Understanding the Effects of Alternative Cost-of-Equity Proxies on Corporate Investment and Financing

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August 24, 2019‡

Abstract

Previous research shows that the implied cost of capital (factor model-based estimates for the cost of equity) have a negative (positive) effect on investment. Our paper documents that these alternative cost-of-equity proxies also have opposite effects on external financing activities. We show that the ICC has negative effects on investment and external financing by capturing the firm-specific discount rate news, whereas the factor model-based proxies have positive effects by capturing the cash flow news. Furthermore, the negative effects of the ICC are more pronounced for firms with high private information and equity dependence, whereas the positive effects of the factor model-based estimates are more pronounced for firms with low private information and equity dependence. Thus, the opposite effects of the cost-of-equity proxies can be explained by their distinctive information contents.

JEL Classification: G31; G32

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

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‡We thank David Ng, Murray Frank, Andrew Karolyi, George Gao, Byoung-Hyoun Hwang, Robert Chirinko, Hyunseob Kim, Murillo Campello, Zhongjin Lu, Zhaoxia Xu, and participants at seminars at Cornell University, Baylor University, Capital University of Economics and Business, Ulsan National Institute of Science and Technology (UNIST), as well as participants at the Tenth Annual Conference on Asia-Pacific Financial Markets, 2016 Midwest Finance Association Meetings, 2016 Eastern Finance Association Meetings, and 2019 Conference on Asia-Pacific Financial Markets for invaluable comments and suggestions. A previous version of the paper is entitled "The Sensitivity of Corporate Investment and Financing to the Implied Cost of Capital". Kai Wu acknowledges financial support from the Program for Innovation Research in Central University of Finance and Economics. All remaining errors are our own.

1 Introduction

The CAPM and the Fama and French (1993) model (FFM) are currently the standard textbook choices for estimating the cost of equity. Recent literature suggests the implied cost of capital (ICC) as an alternative way of estimating the cost of equity, by equating the stock price to the present value of expected future cash flows.[1] Frank and Shen (2016) document that the ICC has a *negative* effect on investment, whereas the factor model-based estimates show *positive* effects on investment. It is puzzling that these alternative estimates have opposite effects on investment.

According to Abel and Blanchard (1986), investment is affected negatively by discount rates and positively by expected cash flows. Lettau and Ludvigson (2002) also suggest that the immediate effect of the discount rate on investment should be negative. This is consistent with the negative effect of the ICC on investment, given that it is designed to capture the firm-specific discount rate as demonstrated in Chen, Da, and Zhao (2013).

How about the positive effect of factor model-based estimates on investment? Are the factor models useless for capital budgeting as Levi and Welch (2014) contend? Or do they still convey relevant information as Frank and Shen (2016) suggest? Our paper attempts to answer these questions.

We hypothesize that the negative effect of the ICC on investment reflects its information on the firm-specific discount rate, whereas the positive effects of the factor model-based

[1]The ICC has been used in various contexts, especially in asset pricing. For example, previous papers use the ICC to study: the unconditional equity premium (Claus and Thomas (2001) and Fama and French (2002)); theories on betas (Kaplan and Ruback (1995), and Easton and Monahan (2005)); international asset pricing (Lee, Ng, and Swaminathan (2009)); default risk (Chava and Purnanandam (2010)); cross-sectional expected returns (Botosan, Plumlee, and Wen (2011)); stock return volatility (Friend, Westerfield, and Granito (1978)); and the cost of equity (Burgstahler, Hail, and Leuz (2006)).

estimates reflect their information on the market-wide cash flows. Vuolteenaho (2002) finds that firm-level stock returns are mainly driven by cash flow news rather than by discount rate news. Campbell and Vuolteenaho (2004) further show that the required return on a stock is determined by permanent cash flow shocks to the market and the temporary shocks to the market discount rate. Chen et al. (2013) also find that the common variation in stock returns is driven more by cash flow news than discount rate news. Moreover, Campbell et al. (2010) and Patton and Verardo (2012) suggest that the systematic risks of stock returns mainly reflect the properties of their cash flow fundamentals of the aggregate economy. According to these studies, factor model-based estimates may capture more of cash flow news that are related to the aggregate economy or market-wide shocks. If the expected stock returns indeed reflect mainly the cash flow effects, then they will show positive effects on investment.

Morck, Shleifer, and Vishny (1990) and Baker, Stein, and Wurgler (2003) suggest that the key channel for the cost of capital to affect corporate investment is through external financing. Consequently, we also examine the effects of the cost-of-equity proxies on external financing to understand their information contents. Moreover, the link between cost-of-equity proxies and external financing has not yet been explored.

To test the hypothesis, we decompose unexpected stock returns into two components: discount rate news and cash flow news following Campbell and Shiller (1988). We also use the Chen, Goldstein, and Jiang (2007) approach to measure private information and test whether the effects of the ICC and factor model-based estimates on investment and financing decisions are through the private or public information channel. Additionally, we examine the effects of the cost-of-equity proxies on investment and external financing, conditional on firm's equity dependence. The effect of the cost of equity on investment through the external financing channel is expected to be more pronounced for firms with greater equity dependence (Baker et al. (2003)).

We find that the ICC has significant and negative effects on investment and external financing for firms with high private information and equity dependence, whereas factor model-based estimates have positive effects on investment and financing for firms with low private information and equity dependence. These results suggest that the ICC, reflecting mainly the firm-specific discount rate news, has significant effects on investment and financing decisions, for firms that are more likely to be sensitive to the discount rate news. In contrast, the factor model-based estimates predict investment and financing decisions positively by reflecting cash flow news. Moreover, when we conduct the mediation analysis to identify the underlying mechanism in the relationship between the cost of equity proxies and investment and financing, the results show that discount rate news has the mediated effect for the ICC, while cash flow news has the mediated effect for factor model-based estimates. Thus, the opposite effects of the ICC and factor model-based estimates on investment and financing decisions can be attributed to the ways they reflect cash flow and discount rate news.

To further identify the link between the cost-of-equity proxies and discount rate news/cash flow news in more controlled settings, we also examine their behaviors following exogenous shocks. We utilize Taxpayer Relief Act of 1997 and the Jobs and Growth Tax Relief Reconciliation Act of 2003. Dai, Shackelford, Zhang, and Chen (2013) have shown that these legislations reduced the cost of equity for financially constrained firms due to the increased supply of equity capital. Since these legislations are not likely to have immediate effects on firms' cash flows, the effects should reflect a discount rate shock. We find that, following these legislations, the ICC decreases, while factor model-based estimates increase, especially for financially constrained firms. We also find that, prior to recessions, ICC measures steeply increase, reflecting mainly positive discount rate shocks, whereas factor model-based estimates exhibit steep decreases, reflecting mainly negative cash flow shocks. These findings further establish that the ICC captures mainly the discount rate shock, while factor model-based estimates capture the cash flow shock.

We further consider alternative measures of the cost of equity as well as cash flow news and discount rate news, address errors-in-variable issues, and control for other firm characteristics. Our results are robust to all these additional examinations.

Taken together, our results suggest that the opposite effects of the ICC and factor model-based estimates for the cost of equity on corporate investment and financing decisions can be explained by their distinct information contents. Our paper is related to the literature on estimating the cost of equity for capital budgeting. Frank and Shen (2016) argue that both the ICC and factor model-based estimates, despite their opposite effects, provide relevant and independent information for corporate investment. However, they remain agnostic as to the nature of information contained in these proxies. Our study contributes to the literature by showing that the distinct information contents captured by these alternative estimates explain their opposite effects on corporate investment and financing decisions. Levi and Welch (2017) maintain that factor models fail because they are based on common inputs for factor exposures estimated from historical observations.[2] Our findings suggest that factor

[2] They suggest that incorporating forward-looking betas may improve factor models. They argue that one obstacle to abandoning factor models may be the absence of an alternative.

model estimates capture more of market-wide cash flow information than the firm-specific discount rate. We suggest that the ICC could be a practical alternative to factor models in estimating the cost of equity for capital budgeting.

Our study also contributes to the literature on the stock price-investment link. On the one hand, Baker et al. (2003), Gilchrist et al. (2005), and Polk and Sapienza (2009) show significant effects of mispricing on investment. In particular, Baker et al. (2003) suggest that financially constrained firms' investment is especially sensitive to mispricing in the stock market. On the other hand, Dow and Gorton (1997), and Chen et al. (2007) suggest that such effects of stock price on corporate investment reflect private information as managers are informed about their investments from the stock market. Moreover, Bakke and Whited (2010) suggest that corporate investment does not respond to stock market mispricing nor private information but to legitimate information (i.e., Q) contained in stock price movement. Our findings suggest that firms with high private information and equity dependence are particularly sensitive to the ICC (discount rate news).

Our paper also contributes to the literature on the relation between factor model-based and survey-based expected returns. Greenwood and Shleifer (2014) document that factor model-based estimates and the surveyed expected returns are negatively correlated with each other. Moreover, they show that the survey expectations are more consistent with investors' actual behavior like mutual fund inflows. Gennaioli, Ma, and Shleifer (2016) further show that the survey expectation of earnings also affects corporate investment. Consistent with these findings, our results suggest that the ICC, reflecting the forward-looking discount rate based on the analysts-surveyed expected cash flows, negatively affect corporate investment and financing decisions, while factor model-based estimates show opposite effects.

