Corporate Discount Rates*

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Abstract

Standard theory implies that the discount rates used by firms in investment decisions (i.e., their required returns to capital) determine investment and transmit financial shocks to the real economy. However, there exists little evidence on how firms' discount rates change over time and affect investment. We construct a new global database based on manual entry from conference calls. We show that, on average, firms move their discount rates with the cost of capital, but the relation is far below the one-to-one mapping assumed by standard theory, with substantial heterogeneity across firms. This pattern leads to time-varying wedges between discount rates and the cost of capital. The average wedge has increased substantially over the last decades as the cost of capital has dropped. Future investment is negatively related to discount rate wedges. Moreover, the large and growing discount rate wedges can account for the puzzle of "missing investment" (relative to high asset prices) in recent decades. We find that beliefs about value creation combined with market power, as well as fluctuations in risk, explain changes in discount rate wedges over time.

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How do asset prices and interest rates affect corporate investment? Since the early 2000s, asset prices have increased dramatically and interest rates have declined. These changes imply that financial investors have become willing to provide capital to firms in exchange for lower rates of return, which is to say that firms' cost of capital in financial markets has decreased.

The stylized view in economics is that such changes in firms' cost of capital directly impact firm investment. According to the stylized view, firms should take on any investment project that offers returns above the cost of capital. As a result, firms should adjust their required returns on new investments (their so-called "discount rates") one-to-one with the cost of capital in financial markets. Firms' discount rates should, for example, have dropped substantially since the early 2000s, in line with the cost of capital, leading to a corporate investment boom (Gutiérrez and Philippon 2017). More generally, the stylized view implies that all shocks to the cost of capital, such as shocks to stock prices, monetary policy, and credit supply, directly influence firms' discount rates and thus investment (e.g., see discussions in Gilchrist and Zakrajšek 2012 and Koby and Wolf 2020).

It is possible, however, that fluctuations in the cost of capital in financial markets are largely irrelevant to firm investment. For the stylized view to work, firms must actively choose to incorporate fluctuations in this "financial cost of capital" into their discount rates.[1] To do so, firms need to take two steps. First, they need to estimate their financial cost of capital based on observed asset prices and interest rates. As this is a non-trivial exercise, the resulting estimate, which we term the "perceived cost of capital," may deviate substantially from the financial cost of capital. Second, firms need to choose a required return on capital, their discount rate. The discount rate may incorporate a host of other, time-varying factors apart from the perceived cost of capital. It is thus possible that discount rates hardly comove with the financial cost of capital, so that financial prices have only modest impact on investment.

Despite the conceptual importance of these discount rate dynamics, our understanding is limited because there exist little data tracing individual firms' perceived cost of capital and discount rates over time and linking them to real outcomes. As a result, we do not know how firms adjust their perceived cost of capital over time, how discount rates change with the perceived cost of capital and other factors, and whether deviations from the stylized view

[1] Firms have substantial discretion over their discount rates (Welch 2022). For instance, firms with market power can raise their discount rates above the financial cost of capital while remaining profitable, as detailed in Section 7.

matter for investment dynamics.

In this paper, we study the dynamics of corporate discount rates and their relation to investment. We construct a new dataset of firm-level discount rates and the perceived cost of capital. The data reveal large deviations from the stylized view. While firms' discount rates and perceived cost of capital move with standard measures of the financial cost of capital, the relation is far below one-to-one. The weak relation generates large and time-varying "discount rate wedges" between discount rates and the perceived cost of capital. The average wedge has increased substantially since 2002, as firms have incorporated the declining financial cost of capital into their perceived cost of capital but only weakly into their discount rates. Discount rate wedges are strongly and negatively related to firm investment. At the aggregate level, the increase in the average wedge is large enough to account for the fact that US investment has been relatively low since 2002. More generally, discount rate wedges reduce the sensitivity of investment with respect to the financial cost of capital by an order of magnitude in standard models. We show that beliefs about value creation combined with market power (Philippon 2019), along with fluctuations in risk (Bloom 2009), have contributed to higher discount rate wedges among US firms.

We begin the paper by measuring firms' discount rates and perceived cost of capital using corporate conference calls (Hassan et al. 2019). The majority of listed firms hold quarterly conference calls, during which managers inform financial analysts and investors about their firms' operations. On these calls, managers sometimes share their discount rates and perceived cost of capital when discussing their investment decision making.[2] Advantages of conference calls include that they are held regularly, that analysts can compare reported discount rates to realized outcomes, and that calls often appear as evidence in securities lawsuits. These aspects incentivize managers to report accurate values. We collect transcripts for conference calls between 2002 and 2021 and identify 74,000 paragraphs where managers discuss their discount rates or perceived cost of capital. We read through each paragraph with a team of research assistants and manually extract relevant information.

The product of this data collection is a global database of firms' discount rates and perceived cost of capital, matched to investment rates. The data contain roughly 2,500 firms across 20 countries. We observe discount rates and the perceived cost of capital for 19 sequential years in multiple countries, giving rise to a country-level panel. In addition, we

[2]The perceived cost of capital is the firm's estimate of its weighted average after-tax cost of debt and cost of equity. The discount rate is the firm's after-tax minimum required return on capital, or "hurdle rate." Most firms use just one discount rate in their net present value (NPV) calculations (see Section 1).

observe many firms multiple times, giving rise to a firm-level panel. This panel variation is new to the literature and key to understanding how discount rates and the perceived cost of capital relate to one another and to investment. We show that firms in our sample are larger than the average firm in Compustat, but otherwise similar on observable characteristics. We also find no evidence that firms report discount rates and the perceived cost of capital in unusual states of the world, such as times of distress.

Using our new data, we assess the stylized view that firms seamlessly transmit shocks to the financial cost of capital into their perceived cost of capital and discount rates. We start by studying the relation between the financial and perceived cost of capital. The financial cost of capital is the weighted average after-tax cost of debt and equity. To calculate their cost of debt and equity, firms need to estimate expected returns to bonds and stocks, which is notably difficult (Campbell and Thompson 2008) and which investors often fail to do correctly (Greenwood and Shleifer 2014, Nagel and Xu 2022). We find that firms' perceived cost of capital comoves with standard estimates of the financial cost of capital (e.g., based on interest rates and the earnings yield or the Capital Asset Pricing Model, CAPM) and we cannot reject that the estimate is close to 1 on average. We do, however, find substantial firm-level heterogeneity in the dynamic incorporation of the financial cost of capital. This heterogeneity may reflect that firms use richer models than the CAPM to calculate their perceived cost of capital or it may reflect mistakes in perceptions of the financial cost of capital.[3]

We next study the link between discount rates and the perceived cost of capital. One challenge for the stylized view is that firms' reported discount rates are often well above their perceived cost of capital, which has puzzled previous research.[4] While our paper focuses on changes over time rather than level differences, the conference calls also allow us to understand the high reported average discount rates. We find that many firms use discount rates that are adjusted upward to compensate for the fact that some overhead costs, such as the costs to the headquarters of administering new projects, are omitted from the cash flow analyses. When we identify firms that include all overhead in their cash flow analyses, we find that average reported discount rates are substantially closer to, but still greater than, the perceived cost of capital and consistent with returns reported on accounting statements. Throughout the paper, we ensure that our results are not driven by the amount of overhead

[3] Gormsen and Huber (2023) provide a detailed analysis of what determines variation in the perceived cost of capital across firms, whereas we focus on variation within firms over time in this paper.

