Firms' Perceived Cost of Capital*

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Abstract

We study firms' perceived cost of capital using hand-collected data covering 20 years and multiple countries. The average perceived cost of capital fluctuates over time with expected returns to debt and equity. Cross-sectional variation in the perceived cost of capital reflects traditional cross-sectional determinants, such as leverage and exposure to the market, size, and value factors. However, most of the cross-sectional variation in the perceived cost of capital is not justified by subsequent realized returns, in contrast to the predictions of standard theory. In addition to this excess volatility in the perceived cost of capital, there is substantial variation in objective expected returns that is not reflected in the perceived cost of capital. These findings challenge the production-based asset pricing paradigm. Moreover, we reject the "Investment CAPM" because firms with higher investment have higher, not lower, perceived cost of capital (when conditioning on profitability alone).

Keywords: cost of capital, factor models, production-based asset pricing
JEL classification: G1, G10, G12, G31, G32, G40

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1 Introduction

In standard models, firms invest in a project if the expected return to the project exceeds the cost of capital. Typically, economists endow firms with perfect information about the cost of capital. In practice, however, the cost of capital is not directly observed. It depends on the returns that financial investors expect to earn from holding a given firm's debt and equity (Modigliani and Miller 1958), which are objects that have to be estimated in the data. Since estimating expected returns is notoriously difficult, firms' perceptions about their own cost of capital may deviate substantially from their "true" cost of capital.

Such mistakes in the perceived cost of capital can have large economic consequences. In order for capital to be efficiently allocated in the economy, firms must use the correct cost of capital in their investment decisions. If they do not, firms may invest too much or too little, and they may allocate capital inefficiently to projects that the social planner would not take on. Moreover, mistakes in the perceived cost of capital are also important for our understanding of asset prices. A large production-based asset pricing literature studies asset prices based on the idea that firms' investment decisions reveal their cost of capital and thus expected stock returns. This approach to asset pricing crucially depends on the assumption that firms' perceived cost of capital accurately incorporates expected returns.

Despite the economic importance, there exists little evidence on firms' perceived cost of capital. One reason is that we do not observe firms' perceived cost of capital in publicly available data. To overcome this issue, we use hand-collected data on firms' perceived cost of debt, equity, and overall capital. The dataset is constructed from corporate conference calls and contains a perceived cost of capital for around 1,200 distinct firms (Gormsen and Huber 2023). The dataset can be merged with detailed measures of firm-level factor exposures and other measures of firm-level cost of capital, allowing us to assess how well firms' perceived cost of capital correspond to their true cost of capital in financial markets.

Firms' cost of capital is usually defined as the opportunity cost of capital for representative projects. Throughout the paper, we operate under the standard view that the appropriate opportunity cost is the weighted average expected return on the outstanding debt and equity of the firm. Under this view, the perceived cost of capital is equal to the weighted average expected return on the outstanding debt and equity of the firm (accounting for tax benefits of debt).

We start the empirical analysis with stylized facts on the perceived cost of capital. In the cross-section, we find that the perceived cost of capital is strongly related to leverage, consistent with a tax benefit to debt. The perceived cost of capital is also related to firm's market beta, market capitalization, and valuation ratio, with small and value firms having higher cost of capital. These results are consistent with the Fama and French (1993) model–which says that market, size, and value factors determine expected stock returns– and thus supports the idea that firms, at least in part, incorporate expected stock returns into their cost of capital. In addition, we also confirm that firms largely incorporate time variation in expected returns correctly, as also shown in Gormsen and Huber (2023).

We next address whether firms' perceived cost of capital is, in fact, equal to the expected return on the firms' outstanding debt and equity. This is the standard assumption maintained in MBA textbooks as well as most academic research. We find, however, that firms' perceived cost of capital differ significantly from true expected returns on firms' debt and equity.

We conduct several tests to arrive at this conclusion. We first study how well a firm's perceived cost of capital predicts future realized returns on the firm's outstanding debt and equity. When using the perceived cost of capital to predict future realized returns, we find a slope coefficient of around 0.25, suggesting that firms with higher perceived cost of capital indeed have higher returns. The effect is, however, statistically insignificant. Moreover, the slope is statistically different from 1, which is the slope we would expect if the perceived cost of capital were an unbiased predictor of expected returns.

The implication of the above finding is that the perceived cost of capital reflects variation that is not justified by subsequent realized returns. We refer to this result as "excess volatility" in the perceived cost of capital. This excess volatility is not simply driven by the fact that firms use the CAPM model, which is known to be imperfect: the excess volatility is equally large in the part of the perceived cost of capital that is not captured by standard risk factors.

To further illustrate the excess volatility, we also construct a cost of capital factor, which is akin to the risk factors constructed by Fama and French (1993). This factor invests in firms with high perceived cost of capital and shorts firms with low perceived cost of capital. Interpreting the perceived cost of capital as the expected returns, we find that this factor has an average expected return above 5% per year. However, the realized return to this factor is much lower. The realized return is below 1% and statistically different from the 5% expected return. This finding, again, implies that there is variation in the perceived cost of capital that is not fully justified by subsequent returns.

We document a similar set of results by comparing firms' perceived cost of capital to measures of expected, as opposed to realized, returns. We first compare the perceived cost of capital to the measure of the "implied cost of capital." The implied cost of capital, a commonly used measure in the literature, calculates a firm's cost of capital as the expected long-run return inferred from asset prices. We find that firms' perceived cost of capital is positively related to the implied cost of capital, but the effect is very weak, with the perceived cost of capital increasing by around 7 basis points when the implied cost of capital increases by 1 percentage point. Similarly, we find that the implied risk premia on risk factors, as observed in the perceived cost of capital, are only weakly related to the true risk premia in financial markets.

Taken together, the results suggests that firms' perceived cost of capital is related to expected returns, but the relation is far from one-to-one. The issues are twofold. First, the perceived cost of capital does not incorporate all fluctuations in expected returns. More problematically, there is excess volatility in the perceived cost of capital, as a large part of the variation in the perceived cost of capital is not justified by future realized returns.

The results have direct implications for production-based asset pricing. If firms know the SDF and use it to make investment decisions, as assumed in production-based asset pricing models, then firms should set their perceived cost of capital in line with the SDF. Specifically, firms' perceived cost of capital should be the best available estimate of expected returns on the firms' outstanding debt and equity. Our results suggests that that this is not the case. Overall, our findings challenge the idea that we can infer all the properties of the SDF from the behavior of firms, in contrast to the basic idea behind production-based asset pricing. However, our results also raise the possibility that there may be dimensions of the SDF that can, at least in part, be inferred from the behavior of firms. The time variation in the average perceived cost of capital, for instance, appears to line up with standard measures of expected returns, lending hope that such time variation could be inferred from firm behavior.

We next consider a specific production-based, namely the q-factor model ("Investment CAPM") by Hou et al. (2015). This model makes specific predictions about how the cross-section of firms' perceived cost of capital varies with expected stock returns. We test and reject these predictions.

The model is based on the idea that firms' investment behavior reflects their cost of capital and thereby expected stock returns. The model argues that expected returns, profitability, and investment are all directly related. If a firm invests aggressively, without being highly profitable, it must be because the firm has a low cost of capital (i.e., low expected stock returns). The authors use this logic to rationalize why firms with high asset expansion (a measure of investment) have low expected stock returns. Moreover, they use the logic to construct profit and investment factors, and show that these factors can explain most of the cross-section of stock returns through the q-factor model.

We find, however, that firms with high asset expansion have slightly higher, not lower, perceived cost of capital. This finding goes directly against the core idea of the Investment CAPM, and suggests that the investment factor does not reflect optimal capital budgeting behavior of firms.

We also consider the "as if" argument that firms incorporate expected stock returns correctly it into their investment decision, even though they fail to incorporate them into their perceived cost of capital. For instance, managers of firms with high expected stock returns may intuitively understand that their firm is risky and that they need to earn high returns to satisfy investors. Fortunately, we can directly test this hypothesis, as the conference call data also contain firms' required returns on new investment. Indeed, while standard theory suggests that firms' required returns should be their cost of capital, many firms' maintain a discount rate (also called "hurdle rate") well above their cost of capital (see Section 2.2 for details). We use these discount rates to test the "as if" argument, finding that firms with high asset expansion have high discount rates (i.e., the same direction as for the perceived cost of capital). This finding suggests that "as if" behavior cannot rationalize the Investment CAPM.

It is important to emphasize that discount rates, in general, relate to firm investment in ways consistent with standard theory. When controlling sufficiently for investment opportunities (i.e., including controls over and above the return on equity used above), discount rates are, in fact, negatively related to investment decisions. Indeed, Gormsen and Huber (2023) show that simply including a firm fixed effect to capture general differences in technology and opportunities is enough for discount rates to negatively predict future investment. Estimating a multifactor model for discount rates, we also find that investment is negatively related to discount rates after controlling for the appropriate set of factors. Rather, the results simply imply that firms that have undertaken high asset expansions, conditional on profitability, do not have a low required return on investment (or a low perceived cost of capital, for that matter). The low future stock return for these firms can therefore not easily be rationalized through a cost of capital channel. This is a rejection of the Investment CAPM formulated by Hou et al. (2015), but not a rejection of the idea that cost of capital influences discount rates and ultimately investment.

Related Literature

Previous research on the perceived cost of capital uses qualitative survey evidence. According to the seminal Duke CFO Survey, 80 percent of large firms apply the CAPM, but 70 percent additionally use multi-factor models and 40 percent use historical returns (Graham and Harvey 2001, Graham 2022). Other surveys find similar results (Jacobs and Shivdasani 2012, Mukhlynina and Nyborg 2016, Jagannathan et al. 2016). These findings leave open how exactly firms apply and combine different approaches, whether firms act "as if" certain factors mattered, and how quantitatively important different factors actually are. Moreover, there is no evidence on the relation between expected returns and the perceived cost of capital as well as the implications for models linking investment and asset prices.[1] Krüger et al. (2015) find evidence for firm-level investment distortions that are consistent with firms applying the CAPM to calculate their perceived cost of capital.

The results of this paper also speak to a large literature on the effects of financial prices on firm investment. Production-based asset pricing typically assumes that expected long-run returns directly impact firms' cost of capital and thereby investment (Cochrane 1991, 1995). This idea has been used to explain a range of phenomena, including misallocation (van Binsbergen and Opp, 2019, David et al., 2022), unemployment (Hall, 2017), business cycle fluctuations (Bloom, 2014 page 165-166, Cochrane, 2017), and the cross-section of stock returns (Gomes et al., 2003, Carlson et al., 2004, Cooper et al., 2008, **?**, Betermier et al., 2019). These research areas assume, or imply,

[1] In contrast to the perceived cost of capital, previous work has studied the quantitative importance of one factor, the market beta, for firms' discount rates (firms' required returns on investment), finding mixed results (Poterba and Summers 1995, Jagannathan et al. 2016, Cho and Salarkia 2020).

a perfect relation between pricing in financial markets, a premise our paper challenges. The cost of capital channel that we emphasize is complementary to work emphasizing that firms can learn about cash flows from financial prices (Bond et al. 2012).

Finally, recent work studies to what extent different equity risk factors can predict long-run returns (van Binsbergen and Opp 2019, Cho and Polk 2019, Keloharju et al. 2019) and whether this reflects irrational expectations by investors (Lakonishok et al. 1994, Bordalo et al. 2019).