Finally, our study is also linked to the q-model theory with the interdependence of investment and financing decisions (for example, Gomes (2001) and Bolton, Chen, and Wang (2011)). This theory suggests that external financing costs have an impact on investment beyond Q. Our findings suggest that, by capturing the discount rate implied by the stock price, the ICC informs managers about the market's assessment of the firm's risk, which they incorporate in their investment and financing decisions.

2 Hypothesis Development

2.1 Components of Q

The price of any asset can be written as a sum of its expected future cash flows, discounted to the present. The price of the asset changes when expected cash flows change, or when discount rates change. Similarly, a firm value is given by the discounted cash flows as follows:

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

where E_t is the expectation operator conditional on information at time t, R_{t+j} is the discount rate, C_{t+j} is cash flow, K_{t+j} and I_{t+j} are capital stock and investment at time $t + j$. 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. Thus, the firm's maximization problem can be written as:

$$L = \max_{I,K} E_t \sum_{j=0}^{\infty} \prod_{i=1}^{j} (1 + R_{t+i})^{-1} \left\{ C_{t+j}(K_{t+j}, I_{t+j}) + Q_{t+j}(I_{t+j} - K_{t+j} + (1-\delta)^{j-1} K_{t+j-1}) \right\} \tag{3}$$

The first order conditions maximizing the firm value at t implies:

$$\frac{\partial L}{\partial K_t} = E_t \sum_{j=0}^{\infty} \prod_{i=1}^{j} (1 + R_{t+i})^{-1} \frac{\partial C_{t+j}}{\partial K_{t+j}} (1-\delta)^j - E_t \sum_{j=0}^{\infty} \prod_{i=1}^{j} (1 + R_{t+i})^{-1} Q_{t+j} (1-\delta)^{j-1} = 0 \tag{4}$$

$$\frac{\partial L}{\partial I_t} = E_t \frac{\partial C_t}{\partial I_t} + Q_t = 0 \tag{5}$$

The presence of convex adjustment cost implies $\frac{\partial C_t}{\partial I_t} < 0$ and $\frac{\partial^2 C_t}{\partial I_t^2} < 0$. The optimal investment will be set in such a way that the expected present value of marginal returns to capital ($E_t \sum_{j=0}^{\infty} \prod_{i=1}^{j} (1 + R_{t+i})^{-1} Q_{t+j} (1-\delta)^{j-1}$) is equal to the marginal cost of investment ($-E_t \frac{\partial C_t}{\partial I_t}$), i.e., the following equality holds:

$$Q_t = E_t \sum_{j=0}^{\infty} \prod_{i=0}^{j} \left(\frac{1-\delta}{1 + R_{t+i}} \right)^i (1-\delta)^{-1} M_{t+j} \tag{6}$$

where $M_{t+j} = \frac{\partial C_{t+j}}{\partial K_{t+j}}$ is defined as the marginal profit of capital at $t + j$. Subject to the transversality condition, Eq.(6) implies:

$$E_t(1 + R_{t+1}) = \frac{E_t(Q_{t+1} + M_{t+1})}{Q_t} \tag{7}$$

We define $\Gamma_{t+j} = (1-\delta)/(1+R_{t+j})$. As in Abel and Blanchard (1986), using Taylor expansion around expected values (denoted by placing a bar over the variable) of Q, Γ_{t+j} and M_{t+j}, we have:

$$Q_t - \bar{Q} \approx \bar{M}(1-\bar{\Gamma})^{-1} \sum_{j=0}^{\infty} \bar{\Gamma}^j (\Gamma_{t+j} - \bar{\Gamma}) + \sum_{j=0}^{\infty} \bar{\Gamma}^{j+1} (M_{t+j} - \bar{M}) \tag{8}$$

Abel and Blanchard (1986) show that the first and the second terms of the right-hand side of Eq.(8) capture the effects of the variability in the discount rate and the marginal profit of capital, respectively. Eq.(8) says that a decrease in discount rate or an increase in marginal profit raises Q_t, and hence the rate of investment. Thus, to the extent that the cost-of-equity proxies reflect the discount rate (marginal profit), we expect them to have a negative (positive) effect on investment.

Lettau and Ludvigson (2002) develop the link between Q and expected return. Specifically, using log variables (denoted by lower case letters), they show that:

$$q_t \approx E_t \left[\sum_{j=0}^{\infty} \rho^j \left[(1-\rho) m_{t+1+j} - r_{t+1+j} + \Phi_{t+j} \right] \right] \tag{9}$$

where Φ_{t+j} contains linearization constants. This equation shows that the marginal Q is a function of expected profits and discount rates.

2.2 Components of Expected Return

Campbell and Shiller (1988) analyze cash flow and discount rate shocks in stock returns. The value of a firm at t can be expressed as:

$$E_t(1 + R^*_{t+1}) = \frac{E_t(P_{t+1} + C_{t+1})}{P_t} \tag{10}$$

where P_{t+1} is the stock value and C_{t+1} is cash dividend at $t+1$. We define $r^*_{t+1} = \ln(1+R^*_{t+1})$ and use lower case letters to denote log variables. Campbell and Shiller (1988) derive the following:

$$c_t - p_t = -\frac{k}{1-\rho^*} + E_t \sum_{j=0}^{\infty} \rho^{*j} \left[r^*_{t+1+j} - \Delta c_{t+1+j} \right] \tag{11}$$

where $\rho^* = 1/(1 + \exp \overline{c - p})$ and $k = -\ln \rho^* - (1 - \rho^*) \ln(1/\rho^* - 1)$ (see also Lettau and Ludvigson (2002) and Campbell, Polk, and Vuolteenaho (2010)).

Eq.(11) can be rewritten as:

$$p_t \approx E_t \left[\sum_{j=0}^{\infty} \rho^{*j} \left[(1-\rho^*) c_{t+1+j} - r^*_{t+1+j} \right] \right] \tag{12}$$

This equation is similar to Eq.(9) and shows that an increase in stock price reflects an increase in expected future cash flows or a decline in expected future returns.

2.3 Linking Q and Expected Return

As shown in Lettau and Ludvigson (2002), Eq.(9) can be rewritten as follows:

$$E_t[r_{t+1}] \approx \rho E_t \Delta q_{t+1} + (1-\rho)E_t[m_{t+1} - q_t] \tag{13}$$

This equation relates the discount rate to the change in marginal Q. The discount rate r in Eq.(13) is the expected investment return, whereas r^* in Eq.(12) is the expected stock return. However, Cochrane (1991) show that the equilibrium stock return will be equal to the equilibrium investment return under general assumptions. Lettau and Ludvigson (2002) also argue that these two returns will equal as firms remove arbitrage opportunities between them. Accordingly, expected stock returns should covary positively with the discount rates in q and hence negatively with future investment.

A higher stock price implies either lower discount rate or greater cash flow growth which also raises q. If discount rates are constant, an increase in stock price reflects an increase in cash flow growth, raising q, and hence investment. A decline in the discount rate today increases stock price, which lowers the cost of capital immediately and hence increases investment. But the increase in stock price imply decline in future cash flow growth as higher future cost of capital will decrease future investment. Indeed, Lettau and Ludvigson (2002) show that a decline in discount rate increases investment immediately, but it also foretells a reduction in future cash flow growth. In sum, the discount rate shock should affect the immediate investment negatively, but it may also affect future cash flows positively through its effects on future investment.

Given that the ICC is to estimate the discount rate in Eq.(1), whereas the factor models estimate the expected return in Eq.(13), we hypothesize that the opposite effects of the ICC and factor model-based estimates are due to the way these estimates reflect the discount rate and the cash flow shocks. In particular, we test if the ICC captures the discount rate shock that affects the immediate investment, while factor model-based estimates capture the cash flow shocks.

3 Data and Methodology

3.1 The Sample

Our initial sample consists of listed U.S. firms from the Center for Research in Security Prices (CRSP)/ Compustat Merged Database between 1976 and 2016. We obtain the stock price, the number of outstanding shares, SIC code, 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 industries (SIC code 6000-6999). We further drop firm-year observations with negative sales or total assets.

3.2 Cost-of-Equity Proxies

We estimate the cost of equity using the CAPM, the Fama and French (1993) 3-factor model (FF3M), and the 4-factor model (FF4M, Carhart (1997)). 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 the ICC in three different ways for each firm, following the procedures utilized by Li et al. (2013)(*ICC-LNS*), Gebhardt et al. (2001) (*ICC-GLS*), and Easton (2004) (*ICC-EAS*) respectively. We provide the detailed estimation procedures in Appendix A.

3.3 Measuring Cash Flow News and Discount Rate News

We follow the methodology of Campbell and Shiller (1988) to decompose the stock return into two components: cash flow news (*CFN*) and discount rate news (*DRN*). Campbell and Shiller (1988) propose that stock returns can be decomposed into cash flow news that is related to future dividends, and discount rate news that is related to the discount rate at the aggregate market level. The basic idea is to predict cash flows and discount rate from predictive variables, and then compute cash flow news and discount rate news as residuals. Vuolteenaho (2002) further develop this methodology for the unexpected return of individual stock. From Eq.(11), Campbell et al. (2010) derive the following:

$$r_{t+1} - Er_{t+1} = (E_{t+1} - E_t)\sum_{j=0}^{\infty}\rho^j \Delta c_{t+1+j} - (E_{t+1} - E_t)\sum_{j=0}^{\infty}\rho^j r_{t+1+j} = CFN_{t+1} - DRN_{t+1}, \tag{14}$$

where *CFN* denotes news about future cash flows, and *DRN* denotes news about future discount rates.

