006)'s q at the beginning of the year and CF is concurrent free cash flow. All regressions include year and firm fixed effects. Detailed definitions of variables are provided in Appendix B. The robust standard errors adjusted for firm-level clustering are reported in parentheses. ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Dependent Variable: CAPX						
	(1)	(2)	(3)	(4)	(5)	(6)
CF	0.138***	0.137***	0.140***	0.144***	0.143***	0.143***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Real Q	0.002***	0.002***	0.002***	0.002***	0.002***	0.002***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
ICC-LNS	-0.059***					
	(0.01)					
ICC-GLS		-0.152***				
		(0.02)				
ICC-CT			-0.029***			
			(0.01)			
Eret-CAPM				0.043***		
				(0.01)		
Eret FF3					0.018***	
					(0.01)	
Eret-FF4						0.020***
						(0.00)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
N	36009	35771	35359	33763	33763	33763
Adj-R^2	0.151	0.151	0.148	0.151	0.150	0.150

Table A3: Estimation Results of Investment Regressions Excluding Growth Firms

This table provides estimation results from panel regressions. The sample consists of US firms from 1985 to 2013. The dependent variable is capital expenditures (CAPX) scaled by beginning-of-year total assets (AT). ICC-LNS, ICC-GLS and ICC-CT are the implied cost of equity estimates following the methods of Li, Ng, and Swaminathan (2013), Claus and Thomas (2001), and Gebhardt, Lee, and Swaminathan (2001), respectively. Eret-CAPM, Eret-FF3, and Eret-FF4 are expected returns based on the CAPM, the FF3M, and the FF4M. All the cost-of-equity proxies are measured at the beginning of the year. Q is Tobin's q at the beginning of the year and CF is concurrent free cash flow. All regressions include year and firm fixed effects. Detailed definitions of variables are provided in Appendix B. The robust standard errors adjusted for firm-level clustering are reported in parentheses. ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Dependent Variable: CAPX						
	(1)	(2)	(3)	(4)	(5)	(6)
CF	0.114***	0.113***	0.113***	0.113***	0.112***	0.112***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Q	0.014***	0.013***	0.014***	0.013***	0.013***	0.013***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
ICC-LNS	-0.028***					
	(0.01)					
ICC-GLS		-0.055**				
		(0.02)				
ICC-CT			-0.007			
			(0.01)			
Eret-CAPM				0.028***		
				(0.01)		
Eret-FF3					0.010*	
					(0.01)	
Eret-FF4						0.011**
						(0.00)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
N	28304	28338	27739	27635	27635	27635
Adj-R^2	0.169	0.166	0.166	0.159	0.158	0.159

Table A4: The Performance of COE Proxies in Recession / Non-Recession Period

This table provides estimation results from panel regressions. The sample consists of US firms from 1985 to 2013. The dependent variable is capital expenditures (CAPX) scaled by beginning-of-year total assets (AT). ICC-LNS, ICC-GLS and ICC-CT are the implied cost of equity estimates following the methods of Li, Ng, and Swaminathan (2013), Claus and Thomas (2001), and Gebhardt, Lee, and Swaminathan (2001), respectively. Eret-CAPM, Eret-FF3, and Eret-FF4 are expected returns based on the CAPM, the FF3M, and the FF4M. All the cost-of-equity proxies are measured at the beginning of the year. Q is Tobin's q at the beginning of the year and CF is concurrent free cash flow. All regressions include year and firm fixed effects. Detailed definitions of variables are provided in Appendix B. The robust standard errors adjusted for firm-level clustering are reported in parentheses. ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Panel A: Non-Recession Period

	(1)	(2)	(3)	(4)	(5)	(6)
CF	0.112***	0.111***	0.108***	0.109***	0.108***	0.108***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Q	0.006***	0.006***	0.007***	0.006***	0.007***	0.006***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
ICC-LNS	-0.039***					
	(0.01)					
ICC-GLS		-0.075***				
		(0.02)				
ICC-CT			-0.014*			
			(0.01)			
Eret-CAPM				0.030***		
				(0.01)		
Eret-FF3					0.007	
					(0.01)	
Eret-FF4						0.012***
						(0.00)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
N	31753	31803	31227	31019	31019	31019
Adj-R^2	0.163	0.162	0.162	0.156	0.155	0.156