2 Framework and Data

2.1 Framework

A firm's cost of capital is the return required by financial investors (i.e., holders of the firm's debt and equity) in exchange for providing capital to the firm. Naturally, a new investment project only adds to firm market value (which is determined by investors) if the expected return of the project exceeds this cost of the capital. As a result, the cost of capital plays a key role in firms' investment decisions, both in textbook theory and in corporate practice.[2]

A fundamental challenge is that a firm's cost of capital is not directly observed, even by the managers of the firm, and needs to be estimated. The cost of capital is the opportunity cost of capital, which, if the law of one price holds, is the expected return in financial markets for an investment with a similar level of risk as the project under consideration. Since the cost of capital of the firm refers to the cost of a project with a riskiness that is similar to the overall firm, the firm can use the expected returns on its own financial securities to estimate the cost of capital. The cost of capital of firm i at time t is then the weighted average cost of debt (r^{debt}, the expected return to the firm's debt) and equity (r^{equity}, the expected return to the firm's equity),

$$r_{i,t}^{\text{capital}} = \omega_{i,t} \times (1-\tau) \times r_{i,t}^{\text{debt}} + (1-\omega_{i,t}) \times r_{i,t}^{\text{equity}}, \tag{1}$$

weighted by firm leverage (ω) and adjusting for the tax benefits of debt (τ). It is also

[2]In theory, firms should use a project-specific cost of capital when evaluating investment decisions. In practice, however, most firms calculate one cost of capital for the entire firm based on their existing debt and equity and then set required returns to investment, called discount rates or hurdle rates, that may deviate from the cost of capital and may be project-specific (Graham and Harvey 2001).

known as the firm's weighted average cost of capital (WACC).

The finance literature typically models expected returns to a security using models of the form,

$$r_{i,t}^{\text{security}} = \lambda^0 + \sum_k \lambda^k X_{i,t}^k, \tag{2}$$

where a factor or a characteristic X^k commands a specific risk premium λ^k. The literature has studied in detail to what extent different factors and characteristics predict expected returns (e.g, Fama and French 1996, 2016).

Two stylized assumptions underlying most models of firm behavior in finance and macroeconomics are (1) that firms are perfectly informed about expected returns to their debt and equity or able to estimate them without bias and (2) that firms use these expected returns to calculate their perceived cost of capital. Under these assumptions, firms' perceived cost of capital fully incorporates expected returns, is associated with the same factors as expected returns, and is an unbiased predictor of expected returns. In practice, however, these assumptions may fail. For one, firms may be misinformed about which models accurately predict expected returns (Greenwood and Shleifer 2014, Giglio et al. 2021, Bordalo et al. 2020, Engelberg et al. 2020, Boutros et al. 2020). Alternatively, firms may believe that the law of one price does not hold and may therefore not base their perceived cost of capital on expected returns (Stein 1996).

In the remainder of this paper, we investigate how firms set their perceived cost of capital. Initially, we will study whether characteristics that predict expected returns (according to the finance literature) also predict firms' perceived cost of capital. Then, we will study whether firms' perceived cost of capital predicts future realized returns and other measures of expected returns without bias. Finally, we will lay out the implications for our understanding of firm behavior, including models of production-based asset pricing. Throughout, our null hypothesis is the stylized assumption of "perfect incorporation": that firms' perceived cost of capital fully reflects expected returns in financial markets without bias.

2.2 Data Collection

Our analysis uses a new dataset of firm-level perceived cost of capital merged to firm-level asset prices and firm-level exposure to risk factors.

Two challenges make it difficult to measure firms' perceived cost of capital. First, firms do not typically report a perceived cost of capital in official financial reports. Second, data from surveys are mostly anonymized and cannot easily be matched to firm characteristics, asset prices, and factor exposure. We overcome these challenges by relying on data from corporate earnings calls, investor conferences, and similar events, which we jointly call "conference calls."

Most listed firms in advanced economies hold quarterly conference calls to inform analysts and investors about their corporate strategy. Firm managers often explicitly disclose an internal estimate of their cost of capital on these calls, which we term the perceived cost of capital. The calls are relatively high-stakes settings, so managers tend to convey accurate information on the calls (Hassan et al. 2019). For example, statements from conference calls often appear as evidence in securities lawsuits (Rogers et al. 2011), analysts and investors ask managers detailed questions about how past realized investment decisions relate to their cost of capital, and within-firm changes in corporate discount rates reported on these calls predict changes in future investment (Gormsen and Huber 2023).

We search through all transcripts of calls available on the databases Refinitiv and FactSet for the years 2002 to 2022. We download paragraphs where managers mention at least one of 22 keywords.[3] Together with a team of research assistants, we manually read through the roughly 110,000 downloaded paragraphs and collect all instances where firms state the "cost of capital," the "weighted average cost of capital," or the "WACC" for the whole firm. The collected data do not include instances where firms discuss hypothetical values (e.g., "imagine a cost of capital of x percent"), where outsiders posit a cost of capital or ask suggestive question (e.g., "am I correctly assuming that your cost of capital is x percent?"), or where managers discuss rates associated with specific debt issuances (e.g., "the yield associated with the new bond issuance is x percent.") Firms almost always discuss the after-tax cost of capital, but

[3]The keywords include capital asset pricing model, cost of capital, cost of debt, cost of equity, discount rate, expect a return, expected rate of return, expected return, fudge factor, hurdle rate, internal rate of return, opportunity cost of capital, require a return, required rate of return, required return, return on assets, return on invested capital, return on net assets, weighted average cost of capital, weighted cost of capital. We also include abbreviated keywords, for example, WACC.

we convert the few pre-tax values to after-tax values. We describe the data collection in detail in Appendix B.

In addition to the perceived cost of capital, we also collect firms' perceived cost of debt, perceived cost of equity, and the discount rates used by firms to assess the net present value of new investment projects. To identify discount rates, we rely on explicit manager statements about the minimum required IRR that they want to earn on new investment projects.[4]

We link firm names from the conference call data to a Compustat firm key using manual matching of firm names. This allows us to then merge firm-level asset prices from the Center for Research in Security Prices and firm-level exposure to 153 equity factors, grouped under thirteen themes, assembled by Jensen et al. (2023).

2.3 Summary Statistics

The mean perceived cost of capital is 8.6 percent, with substantial variation ranging from 5.3 at the 5th percentile to 12 percent at the 95th percentile, as shown in Table 1. The mean average discount rate, used internally by the firm to evaluate investment projects, is 15.3 percent.

We compare firms in the sample to the population of listed firms by reporting the average percentile of firms in the sample, relative to the population of firms in Compustat in the same year and country. The average CAPM beta, investment rate, and book-to-market ratio are relatively close to the 50th percentile, indicating that the average firm in the sample is similar to the average Compustat firm along these characteristics. The average firm in the sample is more levered and profitable compared to its year-country peer group, although the difference is relatively small (61st and 66th average percentile, respectively).

The main difference between firms in the sample and the Compustat population is that firms in the sample are distinctly larger, as the market value of the average firm in the sample lies at the 85th percentile. The bias toward larger firms implies that we cover a substantial share of aggregate market value. For instance, firms appearing in the sample at least once cover over 40 percent of total market value in advanced economies. The sample includes many well-known firms, such as AT&T, Bank of

[4]Other rates (such as realized and expected IRR) and ratios (such as required, realized, and expected ROA, ROIC, ROE) were separately recorded during the data collection to ensure that the perceived cost of capital and discount rate were clearly differentiated.

America, Disney, Exxon, Home Depot, Intel, JPMorgan Chase, Mastercard, Nestle, Novartis, UnitedHealth, and Visa.

3 Stylized Facts about the Perceived Cost of Capital

We start the empirical analysis by presenting stylized facts on time variation and cross-sectional variation in the perceived cost of capital.

3.1 Time Variation in the Perceived Cost of Capital

Our sample for the perceived cost of capital runs from 2002 to 2022. Over this period, there have been substantial fluctuations in expected returns in financial markets. We have seen a secular downward trend in expected returns in both equity and debt markets, with fluctuations around the financial crisis, the sovereign debt crisis, and the 2022 inflation spike.

Gormsen and Huber (2023) document that firms have generally incorporated such time variation in financial market prices into their discount rates. To summarize this pattern, Table 2 presents regressions of firms' perceived cost of capital on measures of the financial cost of capital. For simplicity, we use the earnings yield as a proxy for time variation in the cost of equity and the long-term government interest rate as a proxy for time variation in the cost of debt (this approach abstracts from the impact of credit risk).

In column (1) of Table 2, we regress the firm-level perceived cost of capital on the country-level earnings yield and interest rate for U.S. firms. The slope coefficients are 0.51 and 0.27. Firms are, on average, financed with 2/3 equity and 1/3 debt, so if the proxies capture the cost of equity and debt perfectly, we should expect slopes of 2/3 on the equity yield and $1/3 \times$ tax rate on the interest rates. However, fluctuations in the earnings yield are not a pure measure of the cost of capital on financial markets, as they also reflect fluctuations in expected growth rates, which would lead to lower slopes. For instance, if one believes that 80% of the fluctuations in the earnings yield represent discount rates and 20% represent growth rates (and the two are orthogonal), we should expect a slope coefficient of $0.8 \times 2/3 = 0.53$ (see, e.g., Campbell (1996) for discussion of such variance decomposition). The estimated slope coefficients are therefore close to what one would expect if firms perfectly incorporated fluctuations in expected financial returns into their perceived cost of capital.

The results from column (1) are visualized in Figure 1. The left panel plots the average perceived cost of capital by year for U.S. firms along with the U.S. earnings yield (the inverse of the CAPE). The figure shows a downward trend in the perceived cost of capital that moves almost close to one-to-one with the trend in the earnings yield (the earnings yield is on a separate y-axis, but the ranges of the two y-axes are the same). We observe a similarly close relation between the average perceived cost of debt in the U.S. and the long-term Treasury rate in the right panel. While the trends comove almost one-to-one, the cost of debt is higher than the Treasury rate due to credit risk.

In column (2) of Table 2, we find similar results including firm fixed effects. This finding shows that the relation between the cost of capital and the financial expected returns is driven by firms updating their perceived cost of capital over time. In column (3), we find similar results in the global sample, where we continue to use the earnings yield for a given country and the government long-term interest rate in a given country on the right-hand side.

Overall, the results suggests that firms, on average, incorporate long-run fluctuations in expected stock returns and interest rates into their perceived cost of capital. But while the slope coefficients are close to what full incorporation would predict, the R^2 is far from one, suggesting substantial heterogeneity across firms. We study this cross-sectional variation in detail in the upcoming section.

The finding that firms appear to incorporate fluctuations in expected stock returns into their perceived cost of capital may be surprising, given the syllabuses of MBA classes. Most MBA programs teach simplified methods for estimating the cost of equity and not how to incorporate time variation in expected stock returns. In his AFA Presidential Address, Cochrane (2011) notes that students are typically taught to use a 6% market risk premium and that "it is interesting that investment decisions get so close to right anyway." He speculates that perhaps "a generation of our MBAs figured out how to jigger the numbers and get the right answer" (page 1087 of Cochrane 2011). Our results suggest that managers explicitly incorporate time-varying risk premia in line with standard models of expected returns.

3.2 Cross-Sectional Variation in the Perceived Cost of Capital

In this section, we provide an initial analysis of the cross-section of the perceived cost of capital. We highlight to what extent firms incorporate some of the classic drivers of expected returns into their perceived cost of capital. Our analysis is motivated by the seminal theories of Modigliani and Miller (1958) and Sharpe (1964) along with the empirical results of Fama and French (1993). According to Modigliani and Miller, firms with higher leverage should have lower cost of capital due to a higher tax shield (see equation 1). According to Fama and French (1993), cross-sectional variation in the cost of equity–and therefore to some extent the cost of capital–should be explained by exposure to the market, size, and value factors (see equation 2).

Figure 2 illustrates the empirical relevance of leverage, market beta, size, and value for cross-sectional variation in the perceived cost of capital. In the top-left panel, we plot the perceived cost of capital for five different groups based on leverage ratios. The perceived cost of capital is around 9.5% for firms with the lowest leverage and 8.5% for firms with the highest leverage. The magnitude of this drop is consistent with the benefits of the tax shield. To see this, note that leverage increases from around 0.1 to 0.6 when going from the bottom to top group. If we assume a tax rate of 20% and a cost of debt of around 4.66% (the average in our sample), the difference in the tax shield should be around $0.6 \times 0.2 \times 4.66\% = 0.56\%$. An interesting observation is that the tax shield appears to have a concave effect on the perceived cost of capital, as firms with the highest leverage do not have lower perceived cost of capital than the firms with median leverage.

The top-right panel in Figure 2 plots the average perceived cost of capital for 5 groups of firms sorted on the CAPM beta. The perceived cost of capital goes from around 8% to just under 9.5%. This finding is hardly surprising given that firms in surveys report using the CAPM model as one input into their perceived cost of capital (see, e.g., Graham and Harvey 2001).