[4] E.g., see the discussion in Poterba and Summers (1995).

that is incorporated by different firms.

More importantly, we document that changes in the perceived cost of capital only modestly affect discount rates, in contrast to the stylized view. Using within-firm variation, we show that, on average, a 1 percentage point increase in the perceived cost of capital leads to a 0.3 percentage point increase in the discount rate. Many firms rarely change discount rates, so the relation becomes stronger over longer horizons. However, even at the 10-year horizon, 40 percent of firms maintain unchanged discount rates and, even if they change, adjust less than one-to-one with the perceived cost of capital. In addition, we find substantial variation in discount rates that is unrelated to the perceived cost of capital. These results suggest that discount rates have "a life of their own," beyond the perceived cost of capital.

The weak relation between discount rates and the perceived cost of capital gives rise to a time-varying wedge between discount rates and the perceived cost of capital. Using within-firm variation, we find that the average wedge in the US has increased by around 2.5 percentage points between 2002 and 2021, as the perceived cost of capital has decreased while discount rates have remained more stable. This increase is large relative to typical movements in financial prices, for example, those due to secular interest rate trends and monetary policy.[5] An increase of this magnitude is thus likely to be important for our understanding of investment dynamics.

Indeed, we show that discount rate wedges are associated with investment fluctuations at the firm level. A 1 percentage point increase in the wedge lowers the investment rate by 0.9 points. This estimate is robust to controlling for firm and year fixed effects, Tobin's Q, the financial cost of capital, analyst cash flow expectations, and other firm characteristics. The estimated magnitude is quantitatively consistent with a simple Q-model where firms use the measured discount rates in investment decisions. In addition, discount rates predict future realized returns, consistent with firms earning their required returns. This evidence corroborates that the measured discount rates and wedges capture required returns, and thereby a distinct component of firms' investment demand.

The existence of time-varying discount rate wedges challenges the stylized view that financial shocks directly impact firm investment. We next analyze applications where wedges shape the investment-finance nexus.

A literature argues that US investment has been low in recent decades, relative to the

[5]The secular decline in the natural real rate of interest amounted to roughly 1 percentage point between 2002 and 2020 (Bauer and Rudebusch 2020), whereas the Fed's quantitative easing reduced corporate bond yields by 0 to 0.5 percentage points (Krishnamurthy and Vissing-Jørgensen 2011, Swanson 2011).

financial cost of capital. In particular, declines in the financial cost of capital have raised firms' market value and thereby increased Tobin's Q since the early 2000s. According to standard Q-theory, investment should have risen with Tobin's Q (Gutiérrez and Philippon 2017). However, if anything, investment rates have been low relative to historical standards, leading researchers to argue that there is "missing investment," which by now exceeds 20 percent of the capital stock, even when accounting for intangibles and other measurement issues (Philippon 2019).

We find that changes in discount rate wedges can account for a large part of the missing investment. Intuitively, the increasing wedges imply that firms have been using increasingly higher discount rates than those assumed by standard Q-theory, which ultimately means that firms have been holding back investment relative to what Tobin's Q suggests. To quantify the role of changing wedges, we develop an "adjusted Q," which allows for discount rate wedges in firms' optimization problems. Using the adjusted Q in an accounting exercise akin to Gutiérrez and Philippon (2017), we find that the increase in the average wedge is large enough to account for most of the missing investment in the US economy since 2002. Consistent with this result, we find that firm-level Tobin's Q has increased by more for firms that have increased their wedges by more.

The above results help to disentangle competing interpretations of the missing investment puzzle. Low investment relative to high Tobin's Q could imply that the marginal profitability of capital is low, relative to the average profitability captured by Q. Alternatively, it could imply that firms require returns above the financial cost of capital. It has so far been difficult to distinguish the two competing explanations because existing data do not measure how firms' marginal profitability or required returns have changed over time. Our data reveal that the evolution of firms' required returns is indeed large enough to account for much of the missing investment. In this sense, one may not need a large decrease in marginal profitability to explain the data.[6] Relatedly, the results contribute to the debate on the falling labor share in national income, as growing discount rate wedges imply that the falling labor share is in part driven by rising rents accruing to firms.

We also find that, in a standard model, discount rate wedges reduce the sensitivity of investment to the financial cost of capital by a factor of ten. The sensitivity implied by a model with wedges is close to the sensitivity implied by estimates based on micro data (e.g.,

[6] A complementary explanation of the missing investment puzzle is that investment is mismeasured because of the rise of intangible capital. We analyze the part of missing investment that is not explained by mismeasured intangibles alone. Our results rely on a BEA measure of investment that already accounts for intangibles and these results are consistent with the view that intangibles have also influenced investment.

Zwick and Mahon 2017). Macroeconomic models without wedges often imply an investment sensitivity that is far too high relative to empirical estimates (Koby and Wolf 2020). A common approach in this literature is to assume very high or non-convex adjustment costs, but it is not clear whether such adjustment costs are consistent with the actual costs faced by firms. By including discount rate wedges calibrated to our measurement, models may be able to match the empirically estimated sensitivity without having to modify assumptions about adjustment costs.

In the final part of the paper, we study why discount rate wedges vary across firms and over time. We consider three theories: the interaction of market power with beliefs about value creation; idiosyncratic firm-level risk; and financial constraints. First, we systematically analyze manager statements on conference calls. We find that many managers believe that high discount rates raise shareholder value. High discount rates may signal profitability or managerial prudence, consistent with models where investors worry about overinvestment (Jensen 1986). While the benefits of wedges may accrue to firms independent of market power, we show that firms with market power are able to maintain wedges at a lower cost to their profitability. This implies that firms with more market power are more likely to choose high and steady discount rates over time, even when the cost of capital is falling. A second theory is that firms with irreversible assets postpone investments in the face of increased risk, which can lead riskier firms to use higher discount rates. And third, financial constraints may generate discount rate wedges. Using cross-sectional variation, we find that market power, risk, and financial constraints are all associated with higher discount rate wedges, consistent with the three theories.