Following Vuolteenaho (2002), we estimate the components of Eq.(14) with the following

VAR system of log-linear dynamic equations:

$$R_t = \alpha_1 R_{t-1} + \alpha_2 ROE_{t-1} + \alpha_3 BM_{t-1} + \eta_{1t} \tag{15}$$

$$ROE_t = \beta_1 R_{t-1} + \beta_2 ROE_{t-1} + \beta_3 BM_{t-1} + \eta_{2t} \tag{16}$$

$$BM_t = \gamma_1 BM_{t-1} + \gamma_2 ROE_{t-1} + \gamma_3 BM_{t-1} + \eta_{3t} \tag{17}$$

where R is market-adjusted log stock return, ROE is market-adjusted log return on equity, and BM is the market-adjusted log book-to-market ratio. This approach uses ROE as the cash flow fundamental to predict cash flows and discount rate. We compound the monthly *CFN* and *DRN* to annualize over the firm's fiscal year.

3.4 Summary Statistics

Panel A in Table 1 provides the summary statistics of the variables. The average (median) capital expenditure (*CAPX)* is 5.9% (4.3%) of total assets. The average net external financing (*EXFIN*) is 0.7% of total common equity and the median is −2.3%. Thus, firms engage in fairly active capital investment activities, while external financing is less frequent. The average ICC ranges from 11.4% (*ICC-GLS*) to 15.4% (*ICC-LNS*), while the factor model-based estimates range from 12% to 14%.

We report the Spearman correlation matrix in Panel B of Table 1. ICC and factor model-based estimates are highly correlated among themselves, respectively, but there are also significant positive correlations between factor model-based estimates and ICC measures. ICCs have significant and positive correlations with both cash flow news and discount rate news, and the factor model-based cost of equity shows significant and positive correlation with *CFN*. The *CFN* and *DRN* are also highly correlated (0.72).

(Insert Table 1 about here)

4 Empirical Results

4.1 Primary Specification

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

$$Y_{i,t+1} = \alpha_0 + \alpha_1 R^e_{i,t} + \alpha_2 CF_{i,t} + \alpha_3 TOTALQ_{i,t} + \eta_t + \theta_i + \varepsilon_{i,t}, \tag{18}$$

where subscripts i and t represent firm and time, respectively. The dependent variable, Y, is either investment or external financing. Investment, *CAPX*, is calculated as capital expenditures minus sale of property, scaled by total assets.[3] External financing, *EXFIN*, is calculated as sales of common and preferred stock less purchases of common and preferred stock and cash dividends, scaled by common equity. The primary explanatory variable is the cost of equity proxy, R^e. *CF* is operating income before depreciation over total assets. *TOTALQ* is Tobin's Q developed by Peters and Taylor (2017). We also include firm fixed effects θ_i and year effects η_t in order to control for unobservable firm-specific characteristics and general economic trends.

[3] In an untabulated table, we estimate our investment regressions with the dependent variable broadly defined as the sum of capital expenditure plus M&A and R&D scaled by total assets. The result remains quantitatively the same.

Table 2 reports the estimation results of the baseline regression. In Column (1), the coefficient estimate on *ICC-LNS* is negative and significant at the 1% level, suggesting that firms invest less when the ICC is higher. In contrast, in Column (2) the coefficient estimate on the 4-factor model-based estimate (*ERET-FF4*) is positive and significant at the 1% level, suggesting that firms invest more when the cost of equity is higher. The results also show that *CF* and *TOTALQ* have significantly positive effects on investment, consistent with previous studies.

In order to examine whether the ICC absorbs the explanatory power of factor model-based estimates, or vice versa, we simultaneously include both the ICC and factor model-based estimates in Column (3). The results show that the coefficient estimate on *ICC-LNS* remains negative and highly significant, while that on factor model-based cost of equity *ERET-FF4* are positive and significant at the 1% level, suggesting that both ICC and factor model-based estimate tend to have independent and opposite effects on investment. Our results confirm the findings in Frank and Shen (2016).

In Columns (4)–(6) of Table 2, we investigate the effects of the alternative cost-of-equity proxies on external financing. In Column (4) the coefficient estimate on *ICC-LNS* is negative and significant at the 1% level, whereas in Column (5) the estimated coefficient on the factor model-based cost of equity *ERET-FF4* is positive and significant at the 1% level. Consistent with the result for investment, *CF* and *TOTALQ* are also positively correlated with external financing. When we simultaneously include both the ICC and factor model-based estimates in Column (6), the coefficient on *ICC-LNS* remains negative and highly significant, while the coefficient on *ERET-FF4* remains significant and positive. These results suggest that those two cost-of-equity proxies have independent and opposite effects on financing as well.

In sum, we document a negative effect of ICC on both corporate investment and external financing, suggesting that firms increase their investment and external financing when the cost of equity is relatively low. The factor model-based cost of equity, however, shows opposite effects on investment and external financing.

(Insert Table 2 about here)

4.2 The Effects of Cash Flow News and Discount Rate News

In order to understand the contradicting effects of the ICC and factor model-based estimates, we investigate whether cost-of-equity proxies predict investment and financing through their association with cash flow news and discount rate news. To achieve this, we first regress the cost-of-equity proxies on cash flow news and discount rate news. This allows us to examine whether the alternative cost-of-equity proxies capture more or less of cash flow news and/or discount rate news. Then in the regressions on investment and financing dependent variables, we include the lagged cost-of-equity proxy along with cash flow news and discount rate news. This is a standard setting for the mediation analysis in which one can identify the underlying mechanism in a given relationship. In this case, we test whether cash flow news or discount rate news mainly mediate the relationship between the cost-of-equity proxy and investment/financing decision.

The results are presented in Table 3. The estimates in Columns (1) and (2) suggest that the implied cost of capital (*ICC-LNS*) captures the discount rate news (*DRN*), whereas the results in Columns (3) and (4) show that the factor model-based proxy (*ERET-FF4*) captures the cash flow news (*CFN*). In Columns (5) and (6), we include *ICC-LNS* along with *CFN*, and *DRN* as explanatory variables for the investment and financing regressions. The coefficient estimates on *CFN* and *DRN* are significantly positive and negative, respectively, while the coefficient estimates on *ICC-LNS* remain significant with the negative sign. These findings are consistent with Abel and Blanchard (1986) who find that the cash flow and discount rate components of Q still show significant effects when added to the Q-investment regression. The test statistic for the total mediated effect is -2.28, which is significant at the 5% level. When we measure the individual mediated effects of CFN and DRN, the effect of *DRN* accounts for about 85% of the total mediated effect with its significance at 1% level.

When we conduct similar analysis for the factor model-based proxy in Columns (7) and (8), the coefficient estimates on *ERET-FF4* are significant and positive for both investment and financing regressions. While the total mediated effect is insignificant, the individual effect of *CFN* accounts for nearly 70% of the total mediated effect with its significance at the 5% level. Thus, the factor model-based proxy appears to capture the cash flow news that affect investment and financing decisions positively.

In sum, the findings in this section suggest that the ICC captures discount rate news, while the factor model-based proxy captures cash flow news, which explains their opposite effects on investment and financing decisions.

(Insert Table 3 about here)

4.3 Changes in the Cost of Equity Proxies Around Exogenous Events

In this section we further investigate whether the cost-of-equity proxies capture the discount rate or cash flow news in more controlled settings.

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 increasing the supply of equity capital. These legislations are likely to affect the cost of equity, independent of firms' decisions. Moreover, these tax cuts are not likely to have immediate impacts on firms' cash flows. Accordingly, we use these tax cuts as a quasi natural experiment to test whether the ICC and factor model-based cost of equity capture the discount rate news or not. The effects of the tax cuts on the cost of equity will depend on the elasticity of capital demand. With perfectly inelastic demand, the cost of equity will be reduced by the tax cut. With perfectly elastic demand, the cost of equity will not change. Since financially constrained firms have low demand elasticity of equity capital, they are expected to experience a larger reduction in the cost of equity following the tax cuts. Indeed, Dai et al. (2013) show that these tax cuts have reduced the cost of equity particularly for financially constrained firms. Thus, we hypothesize that the cost-of-equity estimates will capture the discount rate shocks for financially constrained firms.