The bottom two panels of Figure 2 consider the remaining characteristics, size and value. The left panel reveals a substantial size effect. When going from nano-cap firms to mega-cap firms, the perceived cost of capital drops by almost 3 percentage points, from slightly above 11% to slightly above 8%. The result may be more surprising than the beta result, as managers do not explicitly account for size premia according to the survey by Graham and Harvey (2001). The result is, however, consistent with the fact that some financial analytics firms, like the Kroll Cost of Capital Navigator by Duff and Phelps, account for size premia.[5]

Finally, the bottom-right panel plots the perceived cost of capital for firms sorted by value (book-to-market ratios). The perceived cost of capital increases slightly when going from the firms with the lowest book-to-market (growth firms) to firms with the highest book-to-market (value firms). This result is qualitatively consistent with the value premium documented by Fama and French (1992). However, the magnitude is small (the range on the y-axis is much shorter than for the other plots). Going from growth to value firms only increases the perceived cost of capital by around 20 basis points. In the upcoming sections, we will continue to find evidence consistent with a weak value effect in the perceived cost of capital.

We also study the above characteristics in multivariate panel regressions in Table 3. All characteristics are measured in cross-sectional percentiles, relative to the universe of firms in Compustat in the given country and quarter. Each regressor therefore ranges from 0 to 1. For leverage, we include a squared term to capture the non-linearity documented in Figure 2. For the other characteristics, we follow the convention of including only linear terms (i.e., using the linear characteristics as proxies for conditional exposure to the respective). All regressions include country-year fixed effects such that the slope coefficients capture cross-sectional relations only.

In the first column of Table 3, we confirm the concave relation between leverage and the perceived cost of capital shown in Figure 2. The within-R^2 is around 5%, suggesting that substantial variation in the perceived cost of capital comes from differences in leverage.

The next columns consider the Fama-French characteristics. The market beta has a slope close to 3, which means that the perceived cost of capital is 3 percentage points higher for firms with the highest betas. This effect is slightly higher than in Figure 2 because of the leverage controls and fixed effects. We similarly find a significant size effect of around -1.5 percentage points. The value effect continues to be statistically and economically weak, but with the correct sign.

3.3 The Factor Zoo

In addition to the Fama-French characteristics analyzed so far, the asset pricing literature has uncovered hundreds of other factors that could influence the cost of

[5] See https://www.kroll.com/en/cost-of-capital/frequently-asked-questions.

equity and thereby the cost of capital. In this section, we conduct an initial exploration of these other factors. The main takeaway is that most factors are not reflected in the perceived cost of capital and, to the extent that they are, often have the wrong sign.

We consider all factors identified by Jensen et al. (2023). For each factor k, we extract factor premia from slope coefficients in the regression

$$r_{i,t}^{\text{cost of capital}} = b^0 + b^1 X_{i,t}^{\text{beta}} + b^2 X_{i,t}^{\text{lev}} + b^3 X_{i,t}^{\text{lev squared}} + b^4 X_{i,t}^{k} + \varepsilon_{i,t}^{k}, \tag{3}$$

where, as before, $r_{i,t}^{\text{cost of capital}}$ is the perceived cost of capital of firm i at time t, $X_{i,t}^{k}$ is the characteristic associated with the k^{th} factor, and b^k is the parameter estimate for the k^{th} characteristic. The specification thus studies each characteristic k separately, controlling for the CAPM beta, leverage, and leverage squared. We control for the CAPM beta because the equity factors we study are associated with positive CAPM alpha, not necessarily positive expected returns. We control for leverage to account for the mechanical effect of leverage on the cost of capital. We consider the factors in univariate specifications, only conditioning on the above controls, as these factors have typically been studied in univariate specifications.

To create an overview, we categorize the factors into the groups proposed by Jensen et al. (2023) and study average properties across groups. There are seven groups of factors based on well-known major drivers of stock returns: value, profitability, investment, trading frictions, intangibles, momentum, and a final group called "new", which captures a range of recent factors.

Table 4 reports results averaged across the different factor groups. We sign all factors such that a higher factor is associated with a higher monthly CAPM alpha in financial markets. The first column reports the average factor premium in the group. For the group of value factors, the average premium is around 0.25 percentage points. While substantially smaller than the beta and size premia established in Table 3, it is larger than the average risk premium in any other factor group, most of which are either close to zero or negative.

The next column shows the percentage of the factors in a given group that have the correct sign. We see that a reasonable fraction of the factors based on value and trading frictions have premia with the correct sign (66% and 67%). The other groups produce factors that consistently have the correct sign (intangibles is close to 50%).

The last column shows the percentage of the factors in a given group that have the correct sign and are statistically significant. That is, for each factor, we test whether the factor loading is equal to zero against the one-sided alternative that it has the same sign as observed in financial markets (i.e., whether the coefficient positive). To give the factor the best possible chance, we consider a factor to be statistically significant if it has a p-value below 5% in the one-sided test using conventional OLS errors. We correct for the number of factors tested within a group using the Benjamini and Hochberg (1995) method and setting a false discovery rate at 5% (this is lenient once again relative to, for instance, a Bonferroni adjustment).

Despite the arguably generous method for assessing significance, we find that most groups do not have many significant factors. Only a handful of factors are significant in the value, trading friction, intangible, and profitability groups. None of the factors in the investment, new, and momentum groups are significant with the correct sign.

The last row of Table 4 summarizes all factors. Overall, the average factor premium across the 146 factors tested is zero and less than 50% of the factors have the correct sign. Moreover, only 9% of the factors have premia with the correct sign that are statistically significant. Overall, these results leads us to conclude that the majority of factors studied in the asset pricing literature are not reflected in firms' perceived cost of capital. Complementary recent work also shows that most factors do not affect subjective return expectations of financial analysts (Engelberg et al. 2020, Jensen 2022).

Finally, many of the investment factors have the wrong sign. This represents a serious challenge for the Investment CAPM and production-based asset pricing more generally, as discussed in Section 5.

4 The Perceived Cost of Capital Versus Financial Returns

We now address the more general question of whether, on average, a firm's perceived cost of capital fully incorporates expected returns on the firm's outstanding debt and equity, as assumed in standard models (see Section 2.1). We focus on cross-sectional variation in the perceived cost of capital, given that we have already shown that time variation in the perceived cost of capital incorporates time variation in expected returns (see Section 3.1).

We proceed in two steps. We first reject the hypothesis that firms' perceived cost of capital, on average, is an unbiased predictor of future realized returns. This finding suggests that parts of the cross-sectional variation in the cost of capital is not justified by subsequent realized returns. Thereafter, we reject that firms' perceived cost of capital is similar to common measures of expected returns. This finding suggests that there are fluctuations in expecetd returns that are not incorporated into the perceived cost of capital.

4.1 Realized Returns

We relate the perceived cost of capital to realized returns using two methods. First, we run firm-level panel regressions and second, we analyze a new cost of capital factor.

4.1.1 Panel Regressions of Realized Returns

We start by comparing the cost of capital to realized future returns using simple panel regressions. In these analyses, we first explore the relation between the perceived cost of capital and realized stocks returns before going to the relation between perceived cost of capital and realized returns on claims to both debt and equity. We calculate realized stock returns on the 5-year horizon using data from CRSP and Compustat, as explained in Section 2.2.

We begin by regressing future realized stock returns on the perceived cost of capital in Panel A of Table 5. We calculate realized stock returns at the five-year horizon using data from CRSP and Compustat. Column 1 shows a positive, but statistically insignificant slope coefficient of 0.25. We strongly reject that the slope is equal to 1, suggesting that the perceived cost of capital is not an unbiased predictor of realized stock returns. Columns (2) and (3) add year and firm fixed effects, respectively, which does not materially change the results.

One potential explanation for the low coefficients is that some of the equity factors that firms use to estimate their cost of equity have performed poorly over this sample. For instance, it is well known that the returns associated with beta, size, and value factors during this period are well below the full-sample risk premia (Fama and French 2021). To the extent that firms use these factors (see Section 3.2) to construct their estimates, the poor performance of these factors may thus explain the low coefficient in column (1).

To assess the above possibility, we control for the market, size, and value factors in columns (4) and (5). Consistent with a weak effect of these factors on stock returns in this sample, none of the factors have significant predictive power. More importantly, controlling for these factors has very little effect on the slope coefficient on the perceived cost of capital (the correct comparison is the slope coefficient in column 1). These results suggest that whatever firms add to their perceived cost of capital, over and above, the standard factors turns out to be wrong, in the sense that it does not predict returns.

We next consider the realized returns on all the firm's outstanding debt and equity. To this end, we calculate the weighted average of the realized returns on equity and the realized returns on debt, adjusting for the tax shield. For the realized returns on debt, we use the ex-ante of cost of debt, which we measure by interest expenses over outstanding liabilities in Compustat.[6]

If firms form unbiased estimates of expected returns and use them to construct their perceived cost of capital, there should be no predictable differences between the perceived cost of capital and total realized returns on all debt and equity. We can therefore test a sharp null hypothesis, which is whether the difference between realized returns and the perceived cost of capital is predicted by the ex ante perceived cost of capital. This test is conceptually similar to regressing realized returns on the perceived cost of capital and testing whether the slope is equal to 1.

As shown in Panel B of Table 5, we find negative and statistically significant slope coefficients on the perceived cost of capital. This finding implies that the perceived cost of capital is a biased estimate of expected future returns. The slopes are generally close to -1 (which would imply slopes close to zero in the specifications in Panel A). Once again, we find that controlling for beta, size, and value has little impact on the results.

Throughout the analysis above, we estimate standard errors by double clustering on country and date. However, given the strong correlation in residuals coming from autocorrelation and factor structure in realized returns, one may be concerned whether standard errors are too small. We next turn to another empirical strategy that will

[6] Gormsen and Huber (2023) show that this ratio is a good proxy for firms' perceived cost of debt, explaining 40% of the variation in the variable. We consider this measure of the expected cost of debt instead of realized returns since the horizon of most outstanding debt is less than 5 years, making the realized returns very close to the ex-ante cost of debt (with the difference being credit risk components).

be more conservative and yields similar results.

Throughout the analysis above, we estimate standard errors by double clustering on country and date. However, one may be concerned that standard errors are too small, given that the strong factor structure and autocorrelation in the residuals. We next turn to another empirical strategy that will be more conservative and yields similar results.

4.1.2 The Cost of Capital Factor

We construct a cost of capital factor by sorting firms into different portfolios based on their perceived cost of capital. Each month, we assign each firm to portfolios based on the firm's market capitalization and its most recently observed perceived cost of capital. We assign firms to portfolios following the methodology of Fama and French (1993).

Table 6 reports the performance of this cost of capital factor. In column (1), we report the average spread in the perceived cost of capital between the long leg and the short leg of the factor. The average spread is a 0.4% monthly return, translating to an annualized spread of around 6%. This spread is stable over time, leading to tight standard errors.

In column (2), we report the average return to the cost of capital factor. The factor has earned 0.007% per month, which is statistically indistinguishable from zero and statistically different from the spread in the perceived cost of capital of 0.4% per month. The expected return on the factor is the spread in the perceived cost of equity, which need not be the spread in the perceived cost of debt. However, we find that the spread in the perceived cost of debt is smaller than the spread in the perceived cost of capital, which means the spread in the perceived cost of equity must be even larger than the spread in the perceived cost of capital. The test therefore implies that the spread in the perceived cost of equity is not an unbiased predictor of future realized returns.

In columns (3) and (4), we control for the market, size, and value factors. These regressions represent an alternative approach to studying whether the factors are represented in the perceived cost of capital. These regressions reveal whether returns on firms with higher cost of capital behave more like, for instance, returns on small or large firms. The results generally confirm the findings from the characteristics-based analysis in Section 2. Namely, firms with higher cost of capital have higher market betas, smaller size, and higher valuation ratios. However, the evidence for the value effect is now substantially stronger than when looking at the characteristics. In fact, the loading on the value factor is higher than the loading on the market factor and as high as the loading on the size factor. The loading is also highly statistically significant. One potential interpretation of these findings is that there is an economically important difference between characteristics and factor loadings, as first pointed out by Daniel and Titman (1997).