More relevant to the missing investment puzzle, we also analyze the drivers of changes in discount rate wedges. We find a strong role for market power. In particular, firms with high market power (measured at the start of the sample) have kept their discount rates stable since 2002, despite the falling financial cost of capital. Firms with low market power have, in contrast, decreased their discount rates almost one-to-one with the financial cost of capital. This pattern is consistent with the idea that many managers are averse to lowering their discount rates and only do so in response to competitive pressures. Market power has therefore limited the extent to which the secular decline in the financial cost of capital has been incorporated into firms' discount rates.[7] We also find that time variation in risk

[7]Our findings rely solely on cross-sectional, pre-existing variation in market power. The economic mechanism and statistical relation that we emphasize are therefore distinct from existing work that has focused on changes in market power since 2002. The influence of market power on discount rates could be even greater if market power has indeed increased, as discussed in, for instance, Philippon (2019), De Loecker

influences discount rate wedges through the real options channel, meaning that fluctuations in uncertainty (Baker et al. 2016) may have contributed to changes in discount rate wedges.

Related Literature

Firms' cost of capital and discount rates have long been thought to shape investment, both in academic (e.g., Jorgenson 1963, Tobin 1969, Barro 1990, Cochrane 1991, Gilchrist and Zakrajšek 2012, Hall 2017) and policy discussions (Cieslak and Vissing-Jørgensen 2021). We provide the first firm-level dataset that links discount rates, the perceived cost of capital, asset prices, and investment. The data allow us to present novel evidence on the full chain of transmission from the financial cost of capital to the perceived cost of capital, discount rates, and ultimately investment.

Previous surveys have produced mixed results about the extent to which discount rates respond to the cost of capital.[8] Sharpe and Suarez (2021) and Graham (2022) compare the average perceived cost of capital and discount rates across different surveys. In these surveys, both the average perceived cost of capital and the average discount rate in 2019 were almost identical to their respective 2003 value, consistent with a perfect transmission of the perceived cost of capital to discount rates (i.e., time-invariant discount rate wedges). In contrast, our approach relies on dynamic, within-firm variation and annual data. Our results reveal that the average perceived cost of capital has trended downward since 2002; that discount rate wedges vary over time; that the average discount rate has fallen for firms with low market power; and that the average discount rate has remained roughly constant for firms with high market power.[9] We also reveal variation in discount rates over shorter, year-to-year horizons, partly driven by risk.

Existing data on firms' discount rates and perceived cost of capital come from surveys (e.g., Summers 1986, Poterba and Summers 1995, Jagannathan et al. 2016). The raw average levels of reported discount rates and cost of capital are roughly similar in these surveys and in our data. The influential Duke CFO Survey has generated broad insights into corporate

et al. (2020), Liu et al. (2022), and Eggertsson et al. (2021).

[8] Bruner et al. (1998) find that three-quarters of firms update their perceived cost of capital and discount rate at least annually. Meier and Tarhan (2007) report that cost of capital fluctuations trigger discount rate changes for 80 percent of firms and that 48 percent changed their discount rate between 2000 and 2003. Sharpe and Suarez (2021) document that few managers would adjust investment if interest rates changed. Graham (2022) reports that 41 percent of US firms respond "zero" when asked: "over the past 10 years, how many times has your firm changed your hurdle rate by 1 percent or more?"

[9] The finding of relatively stable required returns (i.e., stable discount rates) is consistent with, but distinct from, the finding that realized returns have been relatively stable (e.g., Reis 2022). In principle, realized returns can move differently from required returns, but investment is determined by required returns.

governance and includes discount rates for five years since 2007 (Graham 2022). Recently, Barry et al. (2023) explain that positive discount rate wedges can be sustained in a bargaining model and find evidence in the Duke CFO survey that is broadly consistent with our cross-sectional results. In general, survey data have not been linked over time to construct a panel and to firm investment, which has made it difficult to study how firms adjust their perceived cost of capital and discount rates, in particular at year-to-year frequencies, and the implications of discount rates and wedges for investment.

Our results also inform a large literature on the link between secondary asset markets and real outcomes (reviewed in Bond et al. 2012). For instance, Lamont (2000), Krüger et al. (2015), van Binsbergen and Opp (2019), Dessaint et al. (2021), Pflueger et al. (2020), Kim (2022), and He et al. (2022), among others, study the impact of the financial and perceived costs of capital on investment. Moreover, an asset pricing literature explains anomalies assuming that firms invest based on expected stock returns (Gomes et al. 2003, Zhang 2005, Hennessy et al. 2007, Hou et al. 2015, Frank and Shen 2016). Several papers analyze whether equity prices affect investment because firms issue equity (e.g., Morck et al. 1990, Blanchard et al. 1993, Baker et al. 2003, Gilchrist et al. 2005). We find that equity prices also affect investment through a discount rate channel that can operate without equity issuance.

1 Conceptual Framework

When deciding whether to undertake an investment project, managers evaluate whether the expected return on the project meets a threshold set by the managers. This threshold is the firm's discount rate, also known as the required return to capital. Whether firms undertake a given project or not therefore depends directly on the discount rate.

Textbooks in economics and finance make a clear recommendation on how a firm should calculate its discount rate. As long as the project under consideration has the same risk as the firm's existing investments, the firm should set its discount rate δ_t equal to its financial cost of capital r_t^{fin}, also known as the weighted average cost of capital:

$$\delta_t = r_t^{\text{fin}} \tag{1}$$

$$= \omega_t \times (1-\tau) \times r_t^{\text{debt}} + (1-\omega_t) \times r_t^{\text{equity}}, \tag{2}$$

where r_t^{debt} and r_t^{equity} are the costs of debt and equity, τ is the firm's tax rate, and ω_t is the leverage ratio (i.e., the market value of debt relative to the market value of debt plus equity).

The intuition behind this recommendation is that the financial cost of capital measures the return of an alternative financial investment with the same risk as the project under consideration. Investing in a new project creates value to financial investors as long as the return of the project exceeds the return of an alternative investment with the same risk and destroys value if the project return is below the return of an alternative investment with the same risk. The firm therefore maximizes its stock price by setting the discount rate equal to the financial cost of capital and investing in all projects that clear this threshold. More generally, setting the discount rate this way ensures that the firm's marginal return to capital is equal to the opportunity cost of the capital.[10]

In practice, the vast majority of large firms use a method based on a discount rate to make investment decisions. One approach is to use the discount rate as the threshold for the minimum internal rate of return (IRR) that a project must meet. A closely related approach is to use the discount rate in a net present value (NPV) calculation.[11] The threshold and NPV rules lead to equivalent investment decisions as long as NPV smoothly declines in the discount rate.[12] This condition holds for typical projects and in standard models of firm investment and often leads the finance literature to use the terms "minimum required return" and "discount rate" interchangeably (see Jagannathan et al. 2016).