We test the hypothesis with the following difference-in-difference regression:

$$R^e_{i,t} = \alpha_0 + \alpha_1 POST_t + \alpha_2 HIGHFC_{i,t} + \alpha_3 POST_t \times HIGHFC_{i,t} + \gamma X_{i,t} + \varepsilon_{it},$$

where the dependent variable $R^e_{i,t}$ is the cost of equity proxy. *POST* is a dummy variable that equals one for the third quarter of 1997 or 2003 and zero for the first quarter of 1997 or 2003 (skipping the announcement quarter). *HIGHFC* is a dummy variable that equals one if the firm has above-median financial constraint and zero otherwise. Following the definition in Hadlock and Pierce (2010), the financial constraint measure is calculated as

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

where $\beta' X_{i,t} = 0.737 \times \mathrm{SIZE_{i,t}} + 0.043 \times \mathrm{SIZE}^2_{i,t} - 0.04 \times \mathrm{AGE_{i,t}}$. *SIZE* is the natural logarithm of total assets, and *AGE* is the number of years since the firm's initial public offering.[4]

Table 4 presents the estimation results of the DID regressions. The estimated coefficient on *POST* are negative and significant for all three ICC measures, indicating that the cost of equity becomes lower following the equity capital supply shocks. The significant and negative coefficient estimates on *POST*×*HIGHFC* in Columns (1)–(3) suggest that after the adoption of TRA and JGTRRA, the implied cost of capital decreased significantly more for financially constrained firms than for non-constrained firms. For the factor model-based proxy, however, the coefficient estimates on *POST* and *POST*×*HIGHFC* are all significant

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

and positive, suggesting that the factor model-based proxy increased following the equity capital supply shocks and especially for financially constrained firms.

(Insert Table 4 about here)

We also plot the time-series patterns of the cost-of-equity proxies in Figure 1. Recessions are characterized by heightened uncertainty and risk aversion of investors (Coudert and Gex, 2008), which increases the risk premium and thereby the discount rate. Firms are also expected to face lower cash flows during recessions. If a cost-of-equity proxy captures the discount rate (cash flow) news, it will increase (decrease) prior to recessions. Figure 1 shows that ICC measures tend to increase prior to the highlighted recession periods, while factor model-based estimates show the opposite trend. These results suggest that the ICC reflects the discount rate news, while factor model-based estimates reflect the cash flow news.

In sum, the results in Table 4 and Figure 1 suggest that the ICC and factor model-based estimates contain distinct information that is related to cash flow news and discount rate news, respectively.

(Insert Figure 1 about here)

4.4 Stock Market Information

In the perfect market, Q should be sufficient information for investment decision (Abel and Blanchard, 1986). In the presence of market frictions such as information asymmetry and financial constraints, however, managers may look to additional information when making investment and financing decisions. Given that the cost of equity essentially reflects the market's assessment of the firm-specific risk contained in the stock prices, a cost-of-equity proxy should inform managers about the market's assessment of their firms' risk or discount rate when making investment and financing decisions. Consequently, in this section, we seek to understand the information contained in the cost-of-equity proxies by investigating their effects on investment and external financing in relation to such market frictions.

The literature has documented that the stock price-investment link is more pronounced for firms with higher private information and equity dependence.[5] Since the ICC captures firm-specific information on the discount rate by its design (Pastor et al., 2008; Chen et al., 2013), we postulate that the ICC has negative effects on investment and financing for firms with higher private information and equity dependence. In contrast, given findings that factor model-based proxies reflect market-wide information (Campbell et al., 2010), we expect no such effects for them. To the extent that the stock market informs managers of the economy-wide cash flows, however, the positive effects of factor model-based estimates on investment and external financing may be more pronounced for firms with less private information and equity dependence.

Following Chen et al. (2007), we measure the amount of private information by stock price synchronicity, calculated as R-square from the time-series regression of daily stock return on the market and 3-digit SIC industry portfolio returns over the fiscal year.[6] Chen et al. (2007) suggest that a weak correlation of a firm's stock return with the market and industry returns indicates more private information that is useful for the firm's investment decision. As a

[5]See among others, Chen et al. (2007), Polk and Sapienza (2009), and Bakke and Whited (2010).

[6]We require that firms should have at least 150 days of non-missing returns over the given year in the estimation of stock price synchronicity.

result, we define high private information group as having stock price synchronicity in the bottom 20%, and the low private information group as having stock price synchronicity in the top 20%. The stock price synchronicity is the R-square of time-series regression of daily stock returns on market and 3-digit SIC industry returns over the fiscal year. In addition, we define high equity dependence group as having equity dependence in the top 20%, and the low equity dependence group is defined as having equity dependence in the bottom 20%. We use the KZ index to measure equity dependence, where KZ index is calculated as $KZ_{i,t} = -1.002CF_{i,t} - 39.368DIV_{it} - 1.315CASH_{i,t} + 3.139LEV_{i,t}$ (Baker et al., 2003; Bakke and Whited, 2010).

Panel A of Table 5 presents the results for high and low private information group. The results in Columns (1) and (3) show that *ICC-LNS* has negative and significant effects on both investment and external financing for high private information firms, whereas the results in Columns (5) and (7) show that it has no effect for low private information firms. In Columns (2) and (4), the coefficient estimates on *ERET-FF4* is positive but insignificant, while they are significant and positive for firms with low private information in Columns (6) and (8).

Panel B of Table 5 presents the results for high and low equity dependence. We find that the coefficient estimates on *ICC-LNS* in Columns (1) and (3) are negative and significant for firms with high equity dependence. However, it has no effect for low equity dependence firms, as shown in Columns (5) and (7). In contrast, the effects of *ERET-FF4* on investment and financing are more pronounced for firms with low equity dependence firms.

Overall, the negative effects of the ICC on both corporate investment and external financing are more pronounced for firms with higher private information and equity dependence, while the positive effects of the factor model-based proxy are concentrated on firms with lower private information and equity dependence. These findings suggest that the discount rate component contained in the ICC is important private information that affects firms' investment and financing. In contrast, the factor model-based estimate has effects on investment and financing decisions for non-private information firms, which is consistent with the argument that that the factor model-based estimate captures market-wide cash flows news.

(Insert Table 5 about here)

5 Robustness Checks

5.1 Alternative Cost-of-Equity Proxies

In this subsection we examine the robustness of our main findings by using alternative cost-of-equity proxies. In particular, we use alternative measures of the ICC, *ICC-GLS* and *ICC-EAS*, proposed by Gebhardt et al. (2001) and Easton (2004), respectively. We also consider alternative factor models to estimate the expected stock return, *ERET-CAPM* and *ERET-FF3*, from the CAPM and Fama-French 3-factor models, respectively.

The Columns (1) and (2) of Table 6 show that *ICC-GLS* and *ICC-EAS* have significant and negative effects on corporate investment. Both of *ERET-CAPM* and *ERET-FF3*, however, show significant and positive effects. The results in Columns (5)–(8)show that the coefficient estimates on *ICC-GLS* and *ICC-EAS* are significant and negative, whereas those on *ERET-CAPM* and *ERET-FF3* are significant and positive.

Overall, the results in Table 6 indicate that our findings are not sensitive to the alternative cost-of-equity proxies.

(Insert Table 6 about here)

5.2 Alternative Cash Flow and Discount Rate News

We also consider the methodology of Chen et al. (2013) to decompose the realized return into two components: cash flow news (CFN), defined as the price change holding the discount rate constant, and discount rate news (DRN), defined as the price change holding the cash flow forecasts constant. Since this methodology uses earnings forecasts and stock prices, it identifies forward-looking cash flow news and discount rate news by construction (Chen et al., 2013). Unlike the Campbell and Shiller (1988) approach that provides a decomposition of the unexpected total equity returns, the Chen et al. (2013) approach provides a decomposition of the total capital appreciation on a stock (including both expected and unexpected capital appreciation). However, our results using the later approach are similar and not reported.

5.3 Error-in-Variables GMM Estimation Method

Erickson and Whited (2000) demonstrate that a regression of investment on Q is seriously misspecified because of measurement error in Q. Accordingly, it is possible that our results are driven by measurement errors in Q. It is also possible that the cost-of-equity proxies are subject to the errors-in-variable biases. Erickson et al. (2014) show that the high order linear cumulant estimator is asymptotically equivalent to the high order moments estimator suggested by Erickson and Whited (2000), but the former performs better in finite samples. Accordingly, we follow Erickson et al. (2014) to implement their measurement-error consistent GMM technique to correct for measurement errors in Q and the cost-of-equity estimates. Specifically, we treat Q and cost-of-equity proxies as misspecified variable and use fifth-order cumulants as instruments.

Table 7 presents errors-in-variables GMM regressions of corporate investment and financing on cost-of-equity measures. The results show that our findings remain quantitatively and qualitatively the same when GMM estimation method is applied. Specifically, implied cost of capital *ICC-LNS* has a negative effect on investment and financing, with t-statistics significant at the 1% level. In contrast, factor-model based cost of equity *ERET-FF4* has a significant and positive effect with investment and financing. Thus, we address the concern that our findings may be driven by the measurement errors in Q and cost-of-equity proxies.[7]

(Insert Table 7 about here)

5.4 Controlling for Other Firm Characteristics

We also investigate the effect of the cost-of-equity proxies on corporate investment while controlling for other firm characteristics, which should mitigate the concern that our cost-of-equity proxies simply capture some firm characteristics not reflected in Q. For this exercise, we estimate Eq.(18) including the following additional control variables. *SIZE* is the natural logarithm of market capitalization. *LEV* is total liabilities over total assets. *AGE* is firm

[7] Cummins et al. (2006) suggest that Q constructed using analysts' forecast earnings better reflects fundamentals important for investment spending. In particular, using the analysts' forecast earnings-based Q rather than the stock price, they find no evidence that investment is sensitive to cash flows. Their earnings-based Q is particularly interesting for our study because the ICC is also based on the same earnings forecast from analysts. If the ICC indeed captures the discount rate news embedded in the stock price beyond the information contained in Q and cash flows, the effects of the ICC will remain significant. Thus, we examine if our results are altered when the earnings-based Q is used. In an untabulated table, we show that our findings remain quantitatively similar when we use Tobin's q developed by Cummins et al. (2006).

age calculated as number of years since firm's initial public offering. *DIV* is cash dividend calculated as common and preferred dividends over total assets. *CASH* is cash holdings calculated as cash and short-term investments over total assets, *FA* is calculated as property, plant and equipment over total assets.