4.2 Expected Returns

In this subsection, we compare the perceived cost of capital to measures of expected (as opposed to realized) returns. We measure cross-sectional differences in expected returns in two ways: first, using the implied cost of capital from the accounting literature and second, using factor models.

4.2.1 The Implied Cost of Capital

A large literature in finance and accounting uses present value accounting to back out the expected long-run returns on individual firms. In particular, by combining measures of expected future cash flows with current prices, one can calculate the implied discount rate for a firm, and thereby an "implied cost of capital" (Gebhardt et al. 2001, Botosan and Plumlee 2002, Mohanram 2003). It has been questioned whether measures of the implied cost of capital predict future stock returns(Easton and Monahan 2005). It is, however, possible that these measures predict the perceived cost of capital, in particular if firms use valuation ratios and present value accounting in estimating their perceived cost of capital.

Throughout, we present results for the implied cost of capital using the price-earnings growth model in Easton and Monahan (2005), but we find similar results using alternative measures. The pure implied measures actually capture the implied cost of equity, not full cost of capital. We additionally calculate the implied cost of capital based on the firm's leverage ratio and the proxy for cost of debt used in the above sections.

Panel A of Table 7 reports firm-level panel regressions of the perceived cost of capital on the implied cost of equity or the implied cost of capital. The first column shows a positive relation between the perceived cost of capital and the implied cost of equity. If the perceived cost of capital and the implied cost of equity were both unbiased predictors of expected stock returns, the slope coefficients in these regressions would roughly equal the equity financing share of firms (around 2/3). However, the estimated coefficients are well below that, both in the baseline that uses only country fixed effects and in regressions that include year (column 2) and firm fixed effects (column 3).

In column (4) through (6), we use the implied cost of capital on the right-hand side. The slope coefficient should be 1 if the implied cost of capital, on average, accurately predicts the perceived cost of capital. We strongly reject this prediction. The slope coefficients are between 0.05 and 0.07 and the within-R^2 is modest in all specifications.

The results in Panel A of Table 7 suggest that there are substantial wedges between the perceived and implied cost of capital. To illustrate the magnitude of these wedges, we sort firms into ten portfolios based on the implied cost of capital for a given firm in a given quarter. We then average the implied and perceived cost of capital across firms in these portfolios. Figure 4 shows the averages along with wedges, which are defined as the difference between the average perceived cost of capital of firms in the portfolio and the average implied cost of capital of firms in the portfolio.

The implied cost of capital increases from around 6% to 20% when going from the portfolio with the lowest to the highest implied cost of capital. The perceived cost of capital is, however, essentially the same for all portfolios. As a result, we observe large wedges across the ten portfolios. For the portfolio with the highest implied cost of capital, we find that the wedge is above 11%, substantially exceeding the average cost of capital.

Taken together, the results suggest that measures of the implied cost of capital do not accurately capture firms' perceived cost of capital. As a result, the implied cost of capital may not be a suitable measure for researchers interested in testing how economic shocks influence the cost of capital that firms use to guide their capital allocation and investment decisions. In the final section of the paper, we introduce a new measure of the perceived cost of capital that can be used in applied work going forward.

4.2.2 Factor Wedges

In this subsection, we explore whether the perceived cost of capital incorporates equity factors in line with the factor premia observed in financial markets. For instance, the perceived cost of capital of nano-cap firms is 3 percentage points higher than that of large cap firms, as shown in Section 3.2. We now ask whether this 3 percentage point premium equals the factor premium observed in financial markets. Stylized models assume that firms fully incorporate financial factor premia, so that the financial and perceived premia are equal (after accounting for leverage).

To estimate factor wedges,

$$\delta_k^{\lambda} = \lambda_k^{\text{perceived}} - \lambda_k^{\text{financial}},$$

we need estimates of long-run factor premia in financial markets, $\lambda_k^{\text{financial}}$. Most research on the cross-section of expected stock returns focuses on short-run expected returns. The factor premia documented by Fama and French (1993) and many subsequent papers are for one-month or one-year expected returns. For instance, Fama and French (1993) show that value firms have high CAPM alpha over the year after formation of the portfolios, but the paper is silent on the longer-run expected returns of value firms.

A recent literature discusses how long-run expected stock returns may differ substantially from short-run expected returns (see, e.g., Cohen et al. 2009, Cho and Polk 2019, Keloharju et al. 2019, van Binsbergen et al. 2023, Chen and Kaniel 2021). This literature documents that many of the patterns that characterize the cross-section of expected short-run returns disappear when considering long-run expected returns. A natural example of this difference are momentum factors, which predict returns over a few months but not long-run returns.

We use data from van Binsbergen et al. (2023) to estimate $\lambda_{\text{k}}^{\text{financial}}$. The authors estimate long-run CAPM alphas for a set of popular firm characteristics, 28 of which we merge to our factor data (which come from Jensen et al. 2023). For each of these factors, we estimate the risk premium $\lambda_{\text{k}}^{\text{financial}}$ as the difference in annual CAPM alpha between the firms in the top and bottom decile of the given characteristic.

We compare the estimates of long-run expected returns to the factor premia recovered from equation (3). Equity only accounts for some of the cost of capital, so we assume that exposure to risk premia only influences the perceived cost of equity (not debt) and that leverage ratios are constant at 0.3 for all firms. Under these assumptions, we can extract the implied long-run perceived equity risk premium, $\lambda_{\text{k}}^{\text{perceived}}$, by dividing the slope coefficients extracted from equation (3) by 0.7 (the equity financing share).

In Panel B of Table 7, we test the hypothesis that $\lambda_{\mathrm{k}}^{\mathrm{perceived}}$ and $\lambda_{\mathrm{k}}^{\mathrm{financial}}$ comove one-to-one. The panel reports the following regressions,

$$\lambda_{\mathrm{k}}^{\mathrm{perceived}} = a + b \times \lambda_{\mathrm{k}}^{\mathrm{financial}} + \varepsilon_k.$$

The estimated slope coefficient is 0.24 and statistically significant. Perceived and financial factor premia are thus positively related, although the relation is far from one-to-one. The standard errors are corrected for heteroskedasticity but not for the fact that $\lambda_{\mathrm{k}}^{\mathrm{financial}}$ is a generated regressor. As such, we can reject the null of no predictability but we technically cannot make inference about whether the slope coefficient is equal to 1. That said, the confidence interval is far from 1 with these standard errors.

A large part of the positive coefficient in the above regression is driven by the size effect. The size premium in the perceived cost of capital is close to the size effect in financial markets (both are around 2%). If we discard this one factor, the slope coefficient drops to 0.14 and becomes statistically insignificant, as shown in the second regression in Panel B. $\mathbb{R}^2$ also drops substantially.

Figure 3 compares $\lambda_{\mathrm{k}}^{\mathrm{perceived}}$ and $\lambda_{\mathrm{k}}^{\mathrm{financial}}$ for each of the factors individually. The figure plots the estimated risk premia along with the factor-specific wedges δ_k^{λ}. All factors are signed such that a higher factor exposure is associated with a higher short-run CAPM alpha.

The figure again underscores the importance of the size factor. The size factor has the highest perceived factor premium and the third-highest financial premium, so the size factor wedge is among the smallest wedges. Value factors based on the dividend yield and assets-to-market also have relatively low wedges. However, for most of the other factors, we observe modest values of $\lambda_{\mathrm{k}}^{\mathrm{perceived}}$ and large wedges.

Taken together, the analysis in this subsection echoes the findings from the earlier sections: the perceived cost of capital is positively related to factors predicting expected returns, but the relation is substantially below the full incorporation assumed in stylized models.

5 Production-Based Asset Pricing Meets the Perceived Cost of Capital

The starting point for most of production-based asset pricing is the idea that firms know the stochastic discount factor (SDF) and make decisions that maximize the value of the firm implied by this SDF. A large literature uses production-based asset pricing to infer the key properties of the SDF from the behavior of firms. In this section, we lay out why the results of this paper challenge production-based asset pricing models, in particular the Investment CAPM, and why assuming that firms act "as if" they use the SDF is unlikely to solve the challenges.

5.1 Implications for Production-Based Asset Pricing

If firms know the SDF and use it to make investment decisions, as assumed in production-based asset pricing models, then firms should set their perceived cost of capital in line with the SDF. Specifically, firms' perceived cost of capital should be the best available estimate of expected returns on the firms' outstanding securities. The results presented so far show that that this is not the case.

It is worth laying out two possibilities for why the perceived cost of capital could be an imperfect estimate of expected returns. One possibility is that firms do not incorporate all variation in expected returns into their perceived cost of capital. For instance, imagine that expected returns are driven by three orthogonal factors but that firms only incorporate one of these factors. In this case, firms' perceived cost of capital would be an unbiased predictor of expected returns, but it would be imperfect in the sense that it would not capture all variation in expected returns. This behavior would be an issue for production-based asset pricing models because it would imply that we cannot infer all drivers of the SDF from firm behavior. The analyses in Section 3.3 and 4.2.2 reveal that, indeed, firms do not incorporate all factors into the perceived cost of capital.

A second, and more serious, possibility is that firms incorporate biased signals of expected returns into their perceived cost of capital. For instance, in addition to incorporating one of the true factors, firms may also incorporate other signals that they believe predict expected returns but which, in fact, do not. In this case, firms' perceived capital would be a biased predictor of expected returns. This possibility is a more serious issue for production-based asset pricing models because it suggests that firm behavior may reveal return expectations that are objectively incorrect. The analysis in Section 4.1 suggests that, indeed, the perceived cost of capital is a biased predictor of future returns.

Overall, our analysis suggests both that firms' perceived cost of capital (1) does not incorporate all known drivers of expected returns and (2) relies on biased estimates of expected returns. These findings challenge the idea that we can infer all the properties of the SDF from the behavior of firms, in contrast to the basic idea behind production-based asset pricing. However, our results also raise the possibility that there may be dimensions of the SDF that can, at least in part, be inferred from the behavior of firms. The time variation in the average perceived cost of capital, for instance, appears to line up with standard measures of expected returns, lending hope that such time variation could be inferred from firm behavior.

5.2 Testing the Investment CAPM

We next turn to the Investment CAPM (Hou et al. 2015). This model makes specific predictions about how the cross-section of firms' perceived cost of capital varies with expected stock returns. We test and reject these predictions.

The model is based on the idea that firms' investment behavior depends on their cost of capital and thereby expected stock returns. The model argues that expected returns, profitability, and investment are all directly related. If a firm is highly profitable but invests sparingly, it must be because the firm has a high cost of capital (i.e., high expected stock returns). Hou et al. (2015) formalize this logic in a simple one-period investment model where firms' optimally choose investment based on expected stock returns and expected profits. Adjustment costs are quadratic in investment rates and capital depreciates fully over one period. In this setting, the optimal investment rate for a fully equity-financed firm is,

$$1 + \frac{I_t}{K_t} = \frac{E_t[X_{t+1}]}{E_t[r_{t+1}]} \times \frac{1}{a}, \tag{4}$$

where I_t is investment at time t, K_t is capital at time t, $E_t[r_{t+1}]$ is the expected stock return for the firm at time t for the period between t and $t+1$, $E_t[X_{t+1}]$ is the expected profit at time t for the period between t and $t+1$, and a is a parameter governing the adjustment costs. The equation suggests that firms with greater investment have lower expected stock returns, controlling for the profitability of the firm.

Following this argument, Hou et al. (2015) construct investment and profit factors and estimate that firms with high investment indeed have low expected stock returns (keeping profitability fixed). The authors, through the lens of the model, argue that this empirical finding must be driven by the fact that firms with high investment rates perceive that they have a low cost of capital and adjust their investment accordingly.

Our new data allow us to directly test whether firms with high investment rates indeed perceive their cost of capital to be lower. We find the opposite: firms with high investment rates do not have lower perceived cost of capital. If anything, the relation points toward a positive cross-sectional relation between investment rates and the perceived cost of capital. This finding challenges the basic idea behind the Investment CAPM's interpretation of the data.