Standard models in economics and finance assume that firms follow the textbook recommendation. Specifically, the dominant assumption is that firms always use their financial cost of capital as their discount rate. The assumption gives rise to a stylized view, according to which firms seamlessly respond to financial prices and where shocks to the financial cost of capital, such as those to monetary policy, credit supply, and asset prices, have powerful effects on the real economy. The stylized view is implicit in most canonical models where firms use capital, such as real business cycle, New Keynesian, production-based asset pricing,

[10] Using the financial cost of capital as discount rate generally leads to the same investment decisions as a complex decision rule based on the stochastic discount factor in standard models, as we sketch in Appendix B, as long as the project has the same risk as the firm's existing investments. If project risk differs from the firm's existing investments, the optimal discount rate becomes project specific. However, if a firm on average carries out new projects that are in line with its existing ones, its average discount rate would still be close to its financial cost of capital. In practice, the vast majority of firms in the conference call data and in previous surveys report using just one discount rate that is based on a firm's typical project (Graham and Harvey 2001).

[11] Around 80 to 90 percent of large firms use the threshold and NPV rules to make investment decisions, according to surveys reported in Trahan and Gitman (1995) and Graham (2022).

[12] See Brealey et al. (2011), pages 109–113. The threshold and NPV rules can lead to different decisions if projects involve large lending transactions early in the lifetime of the project, if a project has multiple internal rates of return, and if projects are mutually exclusive.

and dynamic industrial organization models.

However, it is not at all clear whether firms adhere to the stylized view. Two processes within firms may cause discount rates to diverge from the financial cost of capital. First, firms cannot observe the financial cost of capital, but have to estimate it. Estimating the cost of equity is difficult due to modeling and statistical uncertainty (Fama and French 1997, Pástor and Stambaugh 1999, Goyal and Welch 2003, Campbell and Thompson 2008). Indeed, investor expectations in surveys are often at odds with model-based estimates of the cost of equity (Greenwood and Shleifer 2014) and managers are often taught simplifying assumptions (like a constant risk premium, Cochrane 2011). The cost of debt is easier to calculate, but still needs to be estimated based on bond prices and assumptions about default risk. As a result, firms' perceived cost of capital may differ from their financial cost of capital. The perceived cost of capital is the financial cost of capital plus a "cost of capital wedge," υ:

$$r_t^{\text{per.}} = r_t^{\text{fin.}} + \upsilon_t. \tag{3}$$

Second, firms need to decide how to incorporate their perceived cost of capital into their discount rates. Firms can set their discount rates relatively freely, in particular if they have market power in output markets. In contrast to the stylized view, firms may choose to incorporate a range of other factors apart from the perceived cost of capital into their discount rates. Examples of such factors include beliefs about value creation, risk, and financial constraints, as we detail in Section 7. We define the "discount rate wedge," κ_t, as the difference between the discount rate and the perceived cost of capital:

$$\delta_t = r_t^{\text{per.}} + \kappa_t \tag{4}$$

$$= r_t^{\text{fin.}} + \upsilon_t + \kappa_t. \tag{5}$$

The discount rate may thus differ from the financial cost of capital both because of the cost of capital wedge and the discount rate wedge. This paper analyzes both wedges but focuses mostly on the properties and economic consequences of κ_t.

2 Measurement

We construct a new dataset that measures firms' discount rates and their perceived costs of capital, equity, and debt. Importantly, we combine these figures with measures of the financial cost of capital and firm investment, allowing us to shed light on how firms' internal decisions comove with financial markets and real outcomes. We summarize our method here, with details in Appendix C.

2.1 Data from Conference Calls

Our measurement relies on information provided by managers during corporate earnings calls, investor conferences, and similar events, which we jointly call "conference calls." The majority of listed firms participate in one or multiple conference calls every quarter, so that managers can inform financial analysts, investors, and other observers about the firm's strategy (Frankel et al. 1999, Hassan et al. 2019).

Conference calls are high-stakes settings where managers have incentives to report accurate values. For one, analysts and investors often compare the discount rates and cost of capital given on the calls to accounting figures (such as estimates of the cost of capital or investment returns), forcing managers to present plausible values. In addition, since the calls are held regularly, analysts can compare reported discount rates to subsequent investment decisions and financial performance metrics, again incentivizing managers to report truthful numbers. Statements from conference calls are often used as evidence in securities lawsuits, underscoring that managers are held to statements made on the calls (Rogers et al. 2011). Several of our analyses below will confirm that the reported values are meaningful, for instance, that discount rate changes of individual firms predict changes in investment and that changes in the financial cost of capital are reflected in firms' perceived cost of capital.

We download all transcripts of conference calls for the period January 2002 (the first available month) to September 2021 from the Thomson One database and identify paragraphs that contain at least one keyword as well as one of the terms "percent," "percentage," or "%."[13] Details on the data extraction are in Appendix C.

It is difficult to train an algorithm to recognize discount rates and the perceived cost of

[13]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, IRR.

capital from managers' transcripts, as context and background are of the essence. Instead, we rely on manual data entry. We trained a team of research assistants to identify and record the relevant figures from the text. Over the course of roughly 2.5 years, the team read 74,000 distinct paragraphs.

2.2 Identifying Discount Rates and the Perceived Cost of Capital in Conference Calls

In practical usage, a firm's discount rate is the minimum internal rate of return (IRR) that the firm is willing to accept on its investments (often called the "hurdle rate"), as explained in Section 1. Surveys among managers suggest that discount rates are set by top-level executives and then used to evaluate available investment projects throughout the firm (Graham 2022). As a result, discount rates influence firms' investment demand, conditional on the expected cash flow of projects available to the firm and measured in units of a financial rate. Even if managers identified a discount rate ex-post (e.g., to justify how they selected investment projects), the discount rates reported on calls would still capture this notion of firm investment demand.

We only record a discount rate if managers explicitly state their required minimum rate of return on projects as part of an investment rule. There are two types of terminology that allow us to identify discount rates. First, managers often state the required IRR for future investment projects. Second, managers sometimes define a discount rate by mentioning their perceived cost of capital and a required return premium, which is added to the perceived cost of capital. In addition to discount rates (required IRRs), we also separately record realized IRRs (when managers talk about the ex-post performance of projects) and expected IRRs (when managers predict future performance without describing an explicit required rate). These cases are distinct from discount rates and by recording them separately, we ensure that we do not confuse them with required rates.

To measure the perceived cost of capital, we study paragraphs where managers explicitly state their cost of capital (or costs of debt and equity). These figures come from firms' internal calculations, potentially relying on asset prices and interest rates. We also consider abbreviations (e.g., WACC) and synonyms (e.g., required return on equity) as long as managers clearly relate them to financing costs. To ensure that we differentiate discount rates and the perceived cost of capital from other financial figures, we also separately record a range of additional variables, such as required, expected, and realized returns on assets and on invested capital.