Table 8 reports the results when additional firm characteristics are included in the baseline regression model. The signs and significance of all coefficient estimates for cost-of-equity proxies remain the same as Table 2. In particular, the implied cost of capital *ICC-LNS* has a negative effect on investment and financing, and the negative effect is statistically significant at the 1% level. In contrast, factor-model based cost of equity has a positive effect on investment and financing, and the effect is statistically significant at the 1% level. In terms of control variables, both *CF* and *TOTALQ* are positive and significant. In addition, corporate investment increases with firm size, cash holding, and fixed asset ratio, but decreases in leverage and dividend ratio. External Financing increases with fixed asset ratio but decreases with firm size, leverage, dividend ratio and cash holdings. In sum, our main findings remain intact when we control for additional firm characteristics.

(Insert Table 8 about here)

6 Summary and Conclusion

When the market assesses low risk for a firm's investment opportunities, the effective cost of equity becomes lower. As a result, the firm is likely to take on more investment. One puzzling result from the empirical literature is the apparent positive relation between investment and the cost of equity, as proxied by the CAPM and the Fama-French models.

When the cost of equity is measured by the implied cost of capital (ICC), however, the relation becomes negative. In this paper, we document that the ICC has significantly negative effects not only on investment but also on external financing, whereas the factor model-based estimates have opposite effects.

We provide an explanation for this puzzle by showing that the ICC reflects firm-specific discount rate news which has negative effects on investment and financing. In contrast, the positive effects of factor model-based proxies on investment and financing can be explained by market-wide cash flow news captured by them. The ICC decreases (increases) following positive equity capital supply shocks (before recessions), while the factor model-based proxies show opposite movements, consistent with their capturing of discount rate news and cash flow news, respectively. Moreover, the ICC exhibits stronger negative effects for firms with greater private information and equity dependence, whereas the factor model-based proxies show stronger positive effects on firms with low private information and equity dependence.

In sum, these findings suggest that the ICC captures the firm-specific discount rate that is contained in the stock price. It may be close to what managers come up with after considering the market conditions as it shows direct effects on investment and financing decisions. Such consideration is particularly important for more equity dependent firms that are likely to face financial constraints and firms with greater private information that are likely to be sensitive to the discount rate news for their investment and financing decisions. On the contrary, the factor model-based proxies capture non-private or market-wide cash flow news that in turn positively predict corporate investment and financing.

If we evaluate cost-of-capital proxies based on their ability to capture the discount rate that can be used for capital budgeting decisions, our results support the ICC as an alternative to the traditional factor model-based estimates. The main advantage of the ICC is that it captures the firm-specific discount rate that should reflect the market's assessment of the firm's risk. Such an advantage may be particularly important in the presence of market frictions such as financial constraints and asymmetric information.

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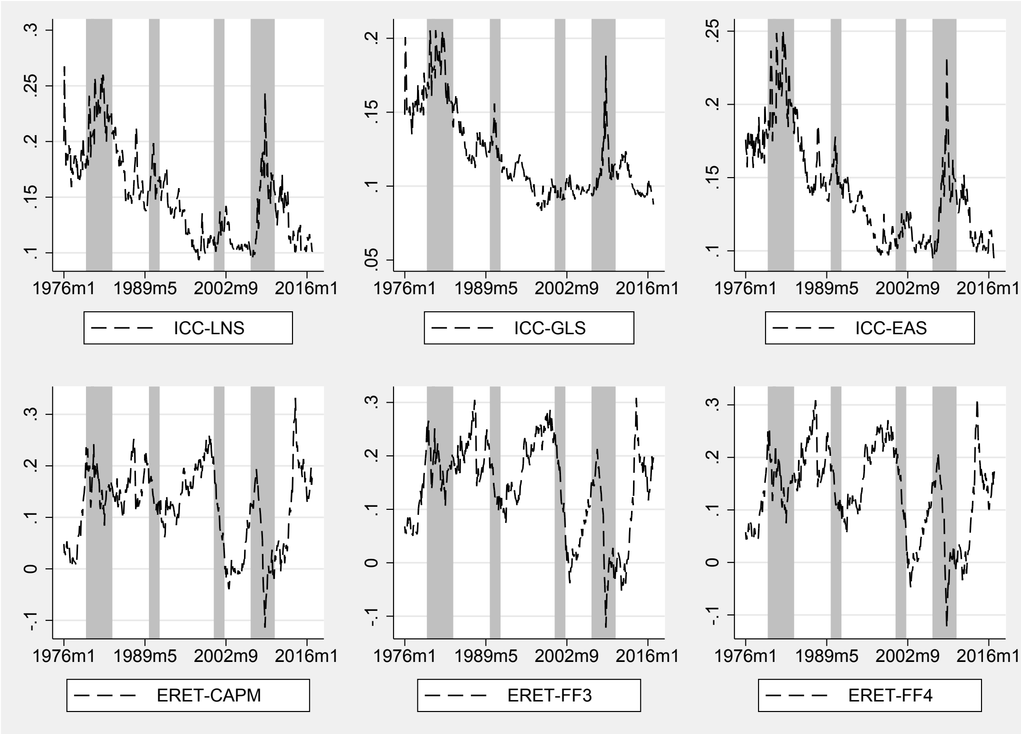

Figure 1: Times-Series Patterns of the Cost-of-Equity Proxies

The figure shows the patterns of value-weighted average of ICC and factor model-based cost-of-equity estimates from 1976–2016. *ICC-LNS*, *ICC-GLS* and *ICC-EAS* are the estimated implied cost of capital following Li et al. (2013), Gebhardt et al. (2001), and Easton (2004), respectively. *ERET-CAPM*, *ERET-FF3*, and *ERET-FF4* are cost of equity measures estimated from the CAPM, Fama-French 3-factor and the FF-Carhart 4-factor models, respectively. The shaded regions denote NBER recession periods.

Table 1: Descriptive Statistics and Variable Correlations

This table presents descriptive statistics and a correlation matrix of key variables of interest for a sample of public firms incorporated in the U.S. from 1976–2016. Panel A presents descriptive statistics, and Panel B presents a Pearson correlation matrix.s. *CAPX* is corporate investment calculated as capital expenditures less sale of property, scaled by total assets. *EXFIN* is the external financing calculated as sale of common and preferred stock less purchase of common and preferred stock and cash dividends, scaled by common equity. *ICC-LNS*, *ICC-GLS* and *ICC-EAS* are the implied cost of equity estimates following Li et al. (2013), Gebhardt et al. (2001) and Easton (2004), respectively. *ERET-CAPM*, *ERET-FF3*, and *ERET-FF4* are cost-of-equity measures estimated from the CAPM, Fama-French 3-factor and FF-Carhart 4-factor models, respectively. *CFN* and *DRN* are the cash flow news and discount rate news following the method of Campbell and Shiller (1988). *CF* is operating income before depreciation over total assets. *TOTALQ* is the Tobin's q developed by Peters and Taylor (2017). *SIZE* is the natural logarithm of market capitalization. *LEV* is total liabilities over total assets. *AGE* is firm age calculated as the number of years since firm's initial public offering. *DIV* is common and preferred dividends over total assets. *CASH* is cash and short-term investments over total assets. *FA* is property, plant and equipment over total assets. Detailed variable definitions are provided in Appendix B. ***, ** and * denote statistical significance at the 1%, 5% and 10% level, respectively.