Our tests of the Investment CAPM are reported in Table 8. In the first three columns, we replicate the empirical findings of the investment CAPM literature by regressing future realized stock returns on the ex-ante investment characteristic of the firm. Following Hou et al. (2015) and Fama and French (2015), we consider asset expansion over the prior year as the investment characteristic (i.e., $\text{Investment}_t = \text{Assets}_t\text{-Assets}_{t-1}$). We measure the investment characteristic in cross-sectional percentiles of the population of firms in the country at a given date (ranging from 0 to 1). In the first three columns, we consider all firms in the CRSP/Compustat sample and all quarters between January 2002 and December 2022. We find similar results to Hou et al. (2015). The relation between future stock returns and the investment characteristic is strong, negative, and significant in column 1. It becomes even stronger when we condition on bins for deciles of firm profitability in column 2. Further controlling for market beta and size does not change the coefficient much in column 3.

In columns 4 to 6, we confirm that the same results also hold in the subsample of firm-quarter observations where we observe the perceived cost of capital. The slope coefficients are similar to the full sample regressions, suggesting that our sample of firms is similar to the population on this dimension (see also Section 2.3).

In columns 7 to 9, we use the perceived cost of capital as left-hand side variable instead of realized future stock returns. The slope coefficients are now of the opposite, positive sign: the greater firm investment, the greater the perceived cost of capital.

The effect is significant once we condition on profitability, as prescribed by the Investment CAPM. These results reject the fundamental idea behind the Investment CAPM. Firms with high investment (for a given level of profitability) do not have a low perceived cost of capital. The low future realized returns on high investment firms therefore cannot be interpreted as the outcome of an optimal capital budgeting decision where firms with low expected returns use a low cost of capital.

We visualize the rejection of the Investment CAPM in Figure 5 using two binscatters. The left-hand panel shows a negative relation between future realized stock returns and the ex-ante investment rate (controlling for country, date, and profitability). The right-hand panel shows a positive relation between the perceived cost of capital and the ex-ante investment rate (using the same controls). The opposite slopes are inconsistent with the Investment CAPM.

We have followed Hou et al. (2015) in using asset expansion to measure investment and the return on equity to measure profits. However, the finding that investment factors are not correctly incorporated into the perceived cost of capital applies more generally. As shown in Table 4, 72% of the investment factors have the wrong sign and none of the factors with the correct sign are significant.

5.3 "As if" Behavior?

One may be tempted to rationalize the above results without rejecting the Investment CAPM by invoking an "as if" argument. The argument could be that low-investment firms do not explicitly articulate that they have a high cost of capital, but instead they implicitly know that they should require a high return on their investments. For instance, these firms may perceive that they face substantial risks, which then causes managers to require a higher return on new investments. Under this argument, firms behave "as if" they had a high perceived cost of capital. The argument could in principle be correct because many firms indeed maintain discount rates (i.e., required returns on new investment) that differ from their perceived cost of capital (Graham and Harvey 2001, Gormsen and Huber 2023).

Fortunately, we can directly test this hypothesis because the conference call data also contain firms' discount rates. In Table 9, we reproduce the regressions of Table 8, except we now use the firm-level discount rate on the left-hand side. The cross-sectional relation between the investment rate and discount rates is also positive and significant when we only condition on profitability (in column 2). These results suggest that high-investment firms do not behave "as if" they have low discount rates.

It is important to emphasize that a firm's discount rates is negatively related to investment, once one conditions on the investment opportunities available to firms (i.e., once one includes more controls than just the return on equity used above). Indeed, Gormsen and Huber (2023) show that, conditional on firm fixed effects, discount rates negatively predict future investment in a manner that is quantitatively consistent with a simple Q-model. More generally, the above results are not a rejection of the idea that the cost of capital raises discount rates and, ultimately, lowers investment. However, the results reject the specific Investment CAPM formulated by Hou et al. (2015), which requires that discount rates and the perceived cost of capital are negatively correlated with investment only conditioning on profitability.

6 Conclusion

We study how firms' perceived cost of capital relates to expected returns in financial markets. According to standard theory, firms perfectly incorporate expected returns into their perceived cost of capital, which has broad implications for the efficiency of macroeconomic capital allocation and the relation between asset prices and firm investment. Analyzing time variation, we confirm that the average perceived cost of capital fluctuates over time with expected returns.

However, analyzing cross-sectional variation, we find that the perceived cost of capital only reflects a few traditional cross-sectional determinants of expected returns, such as leverage and exposure to the market, size, and value factors. More importantly, most cross-sectional variation in the perceived cost of capital is not justified by subsequent realized returns. What firms add to their perceived cost of capital, beyond traditional determinants, actually drives the perceived cost of capital further away from future realized returns. Similarly, traditional proxies for the cost of capital, such as the implied cost of capital, do not predict the actual perceived cost of capital used by firms.

These results challenge the production-based asset pricing paradigm and suggest there is excess volatility in the perceived cost of capital. Moreover, we reject the "Investment CAPM" because firms with higher investment have higher, not lower, perceived perceived cost of capital (when conditioning on profitability alone).

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Table 1
Summary Statistics

This table reports summary statistics at the level of firm-quarter observations. The perceived cost of capital, the perceived cost of debt, and the discount rate are observed in the conference call data. The remaining variables are from the factor zoo data and reported in "percentile ranks," relative to the universe of firms in Compustat in the same year and country of listing. Mean values of variables in percentile rank around 50 imply that firms in the sample are close to the mean in the country-year peer group. The sample includes 2002 to 2022.

	N	mean	p5	p95
Perceived cost of capital	2,625	8.58	5.30	12
Perceived cost of debt	3,805	4.25	1.62	7.30
Discount rate	2,661	15.3	8.00	26.0
Market beta (percentile rank)	2,134	52.4	10	92.8
Investment rate (percentile rank)	2,229	51.1	15.5	89.3
Book-to-market ratio (percentile rank)	2,191	47.7	8.86	87.7
Leverage (percentile rank)	2,230	61.2	25.0	93.8
Profits / assets (percentile rank)	2,091	65.5	25.1	95.9
Market size (percentile rank)	2,233	84.8	55.0	99.5

Table 2
Time Variation in the Perceived Cost of Capital

This table reports results of regressions of firm-level perceived cost of capital on the contemporaneous earnings yield of the stock market in the country of the firm as well as the long-term interest rates in the country. The sample includes 2002 to 2022. Standard errors are clustered by firm. Statistical significance is denoted by *** p<0.01, ** p<0.05, * p<0.1.

	(1)	(2)	(3)
	Perceived Cost of Capital$_t$		
Sample:	U.S. only		Global
Country-level earnings yield$_t$	0.51***	0.58***	0.50***
	(0.11)	(0.20)	(0.12)
Long-term interest rate$_t$	0.27***	0.31***	0.25***
	(0.079)	(0.063)	(0.039)
Observations	1,543	1,543	2,625
R-squared	0.050	0.883	0.879
FE	None	Firm	Firm
R^2	0.050	0.88	0.88
Within R^2	0.050	0.15	0.14

Table 3
The Perceived Cost of Capital and the Fama-French Model

This table reports results of regressions of firm-level perceived cost of equity on measures of firm-level exposure to the Fama and French (1993) factors. Exposure to equity factors is measured by the characteristic of the underlying factor, such as size and book-to-market. Perceived cost of capital is in percent and characteristics are in cross-sectional percentiles ranging from 0 to 1. The sample is 2002 to 2022. Standard errors are clustered by firm.

	(1)	(2)	(3)
		Perceived cost of capital$_t$	
Market Beta$_t$		2.91***	2.81***
		(0.29)	(0.27)
Market size$_t$			-1.49**
			(0.63)
Book-to-market$_t$			0.11
			(0.34)
Leverage ratio$_t$	-7.02***	-5.53***	-4.85***
	(1.85)	(1.57)	(1.54)
Leverage ratio$_t^{\text{squared}}$	4.26***	2.76**	2.10
	(1.59)	(1.37)	(1.37)
Observations	2,099	2,099	2,099
R-squared	0.231	0.335	0.343
FE	Ex/Year	Ex/Year	Ex/Year
Cluster	Firm/year	Firm/year	Firm/year
Within R^2	0.050	0.18	0.19

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 4
Summary of Factor Regressions

This table reports average results for factor regressions across different groups of risk factors. For each factor in our sample, we project the perceived cost of capital onto the given firm's market beta, leverage, leverage squared, and the firm's characteristic for the factor in question. All firm characteristics are measures in cross-sectional percentiles ranging from 0 to 1 and the cost of capital is measured in percentage points. All factors are signed such that higher exposure is associated with higher CAPM alpha in financial markets. The factors are grouped into categories as in Jensen et al. (2023). For each group of factors, we report the average factor premium (λ^i), the number of factors belonging to the category, the percent of factors for which λ^i has the same sign as that observed in financial markets, and the percent of factors that are significant against the one-sided alternative of having a different sign than the one observed in financial markets. A factor is significant if it has a $p-$value above 5% after doing a Benjamini and Hochberg (1995)-correction for number of factors tested in the given category. The sample is 2002 to 2021.

Factor category	Average λ^i	# of factors	% Correct sign	% Significant
Value	0.25	16	0.65	0.12
Trading frictions	0.22	24	0.66	0.16
Intangibles	0.15	29	0.53	0.20
Profitability	0.04	22	0.36	0.22
New	-0.09	14	0.33	0.00
Investment	-0.19	32	0.18	0.00
Momentum	-0.23	9	0.22	0.00
All	0.04	146	0.43	0.12

Table 5
Perceived Cost of Capital versus Realized Returns

This table reports results of panel regressions of realized returns on the perceived cost of capital. In Panel A, we regress firm-level 5-year stock returns on the ex ante perceived cost of capital. In Panel B, we regress the difference between realized returns and the perceived cost of capital onto the perceived cost of capital. In Panel B, realized returns are the weighted average realized returns on stocks and debt, adjusting for tax benefits of debt. The regressions also include controls for market beta, market capitalization, and book-to-market ratios. All returns are in local currencies. The sample is 2002 to 2022.

Panel A: Realized stock returns

	(1)	(2)	(3)	(4)	(5)
	Realized stock returns$_{t;t+5\text{ years}}$				
Perceived Cost of Capital$_t$	0.25	0.14	0.13	0.27	0.25
	(0.29)	(0.27)	(0.46)	(0.29)	(0.30)
Market beta$_t$				-0.57	-0.19
				(2.46)	(2.53)
Market size$_t$					-2.33
					(2.20)
Book-to-market$_t$					2.29
					(1.97)
Observations	1,531	1,531	1,531	1,527	1,475
R-squared	0.002	0.149	0.796	0.002	0.008
FE	None	Date	Firm/date	None	None
Cluster	Firm/date	Firm/date	Firm/date	Firm/date	Firm/date

Panel B: Realized returns

	(1)	(2)	(3)	(4)	(5)
	Realized returns$_{t;t+5\text{ years}}$ − Perceived cost of capital$_t$				
Perceived Cost of Capital$_t$	-0.78***	-0.87***	-1.11***	-0.74***	-0.79***
	(0.23)	(0.21)	(0.33)	(0.23)	(0.22)
Market beta$_t$				-1.15	-0.98
				(1.63)	(1.72)
Market size$_t$					-2.46
					(1.68)
Book-to-market$_t$					1.02
					(1.68)
Observations	1,428	1,428	1,428	1,424	1,376
R-squared	0.025	0.151	0.798	0.027	0.029
FE	None	Date	Firm/date	None	None
Cluster	Firm/date	Firm/date	Firm/date	Firm/date	Firm/date

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 6
The Cost of Capital Factor

This presents results of time series regressions of the return to the cost of capital factor on the Fama and French (1993) factors. We construct the cost of capital factor as follows. Each month, rank all firms based on the most recent estimate of their cost of capital (going no more than 10 years back). We then split firms based on the median market size of the firms in our sample and for each size group sort firms into three value-weighted portfolios based on the 30th and 70th percentile of cost of capital. Each month, the cost of capital factor goes long fifty cent in each of the two portfolios with high cost of capital and short fifty cent in each of the two portfolios with low cost of capital. Portfolios weights are refreshed and balanced every month. The sample starts in January 2005, to ensure at least three years of data on cost of capital, and ends in December 2022. The first column shows the weighted-average perceived cost of capital for the factor (the perceived cost of capital of the firms in the long leg minus the firms in the short leg). The next three columns show the realized returns on the factor. All returns are in monthly percent. The sample is U.S.only.