2.3 Practical Measurement Guidelines

To illustrate our measurement approach, consider the example of the Nasdaq 100 firm Intuit in the first quarter of 2014:

"We continued to take a disciplined approach to capital management (...). Our weighted average cost of capital is about 9 or 9.5 percent (...). Our IRR hurdle is a 15 percent rate of return."

From this paragraph, we record that Intuit's discount rate was 15 percent and its perceived cost of capital was 9.25 percent. Earlier on the same call, the firm said that it was only "investing in opportunities that yield 15 percent-plus." This last sentence on its own would not have been precise enough for our dataset because it does not specify that the return is a required, as opposed to expected, IRR.

We generally record only contemporaneous measures stated by firm managers and exclude figures that are historical, speculative, or posited by outsiders. The majority of firms use only one discount rate, but some firms mention more than one type of discount rate, for example, varying by country. We record the type of discount rate that represents the majority of the firm's operations (e.g., the US discount rate for a firm with operations mainly in the US). We consistently record the same type of discount rate throughout all time periods where we observe a firm.[14] We restrict the data collection to figures representative of the firm overall (e.g., we do not include interest rates for just one bond issuance). Managers mostly discuss their after-tax discount rate and cost of capital. We convert the very few pre-tax observations into after-tax values (see Appendix C.3 for details).

To achieve high quality and consistency across research assistants, we had weekly team meetings where we discussed specific paragraphs. Moreover, all paragraphs were read by at least two separate research assistants. All outlier observations (in levels and changes) for discount rates were checked by hand by the authors.

[14] According to the stylized view, all types of discount rate should move one-to-one with the financial cost of capital.

2.4 Measuring the Financial Cost of Capital

The financial cost of capital is the weighted average cost of debt and equity (equation 2). The cost of debt is the expected return to investors holding the firm's debt, adjusted for tax benefits of debt. The cost of equity is the return that shareholders require for holding the firm's equity (i.e., the expected return on the firm's outstanding shares in financial markets). We estimate two measures of the financial cost of capital, one at the country level and one at the firm level.

2.4.1 Financial Cost of Capital at the Country Level

We estimate the expected equity return at the country level using the balanced growth model. For each country in our sample, we calculate average five-year earnings (based on all firms listed in the country) and compare the trailing five-year earnings to total market capitalization to obtain the earnings yield. In the US, we use the inverse of the CAPE ratio maintained by Robert Shiller as the earnings yield. We shrink the earnings yield towards the time series mean in each country outside the US by a shrinkage factor of 0.5. In the balanced growth model, long-run expected equity returns are:

$$r_t^{\text{equity, country}} = \frac{E_t[\text{Earnings}_{t+1}]}{\text{Price}_t} + g_t. \tag{6}$$

We approximate g_t as 2 percent plus average inflation over the last ten years.[15] We approximate the cost of debt using the long-run (ten-year) yield on government debt from the OECD and assuming a tax rate of 20 percent.

The country-level financial cost of capital is then the average cost of debt and equity, weighted by average leverage in the country.

2.4.2 Financial Cost of Capital at the Firm Level

We use the Capital Asset Pricing Model (CAPM) to estimate the firm-level cost of equity. While the CAPM model does not fully explain long-run expected stock returns (Fama and

[15] Ideally we would use expected inflation in this calculation. In the US, one can use break-even inflation as a measure of expected inflation, but such measures are not available for all countries in our sample. Using past 10-year inflation as a proxy for future inflation is common practice (e.g., the definition of Excess-CAPE by Robert Shiller). We shrink inflation towards the cross-country conditional mean with a shrinkage factor of 0.5.

French 1992), it is the model that practitioners use most commonly. The model says:

$$E_t^{\text{CAPM}}[r_t^{\text{equity, firm}}] = r_t^f + \beta_t^{\text{firm}} \lambda_t, \tag{7}$$

where r_t^f is the risk-free rate, β_t^{firm} is the market beta of the firm, and λ_t is the market risk premium. The market risk premium is the difference between $r_t^{\text{equity, country}}$ and the risk-free rate, which we take to be the short-term interest rate on government debt issued in the given currency.[16] We estimate market betas in rolling five-year regressions of weekly data.[17]

We measure the firm-level cost of debt as the weighted average cost of outstanding debt based on data from Capital IQ. For bond debt, we use the yield-to-maturity as the cost of debt, which is an upper bound on the cost of debt in case default is expected. We calculate yield-to-maturity by matching firms' bonds from Capital IQ with yields from the Wharton Research Data Services bond database.[18] We assume a corporate tax rate of 20 percent.

3 Overview of the New Dataset

3.1 Summary Statistics

The new dataset contains a diverse set of listed firms, summarized in Panel A of Table 1. US firms, for which we observe at least one discount rate or perceived cost of capital, account for around 50 percent of total investment by US Compustat firms over the sample period, suggesting that the data have some relevance for the US macroeconomy. Similarly, firms with at least one reported discount rate or perceived cost of capital account for 50 percent of investment expenditures in our global sample.

Market value in the sample ranges from 342 million USD at the 5$^{\text{th}}$ percentile to 51,812 million at the 95$^{\text{th}}$. The total market value of firms in the data was 31.1 trillion USD in 2019, which covers 42 percent of aggregate market value in our dataset of advanced economies. The data include some of the world's largest corporations, including AT&T, Bank of America, Disney, Exxon, Home Depot, Intel, JPMorgan Chase, Mastercard, Nestle,

[16] For EU countries, we use the short-term rate on German government debt.

[17] The use of weekly data is common among practitioners but differs from the practice in asset pricing research, where betas are often estimated using monthly data over five-year horizons. We follow Frazzini and Pedersen (2014) and shrink betas towards the cross-sectional mean of 1. We use a shrinkage factor of 0.5. We use weekly data as this is more common among practitioners.

[18] If we cannot find information on the cost of debt from Capital IQ, we use interest expenses over the sum of short- and long-term liabilities from Compustat as the cost of debt.

Novartis, UnitedHealth, and Visa.

The data contain roughly 2,700 observations on discount rates, 2,700 on the perceived cost of capital, 4,800 on the perceived cost of debt, and 400 on the perceived cost of equity (see Table 1). The sample includes around 2,500 unique firms with at least one of these observations in the dataset. The perceived cost of capital is distributed fairly symmetrically around a sample mean of 8.4 percent, while discount rates are more dispersed around a sample mean of 15.7 percent (Figure 1).

We plot the raw averages reported by US firms by year in Figure 2. The average perceived cost of debt has trended downward since 2002, in line with the secular decrease in the financial cost of debt and interest rates over this period. The average perceived cost of capital has also trended downward, in line with the falling financial costs of debt and equity. Average discount rates do not display a clear secular trend but fluctuate more over time. We will formally study changes over time in Sections 4 and 5, where we focus on within-firm changes to ensure that differences in sample composition across years cannot bias the estimates.