Panel A. Summary Statistics

	Mean	S.D.	Q5	Q25	Median	Q75	Q95	N
CPAX	0.059	0.056	0.005	0.022	0.043	0.077	0.174	60,730
EXFIN	0.007	0.332	-0.390	-0.107	-0.023	0.071	0.538	60,712
ICC-LNS	0.154	0.076	0.072	0.100	0.133	0.187	0.313	60,730
ICC-GLS	0.114	0.038	0.068	0.090	0.107	0.128	0.178	60,730
ICC-EAS	0.141	0.055	0.077	0.102	0.128	0.167	0.250	60,730
ERET-CAPM	0.125	0.091	-0.017	0.048	0.130	0.185	0.282	60,730
ERET-FF3	0.141	0.106	-0.021	0.066	0.131	0.208	0.341	60,730
ERET-FF4	0.132	0.116	-0.044	0.052	0.123	0.202	0.349	60,730
CFN	0.088	0.735	-1.341	-0.385	0.082	0.562	1.595	52,102
DRN	0.009	0.481	-1.088	-0.140	0.015	0.117	1.246	52,102
CF	0.142	0.085	0.000	0.092	0.139	0.192	0.295	60,730
TOTALQ	1.031	1.270	-0.101	0.286	0.652	1.266	3.751	60,380
SIZE	6.109	1.853	3.205	4.718	6.015	7.375	9.442	60,683
LEV	0.485	0.195	0.156	0.340	0.490	0.621	0.818	60,588
AGE	20.433	16.146	5.000	9.000	15.000	26.000	57.000	60,724
DIV	0.013	0.018	0.000	0.000	0.005	0.020	0.051	60,638
CASH	0.133	0.147	0.005	0.024	0.075	0.191	0.472	60,713
FA	0.289	0.209	0.036	0.125	0.242	0.401	0.739	60,620

Panel B. Spearman Correlation Matrix

	CPAX	EXFIN	ICC-LNS	ICC-GLS	ICC-EAS	ERET-CAPM	ERET-FF3	ERET-FF4	CFN	DRN
CPAX	1.00									
EXFIN	0.15***	1.00								
ICC-LNS	-0.00	0.06***	1.00							
ICC-GLS	0.03***	0.08***	0.56***	1.00						
ICC-EAS	-0.00	0.06***	0.86***	0.67***	1.00					
ERET-CAPM	0.09***	0.08***	0.12***	0.10***	0.12***	1.00				
ERET-FF3	0.08***	0.06***	0.14***	0.15***	0.15***	0.61***	1.00			
ERET-FF4	0.09***	0.06***	0.10***	0.12***	0.09***	0.52***	0.88***	1.00		
CFN	0.06***	0.04***	0.23***	0.20***	0.27***	0.23***	0.15***	0.12***	1.00	
DRN	-0.01*	0.01**	0.10***	0.05***	0.13***	0.01***	0.01**	-0.00	0.72***	1.00

Table 2: Cost of Equity and Corporate Investment/Financing Decisions

This table presents panel regressions of corporate investment and financing on cost-of-equity measures for a sample of listed U.S. firms from 1976–2016. The dependent variable in Columns (1)–(3) is corporate investment, *CAPX*, calculated as capital expenditures minus sale of property, scaled by total assets. The dependent variable in Columns (4)–(6) is external financing, *EXFIN*, calculated as sale of common and preferred stock less purchase of common and preferred stock and cash dividends, scaled by common equity. *ICC-LNS* is the implied cost of equity estimated following Li et al. (2013). *ERET-FF4* is the cost of equity estimated from the FF-Carhart 4-factor model. *CF* is operating income before depreciation over total assets. *TOTALQ* is the Tobin's q developed by Peters and Taylor (2017). All regressions include firm and year fixed effects. Detailed variable definitions are provided in Appendix B. The robust *t*-statistics clustered by firm are reported in parentheses. ***, ** and * denote statistical significance at the 1%, 5% and 10% level, respectively.

	CAPX			EXFIN		
	(1)	(2)	(3)	(4)	(5)	(6)
ICC-LNS	-0.030***		-0.029***	-0.135***		-0.133***
	(-6.80)		(-6.70)	(-4.28)		(-4.21)
ERET-FF4		0.010***	0.009***		0.060***	0.057***
		(3.29)	(3.09)		(2.86)	(2.74)
CF	0.107***	0.114***	0.106***	0.129***	0.163***	0.128***
	(18.64)	(20.76)	(18.62)	(3.45)	(4.55)	(3.40)
TOTALQ	0.003***	0.004***	0.003***	0.013***	0.013***	0.013***
	(9.82)	(10.20)	(9.73)	(6.17)	(6.38)	(6.03)
Firm FE	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y
Observations	50549	50549	50549	50538	50538	50538
Number of Firms	4719	4719	4719	4718	4718	4718
Adjusted R^2	0.61	0.61	0.61	0.14	0.14	0.14

Table 3: The Effect of Cash Flow and Discount Rate News

This table presents the effect of cash flow news and discount rate news on corporate investment and financing for a sample of listed U.S. firms from 1976–2016. The cash flow news *CFN* and discount rate news *DRN* are estimated following Campbell and Shiller (1988). Corporate investment *CAPX* is calculated as capital expenditures minus sale of property, scaled by total assets. External financing *EXFIN* is calculated as sale of common and preferred stock less purchase of common and preferred stock and cash dividends, scaled by common equity. *ICC-LNS* is the implied cost of equity estimated following Li et al. (2013). *ERET-FF4* is the cost of equity estimated from the FF-Carhart 4-factor model. *CF* is operating income before depreciation over total assets. *TOTALQ* is the Tobin's q developed by Peters and Taylor (2017). All regressions include firm and year fixed effects. The significance of total mediated effect of *CFN* and *DRN* is the *t*-statistic calculated following MacKinnon et al. (2002), and the significance of individual mediated effect is the Sobel test statistic (Sobel, 1990) with absolute critical value of 0.9 for p-value below 0.05. Detailed variable definitions are provided in Appendix B. The robust *t*-statistics clustered by firm are reported in parentheses. ***, ** and * denote statistical significance at the 1%, 5% and 10% level, respectively.

	(1) CFN	(2) DRN	(3) CFN	(4) DRN	(5) CAPX	(6) EXFIN	(7) CAPX	(8) EXFIN
ICC-LNS	-0.002	0.016***			-0.025***	-0.014***		
	(-0.44)	(3.57)			(-6.97)	(-4.97)		
ERET-FF4			0.011**	-0.007			0.017***	0.010***
			(1.97)	(-1.21)			(4.36)	(3.50)
CFN					0.043***	0.057***	0.043***	0.057***
					(9.12)	(13.67)	(9.07)	(13.67)
DRN					-0.035***	-0.043***	-0.034***	-0.043***
					(-5.38)	(-8.10)	(-5.28)	(-8.02)
CF	0.112***	-0.051***	0.092***	-0.056***	0.101***	0.011***	0.108***	0.014***
	(14.37)	(-7.59)	(13.50)	(-8.41)	(20.84)	(3.02)	(22.68)	(4.26)
TOTALQ	0.249***	-0.111***	0.175***	-0.112***	0.026***	0.017***	0.027***	0.017***
	(24.79)	(-11.74)	(21.81)	(-11.89)	(5.57)	(4.98)	(5.90)	(5.20)
Firm FE	Y	Y	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y	Y	Y
Observations	43,656	43,656	43,656	43,656	43,656	43,646	43,656	43,646
Number of Firms	5,210	5,210	5,210	5,210	5,210	5,209	5,210	5,209
$Adjusted R^2$	0.53	0.42	0.36	0.42	0.61	0.20	0.61	0.20
Signficance of Total Mediated Effect					-2.28	-4.24	0.47	1.53
Percent of Mediated Effect CFN					0.15	0.16	0.68	0.69
Signficance of Mediated Effect CFN					-0.44	-0.44	1.92	1.95
Percent of Mediated Effect DRN					0.85	0.84	0.32	0.31
Signficance of Mediated Effect DRN					-2.98	-3.27	0.99	1.13

Table 4: Cost-of-Equity Proxies Around Tax Cuts in Capital Gains

This table presents a difference-in-difference regression for a sample of listed U.S. firms in 1997 and 2003. The dependent variables are cost-of-equity proxies. *ICC-LNS*, *ICC-GLS* and *ICC-EAS* are the implied cost of equity estimates following Li et al. (2013), Gebhardt et al. (2001) and Easton (2004), respectively. *ERET-CAPM*, *ERET-FF3*, and *ERET-FF4* are cost-of-equity measures estimated from the CAPM, Fama-French 3-factor and FF-Carhart 4-factor models, respectively. *Post* is a dummy variable that equals one for the third quarter of 1997 or 2003 and zero for the first quarter of 1997 or 2003. *HFC* is a dummy variable that equals one if the firm has the above-median financial constraint and zero otherwise. The financial constraint measure is calculated as

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

where $\beta' X_{i,t} = 0.737 \times \mathrm{SIZE_{i,t}} + 0.043 \times \mathrm{SIZE}^2_{i,t} - 0.04 \times \mathrm{AGE_{i,t}}$. *CF* is operating income before depreciation over total assets. *TOTALQ* is the Tobin's q developed by Peters and Taylor (2017). *SIZE* is the natural logarithm of market capitalization. *LEV* is total liabilities over total assets. *AGE* is firm age calculated as the number of years since firm's initial public offering. *DIV* is common and preferred dividends over total assets. *CASH* is cash and short-term investments over total assets. *FA* is property, plant and equipment over total assets. Detailed variable definitions are provided in Appendix B. The robust *t*-statistics clustered by firm are reported in parentheses. ***, ** and * denote statistical significance at the 1%, 5% and 10% level, respectively.