	(1)	(2)	(3)	(4)
	Perceived. CoC_t	Realized $return_{t,t+1}$		
Constant	0.41***	0.0067	-0.17	-0.11
	(0.0026)	(0.18)	(0.17)	(0.15)
$MKT_{t,t+1}$			0.25***	0.16***
			(0.037)	(0.036)
$SMB_{t,t+1}$				0.27***
				(0.066)
$HML_{t,t+1}$				0.26***
				(0.049)
Observations	216	216	216	216
P(intercept = 0.41)		0.026		
R-squared	0.000	0.000	0.173	0.355

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 7
The Perceived Cost of Capital versus Measures of Expected Returns

Panel A reports results of regressions of firm-level perceived cost of equity and capital the implied cost of capital. The implied cost of equity is calculated based on the price-earning growth model in Easton and Monahan (2005). The implied cost of capital is calculated as the leverage-weighted average of the implied cost of equity and the cost of debt, where the implied cost of debt is estimated as interest expense over total debt in Compustat. Both perceived and implied cost of capital are in percent. The sample in Panel A is 2002 to 2022. Standard errors in Panel A are clustered by firm. Panel B of this table compares factor premia estimated in the perceived cost of capital with factor premia estimated based on long-run stock returns. For each risk factor k we estimate factor premia in both the perceived cost of capital ($\lambda_{\text{k}}^{\text{perceived}}$) and financial markets ($\lambda_{\text{k}}^{\text{financial}}$). Factor premia for the perceived cost of capital are estimated as explained in the text. Factor premia in financial markets are estimated based on the data from van Binsbergen et al. (2023). Factor premia are measured in percentage points difference of firms' in the top and bottom of the cross-sectional distribution of the given characteristic. The sample covers 28 risk factors.

Panel A: Perceived versus. Implied Cost of Capital

	(1)	(2)	(3)	(4)	(5)	(6)
			Perceived cost of capital			
Implied Cost of Equity	0.040**	0.036**	0.035**			
	(0.019)	(0.018)	(0.017)			
Implied Cost of Capital				0.068**	0.055*	0.051**
				(0.031)	(0.029)	(0.026)
Observations	1,166	1,166	1,166	1,102	1,102	1,102
P(slope = 1)	0.00	0.00	0.00	0.00	0.00	0.00
R-squared	0.048	0.140	0.908	0.057	0.158	0.908
FE	Country	Country/year	Firm/year	Country	Country/year	Firm/year
Within R^2	0.0098	0.0084	0.016	0.014	0.0098	0.018

Panel B: Factor premia in perceived cost of capital vs factor premia in financial markets

Dependent variable		$a + b \times \lambda_k^{\text{Financial}} + \varepsilon$					R^2
$\lambda_k^{\text{perceived}}$	=	0.014	+	0.24** $\times \lambda_k^{\text{financial}}$	+	ε_i	0.17
		(0.11)		(0.11)			
Excluding size							
$\lambda_k^{\text{perceived}}$	=	-0.014	+	0.14 $\times \lambda_k^{\text{financial}}$	+	ε_i	0.10
		(0.09)		(0.09)			

Table 8
Testing the Investment CAPM

This table reports results of panel regressions of firm-level measures of returns on firm-level characteristics used by the "Investment CAPM". In column (1) to (3), we regress future 3-year realized stock returns on the given firms' ex-ante investment characteristic, along with controls. In column (4) to (6), we run the same regression for subset of firm/quarters where we also observe firms' perceived cost of capital. In column (7) to (9), we run the same regressions but instead using perceived cost of capital as the dependent variable. All regression include country and date fixed effects. We control for three different ex-ante firm-level characteristics, namely beta, size, and return on equity (profitability). We assign firm-level characteristics to 1 of 10 bins and control for inclusion in these bins using fixed effects. The investment characteristic is growth in total assets over the previous year and it is measured in cross-sectional percentiles ranging from 0 to 1. The sample includes 2002 to 2022.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	All firm/quarters			Firm/quarters with observed perceived cost of capital					
	Realized stock returns			Realized stock returns			Perceived cost of capital		
Asset expansion	-1.43**	-6.58***	-4.61***	-3.01	-4.60*	-4.40*	0.40	0.57**	0.63***
(investment)	(0.61)	(1.35)	(1.19)	(2.28)	(2.45)	(2.20)	(0.24)	(0.25)	(0.23)
Controls:									
Profits bins		X	X		X	X		X	X
Beta bins			X			X			X
Size bins			X			X			X
Observations	739,481	723,243	722,926	1,352	1,334	1,334	2,000	1,960	1,960
R-squared	0.118	0.158	0.183	0.215	0.230	0.264	0.187	0.217	0.345
Cluster	Country/date	Country/date	Country/date	Country/date	Country/date	Country/date	Firm/date	Firm/date	Firm/date

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 9
Testing the Investment CAPM Using Discount Rates

This table reports results of panel regressions of firm-level discount rate on firm-level characteristics used by the "Investment CAPM". All regressions include country and date fixed effects. We also control for three different ex-ante firm-level characteristics, namely beta, size, and return on equity (profitability). We assign firm-level characteristics to 1 of 10 bins and control for inclusion in these bins using fixed effects. The investment characteristic is growth in total assets over the previous year and it is measured in cross-sectional percentiles ranging from 0 to 1. The sample includes 2002 to 2022.

	(1)	(2)	(3)
		Discount rates	
Asset expansion (investment)	0.012	0.029***	0.012
	(0.010)	(0.011)	(0.0089)
Controls:			
Profits bins		X	X
Beta bins			X
Size bins			X
Observations	1,896	1,816	1,816
R-squared	0.130	0.198	0.286
FE	Country/date	Country/date	Country/date
Cluster	Firm/date	Firm/date	Firm/date

Robust standard errors in parentheses
*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Figure 1
Time Series of Perceived Cost of Capital

This figure shows average perceived cost of debt and capital for firms in the US, along with measures of the financial cost of capital. In the left-hand figure, we plot the average cost of capital along with the earnings yield for the U.S.stock market (the inverse of the CAPE ratio). On the right-hand figure, we plot the average cost of debt along with the long-term yield on treasuries.

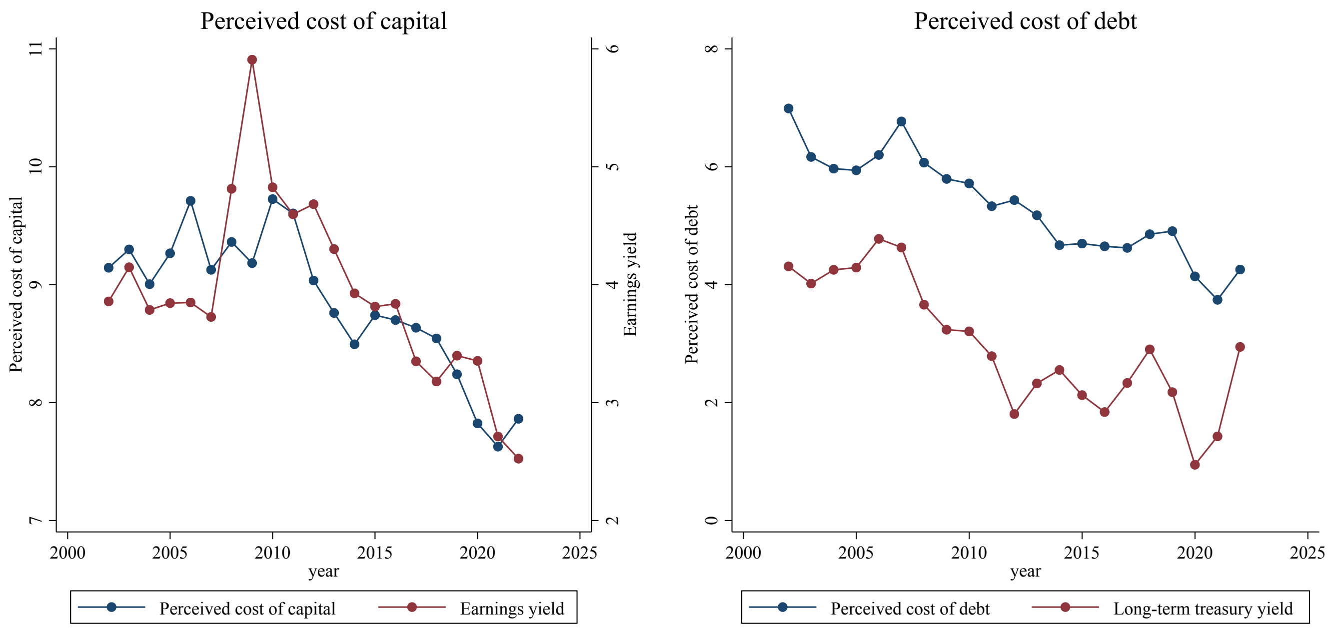


Figure 2
The Cross-Section of the Perceived Cost of Capital

This figure shows the perceived of capital for firms sorted into bins based on firm-level characteristics. The 4 characteristics are leverage, market beta, size, and value. Leverage, beta, and, book-to-market are measured in cross-sectional percentiles of the population of firms in a country on a given date. The three characteristics are sorted into equal-sized groups. For size, we assign all firms to one of 5 size categories based on categorization from Jensen et al. (2023). The sample includes 2002 to 2022.

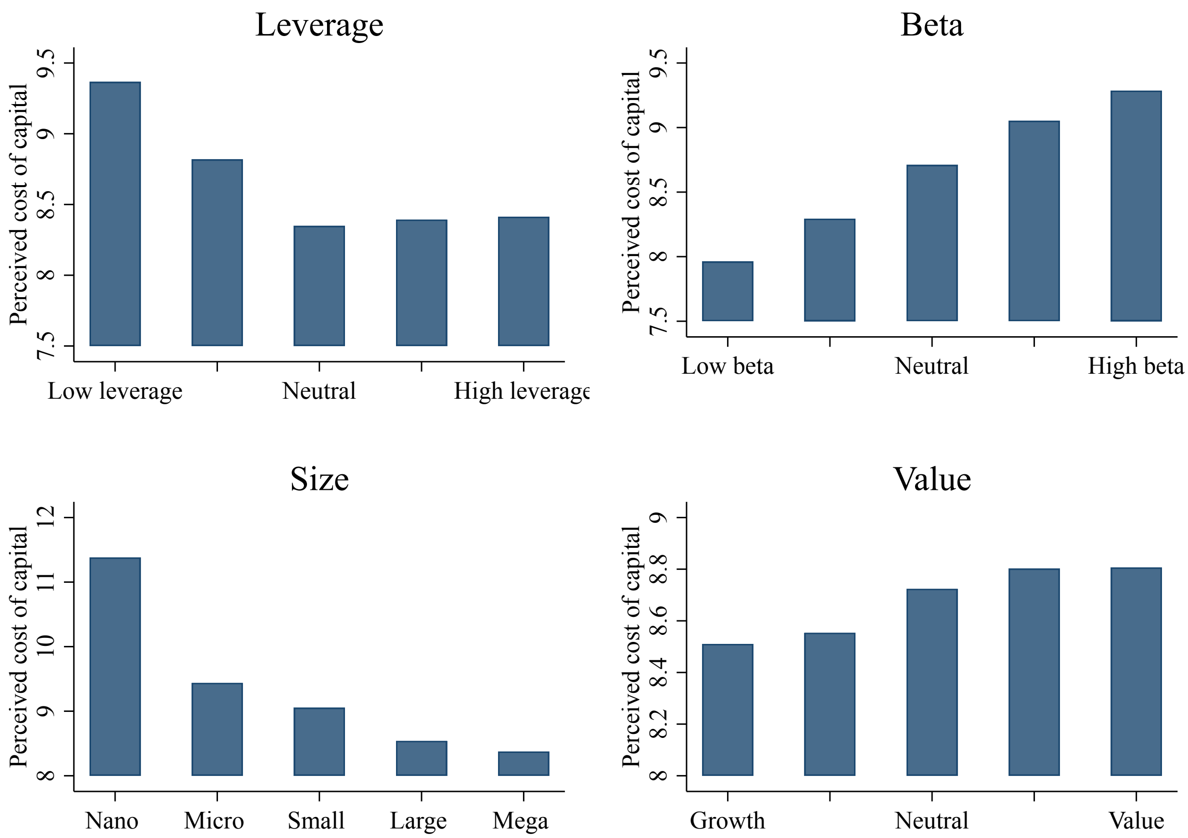


Figure 4
Factor premia in the perceived cost of capital versus long-run premia from financial markets

This figure compares factor premia estimated in the perceived cost of capital with factor premia estimated based on long-run stock returns. For each risk factor k we estimate factor premia in both the perceived cost of capital ($\lambda_k^{\text{perceived}}$) and financial markets ($\lambda_k^{\text{financial}}$). Factor premia for the perceived cost of capital are estimated as explained in the text. Factor premia in financial markets are estimated based on the data from van Binsbergen et al. (2023). Factor premia are measured in percentage points difference of firms' in the top and bottom of the cross-sectional distribution of the given characteristic. All characteristics are signed such that a higher characteristic is associated with higher short-run CAPM alpha. Factor premia are measured in percentage points difference of firms' in the top and bottom of the cross-sectional distribution of the given characteristic.