3.2 Representativeness

Before progressing to our main analyses, we assess how similar firms in the dataset are to other firms in Compustat.[19] We first measure the percentile rank (for different firm characteristics) of each firm in our sample relative to other Compustat firms in the same year and country. We then calculate the average percentile rank of firms for three different subsamples of our dataset. If the average characteristic of firms in a sample were similar to the Compustat population in the same year-country bin, the average rank in the sample would be close to 50. The results, reported in Panel A of Table 2, suggest that this is true for many of the characteristics we consider.

The main dimension along which the sample is not fully representative is firm size. The firms in our data are relatively large, as their average market value rank is 83 in the discount rate sample. The unconditional probability of a Compustat firm being in our sample is roughly 3 percent, while it is roughly 50 percent for the 100 largest firms in Compustat. The selection of large firms is likely driven by the fact that conference calls are more common among large firms. The other metric along which the sample is not fully representative is financial constraints. The firms in our data are generally less constrained than the average

[19] Surveys suggest that 80 to 90 percent of large firms use discount rates to make investment decisions (Trahan and Gitman 1995, Graham 2022).

firm (average rank of 20 in the discount rate sample). This result is driven by the negative relation between size and financial constraints (Hadlock and Pierce 2010).

On average, firms in our discount rate sample do not seem to be unusually distressed as they do not exhibit high bankruptcy risk (Z-score rank of 48), low investment rates (rank of 54), or low profitability (return on equity rank of 60).

We also do not find evidence that firms systematically disclose discount rates in bad states of the world. Panel B of Table 2 reports results of firm-level panel regressions where the outcomes are indicator variables (scaled by 100) for whether a firm mentions a particular variable in a given quarter. In column 1, we regress an indicator for whether we observe a discount rate in a quarter on the contemporaneous Z-score, a measure of bankruptcy risk (measured in country-year percentile ranks). We include firm and year fixed effects, so that we analyze only variation within firms over time. The coefficient on the Z-score is insignificant and implies that the probability of observing a discount rate increases by 0.08 percentage points in the extreme hypothetical case where bankruptcy risk falls from the highest to the lowest value observed in the country-year bin. In column 2, we find small and insignificant coefficients on several other firm characteristics (some of which are components of the Z-score). Similarly, there is also no evidence that characteristics are different when we observe a perceived cost of capital, as shown in columns 3 and 4. In column 6, we report that we are significantly more likely to observe a perceived cost of debt when leverage is high, relative to the firm's average. This finding is consistent with the fact that the cost of debt is more important to firms at times of high leverage. The coefficient on the return on equity in column 6 is also significant but smaller, indicating a positive but weaker relation between the return on equity and observing a perceived cost of equity or debt.

Overall, the results suggest that the sample is representative of the Compustat population along most dimensions, with the exception of firm size.

3.3 Discount Rates, Overhead Costs, and Realized Returns

The raw average discount rate in the new dataset is 15.7 percent, which is close to the averages in previous surveys (Poterba and Summers 1995, Jagannathan et al. 2016, Graham 2022). These discount rates represent firms' minimum required returns on investment (see Section 1). It is therefore natural to expect that discount rates should be similar to, or smaller than, firms' realized returns. On average, however, firms appear to earn returns below this level. The accounting measure of the average return, the return on invested capital (ROIC), is 13.5 percent in Compustat US over our sample period, as shown in Panel B of Table 1.[20] A long-standing puzzle in the literature is how to reconcile high reported discount rates with relatively low accounting measures of average returns.

We find that this puzzle can be explained by how firms incorporate overhead costs in their capital budgeting decisions. The textbook recommendation is that firms should include all costs, including overhead costs, in the cash flows of their NPV analysis when considering a new project. If firms do so, the reported discount rates indeed represent the minimum net returns to the firm (in terms of an IRR) of undertaking a new project. However, the conference calls reveal that many firms do not include all overhead costs in their NPV analyses, which implies that the project's IRR is no longer the net return to the project. In particular, some firms report discount rates that "exclude a corporate overhead allocation" (Hovnanian Enterprises, Q2-2012), while other firms explicitly refer to "IRRs after allocating corporate overhead" (Lottomatica Q1-2006). Total overhead includes, for example, the costs to the headquarters associated with planning, administering, and marketing a new retail store. Total overhead (SG&A) in Compustat amounted to 30.7 percent of invested capital, suggesting that the allocation of overhead can substantially affect the level of returns and discount rates.

To measure the impact of overhead on the level of discount rates, we first define a discount rate for cash flows that account for all corporate overhead costs of firm i at time t: δ_t^i. In comparison, we define $\tilde{\delta}_t^i$ as the discount rate that we observe on conference calls. If the firm accounts for all overhead cost in the cash flows, then $\delta_t^i = \tilde{\delta}_t^i$. However, in general, if a firm excludes certain overhead costs from its cash flows and instead adds o^i to its discount rate, then:

$$
\begin{aligned}
\tilde{\delta}_t^i &= \delta_t^i + o^i && (8)\\
&= r^{\text{fin.}}{}_t^i + \upsilon_t^i + \kappa_t^i + o^i && (9)\\
&= r^{\text{fin.}}{}_t^i + \upsilon_t^i + \tilde{\kappa}_t^i, && (10)
\end{aligned}
$$

where $0 \leq o^i < 1$ and $\tilde{\kappa}_t^i = \kappa_t^i + o^i$ is the observed discount rate wedge (i.e., the difference between observed discount rate $\tilde{\delta}_t^i$ and the perceived cost of capital).

Using the full call transcripts, we identify cases where we are certain that the observed discount rates fully account for corporate overhead (i.e., where $o^i = 0$). This is the case

[20] The return on total assets is not comparable to the discount rate because it includes non-invested capital (e.g., cash) among the assets in the denominator.

for 15 percent of the observed discount rates. The average discount rate in these cases is 11.4 percent, as reported in Panel B of Table 1. Once accounting for corporate overhead, the average discount rate is thus notably below the accounting return on invested capital, consistent with discount rates accurately capturing firms' required returns.[21]

In our measurement, we are careful to record the same type of discount rate for each firm across all time periods. Our approach is helped by the fact that managers and analysts often explicitly discuss changes in discount rates with respect to a previous conference call. Hence, the firm-specific overhead fraction o^i is constant across observations of the same firm in the dataset. Much of the analysis in this paper focuses on within-firm changes in discount rates and wedges where we difference out the overhead fraction used by each firm. As a result, most findings are unaffected by what type of discount rate each firm reports and we can use the observed discount rates $\tilde{\delta}_t^i$ and wedges $\tilde{\kappa}_t^i$ in most of our analyses. In the two subsections where the level of discount rates plays a role, we control for differences between firms accounting for all overhead costs and other firms (in Sections 6.2 and 7.4).