	(1) ICC-LNS	(2) ICC-GLS	(3) ICC-EAS	(4) ERET-CAPM	(5) ERET-FF3	(6) ERET-FF4
POST	-0.006***	-0.007***	-0.008***	0.032***	0.051***	0.058***
	(-4.19)	(-13.33)	(-9.58)	(33.83)	(38.85)	(36.93)
HFC	0.009***	0.006***	0.009***	0.001	-0.016***	-0.018***
	(2.93)	(4.16)	(4.34)	(0.51)	(-4.04)	(-3.43)
POST*HFC	-0.006**	-0.004**	-0.007***	0.005***	0.025***	0.025***
	(-2.15)	(-2.46)	(-4.40)	(3.09)	(10.67)	(8.96)
CF	-0.205***	0.027**	-0.164***	-0.008	-0.012	0.063**
	(-11.81)	(2.23)	(-14.97)	(-0.43)	(-0.47)	(2.07)
TOTALQ	0.002**	0.003***	0.001*	0.006***	-0.001	0.003
	(2.34)	(2.92)	(1.71)	(4.57)	(-0.60)	(1.43)
SIZE	-0.013***	-0.008***	-0.011***	0.001*	-0.011***	-0.009***
	(-13.26)	(-12.94)	(-16.47)	(1.78)	(-8.41)	(-6.07)
LEV	0.027***	0.047***	0.033***	0.007	0.018*	0.012
	(3.72)	(9.27)	(6.77)	(1.08)	(1.80)	(0.90)
AGE	0.000***	0.000***	0.000***	0.000	0.000***	0.000***
	(3.06)	(3.73)	(3.70)	(0.74)	(3.77)	(2.86)
DIV	-0.039	-0.373***	0.057	-0.528***	-0.421***	-0.519***
	(-0.57)	(-9.88)	(1.18)	(-6.88)	(-4.48)	(-4.63)
CASH	-0.022**	-0.011*	-0.008	0.018*	-0.038***	-0.043**
	(-2.43)	(-1.91)	(-1.35)	(1.83)	(-2.66)	(-2.34)
FA	0.019***	-0.008**	0.018***	-0.012**	0.024***	0.026***
	(3.15)	(-2.52)	(4.54)	(-2.45)	(3.00)	(2.69)
Year FE	Y	Y	Y	Y	Y	Y
Observations	6115	6059	5736	6105	6105	6105
Number of Firms	2424	2410	2336	2420	2420	2420
Adjusted R^2	0.17	0.16	0.28	0.73	0.43	0.37

Table 5: Private Information and Equity Dependence

This table presents panel regressions of corporate investment/financing on cost-of-equity measures along with level of private information and equity dependence for a sample of listed U.S. firms from 1976–2016. The dependent variable in Columns (1)–(4) of Panel A and Panel B is corporate investment, *CAPX*, calculated as capital expenditures minus sale of property, scaled by total assets. The dependent variable in Columns (5)–(8) of Panel A and Panel B is external financing, *EXFIN*, calculated as sale of common and preferred stock less purchase of common and preferred stock and cash dividends, scaled by common equity. In Panel A the high private information group is defined as having stock price synchronicity in the bottom 20%, while the low private information group is defined as having stock price synchronicity in the top 20%. The stock price synchronicity is the R-square of time-series regression of daily stock returns on market and 3-digit SIC industry returns over the fiscal year. In Panel B the high equity dependence group is defined as having equity dependence in the top 20%, while the low equity dependence group is defined as having equity dependence in the bottom 20%. The equity dependence is measured by the KZ index defined as -1.002**CF*-39.368**DIV*-1.315**CASH*+3.139**LEV*. *ICC-LNS* is the implied cost of equity estimated following Li et al. (2013). *ERET-FF4* is the cost of equity estimated from the FF-Carhart 4-factor model. *CF* is operating income before depreciation over total assets. *TOTALQ* is the Tobin's q developed by Peters and Taylor (2017). All regressions include firm and year fixed effects. Detailed variable definitions are provided in Appendix B. The robust t-statistics clustered by firm are reported in parentheses. ***, ** and * denote statistical significance at the 1%, 5% and 10% level, respectively.

Panel A. Private Information								
	High Private Information				Low Private Information			
	(1) CAPX	(2) CAPX	(3) EXFIN	(4) EXFIN	(5) CAPX	(6) CAPX	(7) EXFIN	(8) EXFIN
ICC-LNS	-0.029***		-0.321***		-0.019		-0.077	
	(-2.77)		(-3.30)		(-1.57)		(-1.70)	
ERET-FF4		0.011		0.040		0.018***		0.086**
		(1.40)		(1.35)		(2.61)		(1.98)
CF	0.089***	0.096***	0.138	0.142***	0.133***	0.136***	0.083**	0.096**
	(6.85)	(7.82)	(1.26)	(3.01)	(11.07)	(11.81)	(2.06)	(2.49)
TOTALQ	0.002***	0.002***	0.016*	0.010***	0.004***	0.004***	0.009***	0.009***
	(2.99)	(3.20)	(1.95)	(2.96)	(5.01)	(5.03)	(4.11)	(4.21)
Firm FE	Y	Y	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y	Y	Y
Observations	6663	6663	6660	6660	8448	8448	8448	8448
Number of Firms	1908	1908	1907	1907	1608	1608	1608	1608
Adjusted R^2	0.49	0.49	0.13	0.17	0.71	0.71	0.22	0.22
Panel B. Equity Dependence								
	High Equity Dependence				Low Equity Dependence			
	(1) CAPX	(2) CAPX	(3) EXFIN	(4) EXFIN	(5) CAPX	(6) CAPX	(7) EXFIN	(8) EXFIN
ICC-LNS	-0.041***		-0.210**		-0.009		0.049	
	(-3.94)		(-2.19)		(-0.90)		(0.72)	
ERET-FF4		0.008		0.059		0.014*		0.085**
		(1.08)		(0.78)		(1.95)		(2.21)
CF	0.125***	0.138***	0.759***	0.826***	0.075***	0.076***	0.006	-0.008
	(5.47)	(6.43)	(5.05)	(5.76)	(7.33)	(7.66)	(0.10)	(-0.13)
TOTALQ	0.004***	0.004***	0.041***	0.043***	0.003***	0.003***	-0.000	-0.001
	(2.90)	(3.18)	(3.84)	(4.03)	(5.49)	(5.49)	(-0.08)	(-0.27)
Firm FE	Y	Y	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y	Y	Y
Observations	9214	9214	9214	9214	10254	10254	10248	10248
Number of Firms	1205	1205	1205	1205	975	975	974	974
Adjusted R^2	0.64	0.64	0.14	0.14	0.57	0.57	0.16	0.16

Table 6: Alternative Cost-of-Equity Proxies

This table presents panel regressions of corporate investment and financing on cost-of-equity measures for a sample of listed U.S. firms from 1976–2016. The dependent variable in Columns (1)–(4) is corporate investment, *CAPX*, calculated as capital expenditures minus sale of property, scaled by total assets. The dependent variable in Columns (5)–(8) is external financing, *EXFIN*, calculated as sale of common and preferred stock less purchase of common and preferred stock and cash dividends, scaled by common equity. *ICC-GLS* and *ICC-EAS* are the implied cost of equity estimated following Gebhardt et al. (2001) and Easton (2004), respectively. *ERET-CAPM* and *ERET-FF3* are cost of equity estimated from the CAPM and Fama-French 3-factor models, respectively. *CF* is operating income before depreciation over total assets. *TOTALQ* is the Tobin's q developed by Peters and Taylor (2017). All regressions include firm and year fixed effects. Detailed variable definitions are provided in Appendix B. The robust *t*-statistics clustered by firm are reported in parentheses. ***, ** and * denote statistical significance at the 1%, 5% and 10% level, respectively.

	CAPX				EXFIN			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ICC-GLS	-0.066***				-0.217**			
	(-6.33)				(-2.40)			
ICC-EAS		-0.068***				-0.291***		
		(-9.94)				(-5.28)		
ERET-CAPM			0.011*				0.038**	
			(1.93)				(2.07)	
ERET-FF3				0.006*				0.016**
				(1.70)				(2.42)
CF	0.116***	0.102***	0.115***	0.114***	0.170***	0.112***	0.035***	0.035***
	(21.13)	(17.50)	(20.87)	(20.79)	(4.75)	(2.97)	(3.69)	(3.61)
TOTALQ	0.003***	0.003***	0.004***	0.004***	0.013***	0.012***	0.006***	0.006***
	(9.32)	(9.24)	(10.21)	(10.32)	(5.88)	(5.70)	(9.61)	(9.68)
Firm FE	Y	Y	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y	Y	Y
Observations	50549	50549	50549	50549	50538	50538	50538	50538
Number of Firms	4719	4719	4719	4719	4718	4718	4718	4718
Adjusted R^2	0.61	0.61	0.61	0.61	0.14	0.14	0.19	0.19

Table 7: Erickson & Whited Errors-in-Variables GMM

This table presents Errors-in-Variables GMM regressions of corporate investment and financing on cost-of-equity measures for a sample of listed U.S. firms from 1976-2016. The dependent variable in Columns (1)–(2) is corporate investment, *CAPX*, calculated as capital expenditures minus sale of property, scaled by total assets. The dependent variable in Columns (3)–(4) is external financing, *EXFIN*, calculated as sale of common and preferred stock less purchase of common and preferred stock and cash dividends, scaled by common equity. *ICC-LNS* is the implied cost of equity estimated following Li et al. (2013). *ERET-FF4* is the cost of equity estimated from the FF-Carhart 4-factor model. *CF* is operating income before depreciation over total assets. *TOTALQ* is the Tobin's q developed by Peters and Taylor (2017). The cost-of-equity proxies are treated as misspecified variables, and fifth-order cumulants are used in Erickson et al. (2017). We performance within-firm transformation before estimation. Detailed variable definitions are provided in Appendix B. The robust t-statistics clustered by firm are reported in parentheses. ***, ** and * denote statistical significance at the 1%, 5% and 10% level, respectively.