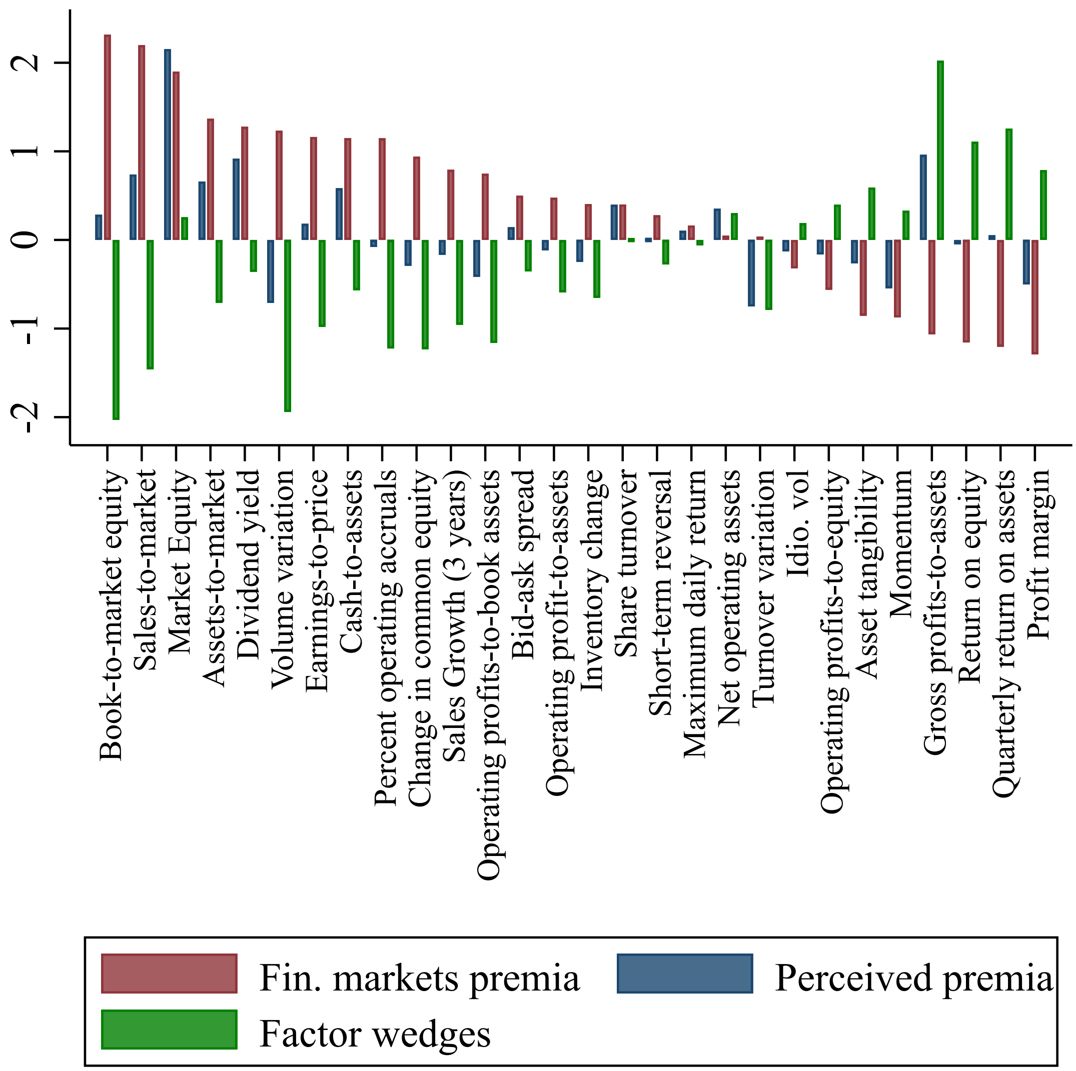


Figure 5
Wedges between implied and perceived cost of capital

This figure plots the implied cost of capital, the perceived cost of capital, and the difference between the two for 10 groups of firms sorted on the firms' implied cost of capital. The implied cost of capital is calculated as the weighted average of the cost of debt and the perceived cost of equity. The perceived cost of equity is calculated using the price-earning growth model in Easton and Monahan (2005). Wedges are defined as the difference between the average perceived cost of capital of firms in the portfolios and the average implied cost of capital of firms in the portfolio.

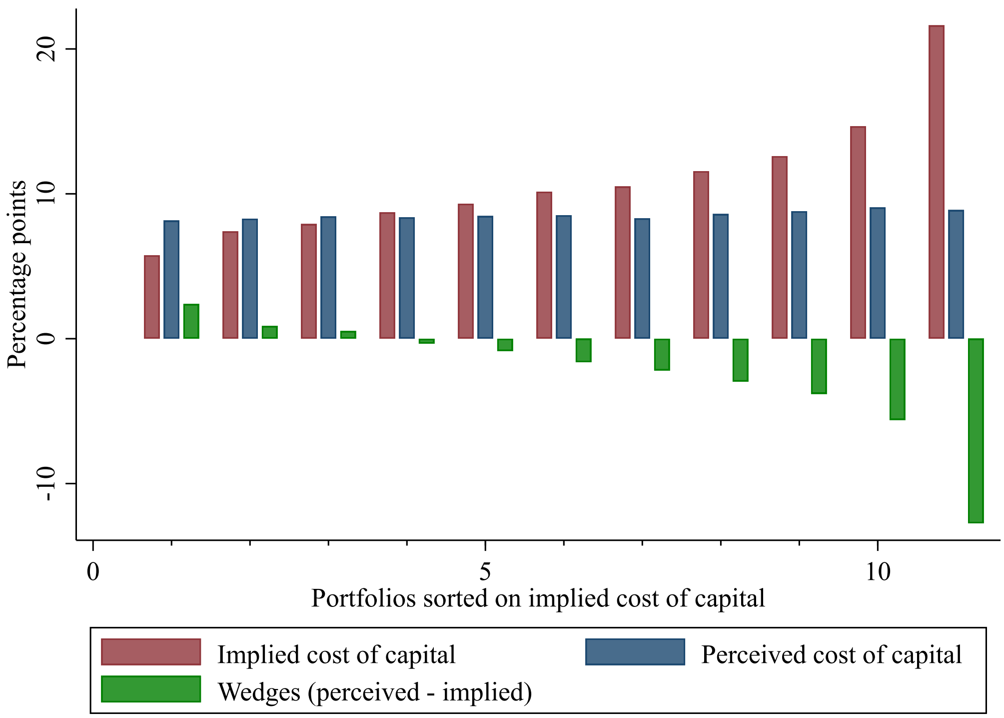
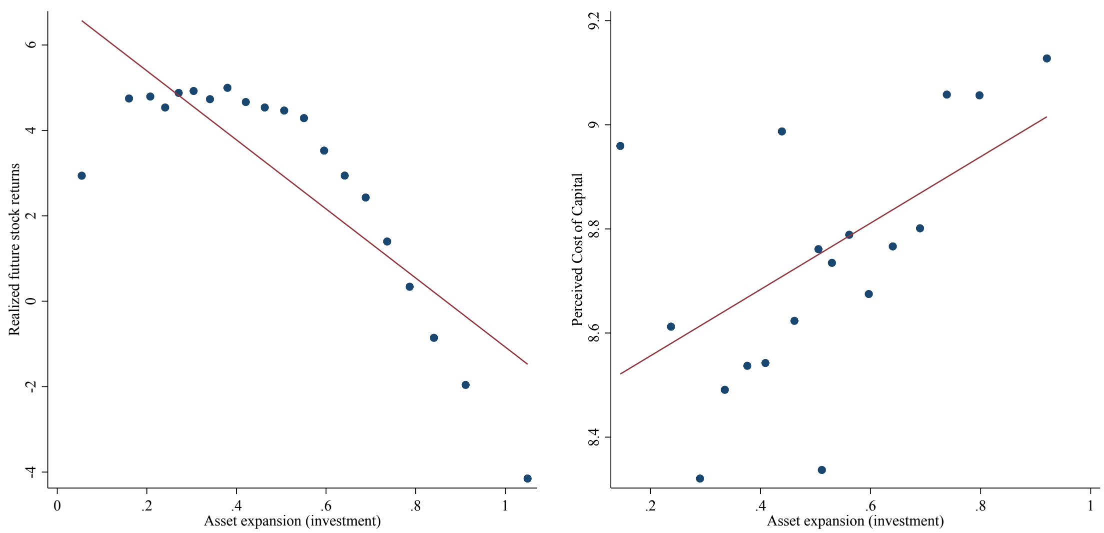


Figure 6
Testing the Investment CAPM

This figure shows binscatters for plots of future realized stock returns and perceived cost of capital against the firm-level investment rate. The left-hand figure plots the realized future 3-year return against the ex-ante investment of the firm. Investment is measured as asset expansion and it is measured in cross-sectional percentiles of the full population of firms in the country at a given date. The right-hand figure plots the perceived cost of capital against firm-level investment. Both plots includes controls for country-date fixed effects as well as profit bins of the given firms. Profit bins are based on the return on equity, which is measured in cross-sectional percentiles of the full population of firms in the country at a given date. The sample includes 2002 to 2022.



Online Appendix

Appendix A Figures and Tables

Figure A1
Histograms of Discount Rates and the Perceived Cost of Capital

This figure plots histograms of discount rates and the perceived cost of capital. The sample is 2002 to 2021.

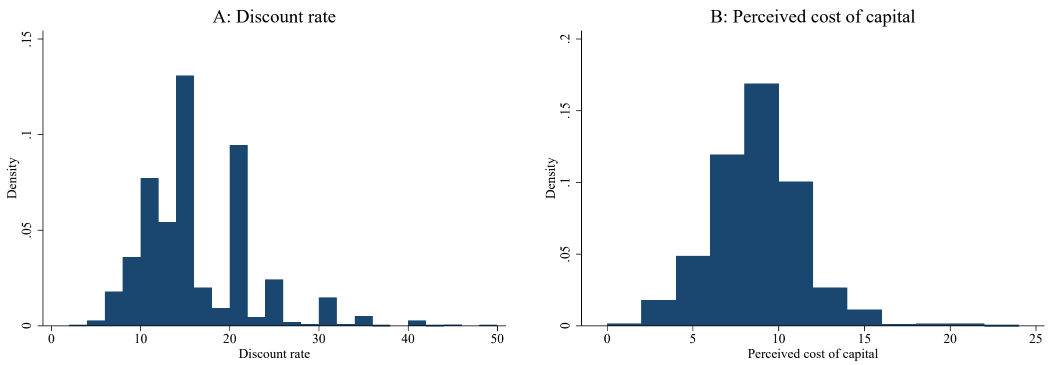


Figure A2
Leverage and the perceived cost of capital

This figure shows the coefficient estimates for different leverage bins in a regression of the perceived cost of capital on leverage groups, absorbing year and country fixed effects. Perceived cost of capital is in percent. The figure shows one standard errors bars.