We carry out a separate analysis to evaluate whether the reported discount rates are related to realized returns. As part of our data collection, we also record realized returns (IRRs) for individual projects reported by firms. We find that discount rates strongly predict future realized returns in an untabulated regression: a firm whose discount rate is 1 percentage point higher in a given year reports realized returns in subsequent years that are on average 0.97 percentage points higher (standard error: 0.13). We find similar results when controlling for year fixed effects and for whether firms account for overhead or not. This finding is consistent with the fact that analysts and managers often reference discount rates reported in the past when discussing realized returns of projects, implying that analysts and managers believe that discount rates need to be earned. Overall, the results of this subsection imply that discount rates actually are required returns.

[21] The literature has discussed whether discount rates are high because managers correct for excessively optimistic cash flow forecasts through higher discount rates. Our analysis does not exclude this possibility but shows that it is not necessary to explain the level of discount rates. In principle, discount rates could also be elevated above realized returns if managers account for taxes by using higher discount rates. However, as almost all firms report after-tax discount rates, taxes are unlikely to matter in our sample (see Appendix C.3).

4 Dynamics of Discount Rates and the Cost of Capital

In this section, we study the dynamic relation between the financial cost of capital, the perceived cost of capital, and discount rates. The stylized view assumes that these objects move in parallel. We analyze the extent to which this view holds by tracing within-firm variation in these objects over time.

4.1 The Perceived and the Financial Cost of Capital

We first analyze the relation between the perceived and financial cost of capital. We use two measures of the financial cost of capital (calculated in Section 2.4), one at the country level and one at the firm level. The firm-level measure is estimated using the CAPM, which is the standard approach taught to practitioners.

The perceived cost of capital, on average, comoves with the financial cost of capital. In columns 1 and 2 of Panel A of Table 3, we regress the firm-level perceived cost of capital on the country-level measure of the financial cost of capital. We include country fixed effects in column 1 and firm fixed effects in column 2, so that the variation stems entirely from country-level, time-series fluctuations in asset prices and interest rates.[22] The slope coefficients are around 0.8, implying that firms on average increase their perceived cost of capital by 0.8 percentage points when our estimated country-level financial cost of capital rises by 1 percentage point. In columns 3 and 4, we consider our firm-level measure of the financial cost of capital on the right-hand side. The point estimates decrease slightly to 0.7 (using country fixed effects) and 0.5 (using firm fixed effects). In columns 5 and 6, we study how variation in the financial costs of debt and equity is incorporated in the perceived cost of capital. We find that firms incorporate the two to a similar degree.

The slope coefficients in Panel A of Table 3 are slightly below the prediction of the stylized view (i.e., slope coefficients of 1). However, we cannot rule out that this deviation arises because of measurement error. In particular, if we are measuring the true financial cost of capital with error, there may be attenuation bias in the slope coefficients. When studying the evolution of discount rates in the upcoming section, we will introduce a two-stage methodology that is robust to concerns about attenuation bias.

While the average perceived cost of capital moves closely with the estimates of the financial cost of capital, many firms substantially deviate from this rule. This can be seen

[22] We do not include time fixed effects in these specifications, since much of the variation in the financial cost of capital is driven by common changes over time.

from the low within-firm R^2 in Panel of A of Table 3, which is around 0.1. Unlike the slope coefficients, the low R^2 cannot be easily explained by measurement error. Consider, for instance, column 3. The estimated slope coefficient is 0.7 and the $R^2 = 0.13$. If the true slope coefficient were 1 and the deviation were only due to classical measurement error, the true R^2 would be below 0.2, which is still far from 1. Instead, the low R^2 suggests substantial firm-level heterogeneity in the dynamic incorporation of the financial cost of capital. This heterogeneity may arise, for instance, because firms use richer models than the CAPM to calculate their perceived cost of capital (see Gormsen and Huber 2023 for additional analysis of which models are used by firms). It may also arise from firm-level beliefs or mistakes about the financial cost of capital, as captured by υ, that cancel out in aggregate.

We also study how firms change their perceived costs of debt and equity over time. In Panel B of Table 3, we find that measures of the financial cost of debt (country-level long-term rates and firm-level interest expenses) predict the perceived cost of debt. Measures of leverage and beta do not have significant coefficients (controlling for firm fixed effects). In Figure 3, we plot the perceived cost of equity along with three estimates of the financial cost of equity. Two of these are based on Shiller's CAPE ratio measure and the other assumes a constant risk premium of 6 percent. The average perceived cost of equity moves over time with the CAPE ratio measures.[23] It is most closely aligned with the estimate that has a bullish expected growth rate of 6 percent. Overall, the results are consistent with firms incorporating fluctuations in both cost of equity and cost of debt into their perceived cost of capital.

Taken together, firms on average incorporate fluctuations in the financial cost of capital, but there is substantial heterogeneity in the dynamics of the perceived cost of capital, potentially reflecting differences in beliefs or mistakes. As an example of such behavior, we quote a conference call of IAG (the parent company of British Airways and Iberia). The CFO describes how IAG increased its perceived cost of equity in response to the European sovereign debt crisis in 2011 (and the associated increase in the financial cost of capital). However, as of 2014, IAG was still keeping its perceived cost of capital at this high crisis level, even though the financial cost of capital had fallen. This behavior has implicitly raised IAG's cost of capital wedge υ (difference between perceived and financial cost of capital):

IAG, Enrique Dupuy, CFO, Q4-2014: *"We are still keeping a cost of capital of 10 percent*

[23]Consistent with this result, Dahlquist and Ibert (2023) also find that sophisticated investors have long-run expectations that comove with the CAPE measure over time.

and this is getting very conservative (...) We had to make a fine tuning exercise through the crisis in Spain and Europe a couple of years ago (...) and we increased the figure to this 10 percent level. But (...) the 15 percent cost of equity, it appears to have a big, big premium there. Maybe those figures could be brought down slightly so 10 percent, we are keeping it there as a reference." [edited for ease of understanding]

4.2 Discount Rates and the Perceived Cost of Capital

We examine how discount rates move with the perceived cost of capital in Table 4. Our initial analysis uses only observations where firms report both their discount rate and perceived cost of capital in the same quarter. In column 1, we conduct a cross-sectional analysis where we regress the discount rate on the perceived cost of capital, including country fixed effects. We find that firms whose perceived cost of capital is 1 percentage point higher have a discount rate that is 0.7 percentage points higher. The estimate is 0.4 when adding firm and year fixed effects in columns 2 and 3, which means that we only use dynamic variation within firms and within year. The estimate implies that when a firm's perceived cost of capital increases by 1 percentage point, relative to other firms in the same year, the firm raises its discount rate by 0.4 percentage points more. We strongly reject that the slope is 0 or 1.