	CAPX		EXFIN	
	(1)	(2)	(3)	(4)
ICC-LNS	-0.375***		-7.364***	
	(-3.49)		(-5.87)	
ERET-FF4		0.618***		5.011**
		(4.12)		(2.48)
CF	0.082***	0.076***	-1.007***	0.869***
	(4.02)	(3.81)	(-4.30)	(3.51)
TOTALQ	0.001	-0.002	-0.037***	0.057***
	(1.03)	(-1.40)	(-3.99)	(3.09)
Observations	51342	51342	51329	51329
ρ	0.070	0.183	0.014	-0.024

Table 8: Investment and Financing Regressions with Additional Controls

This table presents panel regressions of corporate investment and financing on cost-of-equity measures for a sample of listed U.S. firms from 1976–2016. The dependent variable in Columns (1)–(3) is corporate investment, *CAPX*, calculated as capital expenditures minus sale of property, scaled by total assets. The dependent variable in Columns (4)–(6) is external financing, *EXFIN*, calculated as sale of common and preferred stock less purchase of common and preferred stock and cash dividends, scaled by common equity. *ICC-LNS* is the implied cost of equity estimated following Li et al. (2013). *ERET-FF4* is the cost of equity estimated from the FF-Carhart 4-factor model. *CF* is operating income before depreciation over total assets. *TOTALQ* is the Tobin's q developed by Peters and Taylor (2017). *SIZE* is the natural logarithm of market capitalization. *LEV* is total liabilities over total assets. *AGE* is firm age calculated as the number of years since firm's initial public offering. *DIV* is common and preferred dividends over total assets. *CASH* is cash and short-term investments over total assets. *FA* is property, plant and equipment over total assets. Detailed variable definitions are provided in Appendix B. The robust *t*-statistics clustered by firm are reported in parentheses. ***, ** and * denote statistical significance at the 1%, 5% and 10% level, respectively.

	CAPX		EXFIN	
	(1)	(2)	(3)	(4)
ICC-LNS	-0.021***		-0.126***	
	(-4.98)		(-3.98)	
ERET-FF4		0.011***		0.070***
		(3.79)		(3.35)
CF	0.096***	0.100***	0.107***	0.132***
	(17.10)	(18.33)	(2.82)	(3.64)
TOTALQ	0.002***	0.002***	0.020***	0.020***
	(6.27)	(6.06)	(7.79)	(7.57)
SIZE	0.004***	0.004***	-0.013***	-0.011***
	(6.68)	(7.44)	(-3.29)	(-2.75)
LEV	-0.019***	-0.020***	-0.283***	-0.290***
	(-7.07)	(-7.54)	(-12.04)	(-12.36)
AGE	-0.000	-0.000	0.000	0.000
	(-1.51)	(-1.60)	(0.44)	(0.39)
DIV	-0.154***	-0.154***	-1.168***	-1.168***
	(-5.81)	(-5.83)	(-5.80)	(-5.80)
CASH	0.008**	0.008***	-0.270***	-0.266***
	(2.44)	(2.64)	(-11.17)	(-11.03)
FA	0.048***	0.047***	0.088***	0.085***
	(8.57)	(8.47)	(2.91)	(2.81)
Firm FE	Y	Y	Y	Y
Year FE	Y	Y	Y	Y
Observations	50405	50405	50394	50394
Number of Firms	4713	4713	4712	4712
Adjusted R^2	0.62	0.62	0.16	0.15

Appendix A. Cost-of-Equity Proxies

A.1. Factor Model-Based Estimates

Our factor-model-based proxies include the expected returns estimated by the CAPM (*ERET-CAPM*), the 3-factor model (*ERET-FF3*) (Fama and French, 1993) and the 4-factor model (*ERET-FF4*) (Carhart, 1997). Specifically, at the end of each month for each firm, the expected monthly return is estimated as

$$\hat{E}_t\left[r_{i,t+1}\right] = r_{f,t+1} + \sum_{j=1}^{J} \hat{\beta}_i \hat{E}_t\left[f_{j,t}\right] \tag{19}$$

where $\hat{E}_t\left[r_{i,t+1}\right]$ is expected return for month $t+1$, $r_{f,t+1}$ is the risk-free rate for $t+1$, $\hat{\beta}_i$ is the factor loading, and $\hat{E}_t\left[f_{j,t}\right]$ is the expected factor premiums in month t. The factor loadings are estimated through time-series regression using past five years of monthly stock returns. Consistent with Frank and Shen (2016), we calculate expected factor premiums using the means of factor premiums over the full sample period up to the forecast date. Finally, the monthly expected returns are compounded into an annual return for a given fiscal year. We obtain monthly factor premiums MKT, SMB, HML, and UMD from Ken French's data library.

A.2. The Implied Cost of Capital

Following Li et al. (2013), we assume that the steady-state earning growth rate after 15 years (g_t) will be a rolling average of annual GDP growth rate: e.g. $g_t = ICC_t \times b_t$, 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 $b_{t+1} = [1\text{- Cash Dividend}_t\ /\text{Net Income}_t]$.

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.

$$P_t = \sum_{k=1}^{15} \frac{FE_{t+k} \times [1 - b_{t+1} + \frac{(b_{t+1} - \frac{g_t}{ICC_t})}{15} \times (k-1)]}{(1 + ICC_t)^k} + \frac{FE_{t+15} \times (1 - b_t)}{(ICC_t - g_t)(1 + ICC_t)^{15}}. \tag{20}$$

This equation is equivalent to Eq. (4) in Li et al. (2013).

We consider an alternative model following the Easton (2004) approach. For this, we can the stock price P_t as the sum of capitalized expected earnings and expected abnormal growth in accounting earnings:

$$P_t = eps_1/r + r^{-1}\sum_{t=1}^{\infty}(1+r)^{-1}agr_t \tag{21}$$

If earning forecasts are available for two periods, then the Eq.(21) can be reduced to

$$P_0 = eps_1/r + agr_1/\left(r\left(r - \Delta agr\right)\right) \tag{22}$$

where $\Delta agr = (agr_{t+1}/agr_t) - 1$.

In the special case $\Delta agr = 0$, Eq.(22) can be written as

$$P_0 = \left[eps_2 + rdps_2 - eps_1\right]/r^2 \tag{23}$$

and $r = \sqrt{\left(eps_2 + rdps_1 - eps_1\right)/P_0}$. The expected return, which is called the modified PEG ratio in Easton (2004), is denoted as *LCC-EAS* in our paper.

As the last approach, we follow the Gebhardt et al. (2001) and estimate *ICC-GLS* as follows:

$$P_t \;=\; BE_t + \sum_{k=1}^{12} \frac{(ROE_{t+k} - ICC_t)BE_{t+k-1}}{(1 + ICC_t)^k} + \frac{(ROE_{t+12} - ICC_t)BE_{t+11}}{ICC_t(1 + ICC_t)^{12}} \tag{24}$$

where ROE_{t+k} is the return on equity at $t + k$ which is assumed to fade linearly to the industry median 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 $BE_{t+k} = BE_{t+k-1} + FE_{t+k} \times (1 - b_{t+k})$.

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 of equity and earnings. 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-sale of property) / total assets
EXFIN	(sale of common and preferred stock - purchase of common and preferred stock - cash dividends)/ common equity
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 et al. (2013))
ICC-GLS	Following the methogology of Gebhardt et al. (2001)
ICC-EAS	Following the methogology of Easton (2004)
ERET-CAPM	Monthly expected returns estimated by CAPM. $Ret_{i,t+1}^{CAPM} = R_{f,t+1} + \hat{\beta}_1 E\left[MKT_t\right]$. β estimated by past five years of monthly stock returns, and MKT is the expected factor premiums calculated as the historical average up to the forecast date.
ERET-FF3	Monthly expected returns estimated by Fama-French three-factor model. $Ret_{i,t+1}^{FF3} = R_{f,t+1} + \hat{\beta}_1 E\left[MKT_t\right] + \hat{\beta}_2 E\left[SMB_t\right] + \hat{\beta}_3 E\left[HML_t\right]$. β is estimated by past five years of monthly stock returns, and MKT, SMB, HML are the expected factor premiums calculated as the historical average up to the forecast date.
ERET-FF4	Monthly expected returns estimated by Fama-French-Carhart four-factor model. $Ret_{i,t+1}^{FF4} = R_{f,t+1} + \hat{\beta}_1 E\left[MKT_t\right] + \hat{\beta}_2 E\left[SMB_t\right] + \hat{\beta}_3 E\left[HML_t\right] + \hat{\beta}_4 E\left[UMD_t\right]$. β is estimated by past five years of monthly stock returns, and MKT, SMB, HML , UMD are the expected factor premiums calculated as the historical average up to the forecast date.
TOTALQ	Tobin's q developed by Peters and Taylor (2017).
CF	Operating income before depreciation / total assets
SIZE	Natural logarithm of market capitalization
LEV	Total liabilities / total assets
DIV	(Common dividend + preferred dividends) / total assets
FA	Net plant, property, and equipment / total assets
CASH	Cash and short-term investments / total assets