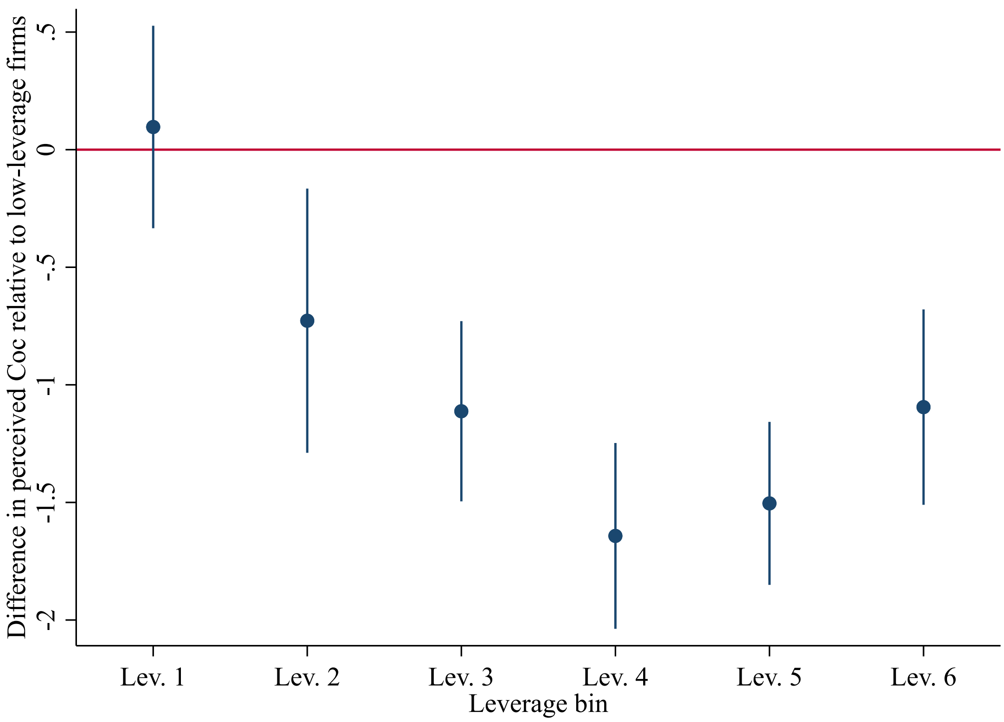


Figure A3
The 5-factor model and the perceived cost of capital

This figure shows a binned scatterplot of the perceived cost of capital for different bins of predicted values in the Fama and French (2015) 5-factor model. The figure absorbs year and country fixed effects and controls for leverage. Perceived cost of capital and the predicted values are in percent. The sample is 2002 to 2021.

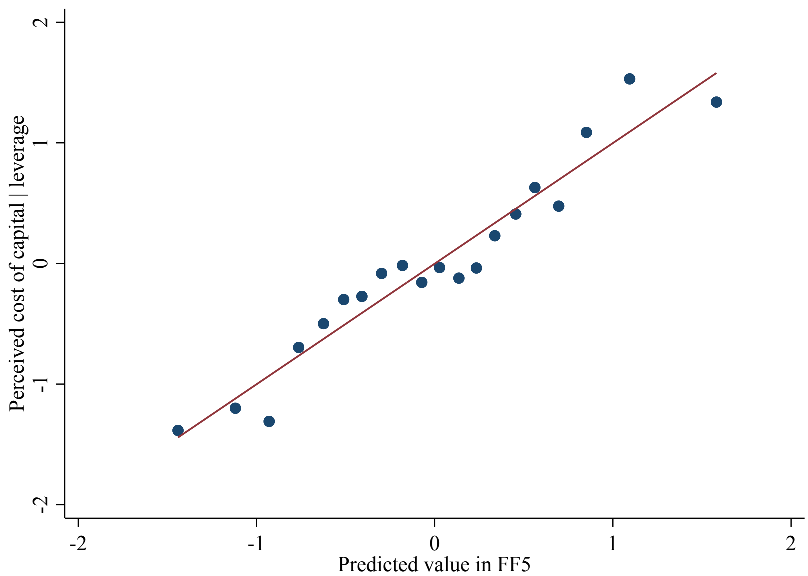
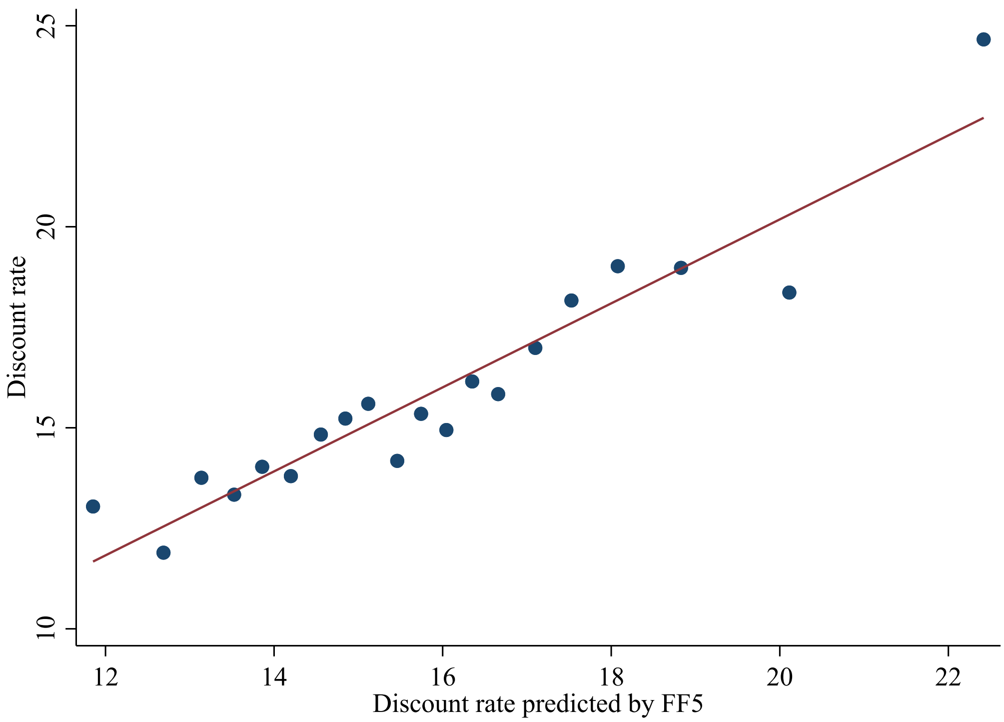


Figure A5
The 3-factor model and discount rates

This figure shows a binned scatter plot of discount rates for different bins of predicted values in the Fama and French (1993) 5-factor model. The figure absorbs year and country fixed effects. Discount rates and predicted values are in percent. The sample is 2002 to 2021.



Appendix B Details on Measurement

We follow the data collection procedure established by Gormsen and Huber (2023). We extend that dataset by adding conference calls for all years from FactSet and for the years 2021 and 2022 from FactSet and Refinitiv.

Appendix B.1 Extraction of Paragraphs from Conference Calls

We access all calls held in English during the period January 2002 to December 2022 and available on the databases Refinitiv and FactSet. We download paragraphs from the calls that fulfill two criteria: first, they contain one of the terms "percent," "percentage," or "%" and second, they contain at least one keyword related to the cost of capital. The keywords are capital asset pricing model, cost of capital, cost of debt, cost of equity, discount rate, expect a return, expected rate of return, expected return, fudge factor, hurdle rate, internal rate of return, opportunity cost of capital, require a return, required rate of return, required return, return on assets, return on invested capital, return on net assets, weighted average cost of capital, weighted cost of capital. We also include abbreviations of the keywords in the search, for example, WACC. We identify roughly 110,000 paragraphs containing a keyword.

We match the firm name listed on the conference call to Compustat Global Company Keys by using a fuzzy merge algorithm, checking each match by hand. Ultimately, we link 93 percent of the paragraphs to a Compustat firm.

Appendix B.2 Guidelines for Manual Data Entry

With our data collection team, we read through each paragraph and enter relevant figures into tables. We record the following financial variables from the calls:

- discount rate
- hurdle rate
- hurdle premium over the cost of capital
- fudge factor over the cost of capital
- cost of debt
- weighted average cost of capital (WACC)
- opportunity cost of capital (OCC)
- cost of capital
- cost of equity
- required, expected, and realized internal rate of return (IRR)
- required, expected, and realized return on invested capital (ROIC)
- required, expected, and realized return on equity (ROE)
- required, expected, and realized return on assets (ROA)
- required, expected, and realized return on net assets

We do not record hypothetical numbers (e.g., "we may use a discount rate of x percent" or "imagine that we use a cost of capital of x") and figures given by someone outside the firm (e.g., an analyst on the call suggesting a specific cost of capital for the firm). The context of statements is often key, so automated text processing cannot easily replace human reading for this task. For instance, the abbreviation OCC may refer to the opportunity cost of capital but more often than not actually refers to Old Corrugated Cardboard, a term for cardboard boxes used in the transport and recycling industries.

We only measure discount rates when managers explicitly discuss them as part of an investment rule. This means, for example, that we do not record discount rates used to value firms' pension liabilities. We focus on discount rates and the cost of capital that represent investment rules of the firm, as opposed to specific figures related to individual projects. For instance, we do not record the interest rate for a particular bond issuance. The paragraphs in the data entry sheets are sorted by firm and date, which helps us to interpret statements from the same firm consistently. When managers list multiple discount rates (usually for different regions and industries), we enter the figures that are representative of most of the company's operations (e.g., U.S.figures for a U.S.company). We discuss all cases with multiple rates among the whole team.

Managers mostly discuss their after-tax discount rate and cost of capital. We note when managers refer to pre-tax discount rates and pre-tax cost of capital. We convert all observations into after-tax values in two steps. First, we estimate the average percentage point difference between after-tax and pre-tax observations, controlling for country-by-year fixed effects. Second, we then adjust the pre-tax values reported on the calls using this average difference.

Similarly, managers rarely mention a "levered" discount rate, which is used in return calculations that do not take into account all the capital used to finance the investment. We convert all levered observations into unlevered values. Again, we estimate the average percentage point difference between levered and unlevered observations, conditional on country-by-year fixed effects, and then adjust the levered values using this difference.

Managers sometimes specify a range rather than an actual value. We enter the average value in these cases. We do not record values when the range is very large or ambiguous. Managers sometimes give different realized returns depending on the time horizon (e.g., "we have achieved a 5 percent ROIC over the last five years and a 10 percent ROIC over the last ten.") We enter the most recent horizon for such cases. Realized returns referring to a previous episode unconnected to current years (e.g., "return in the 1990s") are not recorded.

Appendix B.3 Data Collection Team

A total of 23 research assistants contributed to the data collection. The average team size at any point was 7. The team members were: Alexandra Bruner, Ben Meyer, Cagdas Okay, Charlotte Wang, Chris Saroza, Daniel Marohnic, Esfandiar Rouhani, Henry Shi, Izzy Sethi, Jasmine Han, Jason Jia, Madeleine Zhou, Manhar Dixit, Meena Rakasi, Neville Nazareth, Rachel Kim, Rahul Chauhan, Rohan Mathur, Sanjna Narayan, Scarlett Li, Sean Choi, Sungil Kim, Tony Ma.

Before assistants begin the actual data collection, we teach them basic asset pricing and capital budgeting. Each assistant then reads roughly 2,000 paragraphs to train, which we check and discuss.

All paragraphs containing values for a perceived cost of capital and a discount rate were read at least twice by different assistants and outliers were checked by the authors to avoid errors. The research team met every week to discuss individual cases and to coordinate on consistent data entry rules.