Panel B: Recession Period

	(1)	(2)	(3)	(4)	(5)	(6)
CF	0.099***	0.100***	0.100***	0.103***	0.103***	0.102***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Q	0.007***	0.008***	0.008***	0.007***	0.007***	0.007***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
ICC-LNS	-0.015					
	(0.02)					
ICC-GLS		0.022				
		(0.05)				
ICC-CT			-0.013			
			(0.02)			
Eret-CAPM				0.036**		
				(0.02)		
Eret-FF3					0.032***	
					(0.01)	
Eret-FF4						0.018
						(0.01)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
N	6340	6377	6276	6157	6157	6157
Adj-R^2	0.201	0.201	0.202	0.191	0.192	0.191

Table A5: Estimation Results of Investment Regressions Including R&D and M&A Expenses

This table provides estimation results from panel regressions. The sample consists of US firms from 1985 to 2013. The dependent variable is capital expenditures (CAPX) plus R&D expenses (XRD) and M&A expenses (AQC) scaled by beginning-of-year total assets (AT). ICC-LNS, ICC-GLS and ICC-CT are the implied cost of equity estimates following the methods of Li, Ng, and Swaminathan (2013), Claus and Thomas (2001), and Gebhardt, Lee, and Swaminathan (2001), respectively. Eret-CAPM, Eret-FF3, and Eret-FF4 are expected returns based on the CAPM, the FF3M, and the FF4M. All the cost-of-equity proxies are measured at the beginning of the year. Q is Tobin's q at the beginning of the year, and CF is concurrent free cash flow. All regressions include year and firm fixed effects. Detailed definitions of variables are provided in Appendix B. The robust standard errors adjusted for firm-level clustering are reported in parentheses. ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Dependent Variable: CAPX+R&D+M&A						
	(1)	(2)	(3)	(4)	(5)	(6)
CF	0.189***	0.182***	0.180***	0.182***	0.182***	0.182***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Q	0.014***	0.014***	0.015***	0.016***	0.016***	0.016***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
ICC-LNS	-0.093***					
	(0.01)					
ICC-GLS		-0.156***				
		(0.03)				
ICC-CT			-0.046***			
			(0.01)			
Eret-CAPM				-0.005		
				(0.02)		
Eret-FF3					-0.005	
					(0.01)	
Eret-FF4						0.002
						(0.01)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
N	38093	38180	37503	37176	37176	37176
Adj-R^2	0.084	0.082	0.081	0.080	0.080	0.080

Table A6: Long-term Effects of the Cost of Equity Proxies

This table provides estimation results from panel regression. The sample consists of US firms from 1985 to 2013. The dependent variable is capital expenditures (CAPX) scaled by beginning-of-year total assets (AT). ICC-LNS, ICC-GLS and ICC-CT are the implied cost of equity estimates following the methods of Li, Ng, and Swaminathan (2013), Claus and Thomas (2001), and Gebhardt, Lee, and Swaminathan (2001), respectively. Eret-CAPM, Eret-FF3, and Eret-FF4 are expected returns based on the CAPM, the FF3M, and the FF4M. All the cost-of-equity proxies are measured at the year $t-1$ and $t-2$. Q is Tobin's q at the beginning of the year and CF is concurrent free cash flow. All regressions include year and firm fixed effects. Detailed definitions of variables are provided in Appendix B. The robust standard errors adjusted for firm-level clustering are reported in parentheses. ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
CF	0.110***	0.105***	0.103***	0.105***	0.104***	0.104***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Q	0.006***	0.007***	0.007***	0.006***	0.006***	0.006***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
$ICC-LNS_{t-1}$	-0.039***					
	(0.01)					
$ICC-LNS_{t-2}$	-0.000					
	(0.01)					
$ICC-GLS_{t-1}$		-0.078***				
		(0.02)				
$ICC-GLS_{t-2}$		-0.001				
		(0.02)				
$ICC-CT_{t-1}$			-0.013*			
			(0.01)			
$ICC-CT_{t-2}$			0.005			
			(0.01)			
$Eret-CAPM_{t-1}$				0.025***		
				(0.01)		
$Eret-CAPM_{t-2}$				0.011		
				(0.01)		
$Eret-FF3_{t-1}$					0.012**	
					(0.01)	
$Eret-FF3_{t-2}$					0.004	
					(0.00)	
$Eret-FF4_{t-1}$						0.007
						(0.00)
$Eret-FF4_{t-2}$						0.013***
						(0.00)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
N	36152	35563	34483	34516	34516	34516
Adj-R^2	0.169	0.166	0.169	0.155	0.155	0.155