In columns 4 to 6, we use a two-stage estimation approach, in which we predict the firm-level perceived cost of capital in a first-stage regression and then use the predicted values on the right-hand side in a second stage. This approach serves two purposes. First, it is immune to attenuation bias that would arise in the case of classical measurement error in the perceived and financial cost of capital. Second, it allows us to study the relation between discount rates and the perceived cost of capital for all firms for which we observe discount rates, as opposed to only the firms for which we observe discount rates and the perceived cost of capital in the same quarter.

We predict the perceived cost of capital using a standard lasso procedure. The procedure constructs the optimal estimate of the perceived cost of capital based on the variables that determine the financial cost of capital. We allow the procedure to choose between the following inputs: the equity risk premium, beta, short- and long-term risk-free rates, the financial cost of debt, and leverage. We allow for interactions between beta and the equity risk premium to capture that changes in the equity premium should influence the cost of capital more strongly for firms with higher betas. The lasso procedure predicts the perceived cost of capital with an R^2 of 15 percent, close to 50 percent better than the simple financial cost of capital used in Table 3.

The results of the two-stage procedure are in columns 4 to 6. We find similar point estimates as in columns 1 to 3. Without firm fixed effects, the slope coefficient is around 1.1 and thus slightly higher than the previous specification. With firm and year fixed effects, the slope coefficients drop to around 0.3, which is slightly below the previous specification. The slope coefficients remain statistically different from 0. The within-R^2 in columns 4 to 6 is lower than in columns 1 to 3 because we use a predicted regressor.

The results imply that firms do not move their discount rates one-to-one with their perceived cost of capital. In columns 2 and 3, we can reject a slope of 1 in all specifications. In the two-stage regressions of columns 5 and 6, the p-values also reject the slope of 1, although these two p-values need to be interpreted with caution because the two-stage estimation procedure does not account for noise induced by the predicted regressor, so we technically cannot reject a slope of 1.

The remainder of this subsection sheds light on the drivers of the imperfect transmission of the perceived cost of capital into discount rates. We first address the frequency at which discount rates are updated. Figure 4 plots the share of firms that have changed their discount rate since the first time we observe a discount rate for the same firm. After a year, around 80 percent of firms still have the same discount rate. After ten years, over 40 percent have still not adjusted. This finding is consistent with the survey evidence in Graham (2022). In contrast, around 40 percent of firms have an unchanged perceived cost of capital after a year and only 5 percent have the same perceived cost of capital after ten years.

In addition, we find that, conditional on adjusting, firms move their discount rates with their perceived cost of capital, but still only partially. We regress the change in the discount rate (relative to a firm's last observed value) on the change in the predicted perceived cost of capital over the same period. The coefficient is 0.67 (significant at 10 percent) for firms that had a non-zero change in their discount rate. Hence, firms that change their discount rate move it on average by two-thirds of the change in the perceived cost of capital.

The results suggest that firms are aware of changes in their cost of capital, but at the same time consciously introduce time-varying discount rate wedges. Conference call statements support this conclusion. One-quarter of firms that report a discount rate in a given quarter also discuss their cost of capital in the same quarter. The following quote by a Russell 1000 CFO is a typical example:

Premier, Craig McKasson, CFO, Q1-2017: *"We obviously, with changing markets, will al-*

ways reassess and evaluate what our weighted average cost of capital is and whether that return hurdle needs to change."

In addition, the following quote by a Fortune 500 CFO is a typical example of partial incorporation:

Spectra Energy, John Patrick Reddy, CFO, Q3-2014: *"We didn't lower our hurdle rates (...) all the way down with long-term rates (...) We are still looking at returns of, say, 10 percent, on average for our projects."*

A final insight is that changes in discount rates are more dispersed than changes in the perceived cost of capital. The raw averages of Figure 2 already hint at this wider dispersion. We document this fact more directly by using within-firm data in Figure A1. The figure plots histograms of annualized changes in discount rates (in Panel A) and in the perceived cost of capital (in Panel B), relative to each firm's first observed value of the respective object. By annualizing, we ensure that changes over different horizons are comparable. The pattern implies that, once firms adjust their discount rates, the changes cannot be fully explained by previous or contemporaneous changes in the perceived cost of capital. Instead, discount rates have "a life of their own" and are partially driven by other factors, which we analyze in Section 8.

In sum, the combination of infrequent changes in discount rates, partial incorporation conditional on changing, and more extreme movements in discount rates implies that the average discount rate partly comoves with the perceived cost of capital, but far less than the one-to-one mapping implied by the stylized view.

4.3 Time-Varying Discount Rate Wedges

A key implication of the partial comovement of the perceived cost of capital and discount rates is that the discount rate wedge $\tilde{\kappa}$ (difference between discount rate and perceived cost of capital) varies over time. We analyze the time series behavior of $\tilde{\kappa}$ in the US by controlling for time-invariant variation across firms. To do so, we first regress firm discount rates on year and firm fixed effects (using all observations of US discount rates). We measure the average "within-firm" discount rate in every year by adding the year fixed effect to the unconditional mean. We follow an analogous procedure to create the average "within-firm" perceived cost of capital in every year (using all observations of the perceived cost of capital in the US). The difference between the two series is the average "within-firm" discount rate wedge $\tilde{\kappa}$.

We plot the within-firm $\tilde{\kappa}$ in Figure 5 as a three-year moving average. The wedge has increased by roughly 2.5 percentage points between 2002 and 2021. This is a large change relative to historical movements in expected stock returns, interest rates, and policy rates. Much of the secular increase since 2011 is driven by the fact that the perceived cost of capital has fallen while discount rates have remained relatively more stable. The remaining parts of the paper study the consequences and drivers of this variation in discount rate wedges.

5 Dynamics of Discount Rate Wedges and Investment

In this section, we show that discount rates and discount rate wedges predict future investment. The findings imply that discount rates and wedges, as observed in the conference calls, accurately capture an important component of firm investment demand.

To motivate the analysis, we first plot the average discount rate in the US, as measured in the conference calls, against aggregate net investment in the following year, as measured in the US national accounts. Figure 6 shows strong comovement between discount rates and investment, suggesting that the measured discount rates may have some relevance for the aggregate economy. Since aggregate data do not allow us to investigate the mechanisms underlying this comovmenent in detail, we turn to firm-level data.

Table 5 reports regressions of firm-level net capital investment one year ahead on firm-level discount rates and wedges. A 1 percentage point increase in the discount rate lowers the investment rate in the following year by 0.9 percentage points, as shown in column 1. The coefficient is robust to adding year fixed effects in column 2. We test whether discount rate wedges on their own also predict investment in columns 3 and 4. Indeed, both the discount rate wedge (conditional on the perceived cost of capital) and the sum of discount rate and cost of capital wedges (conditional on the financial cost of capital) are associated with lower investment. In column 5, we report that the coefficient on the discount rate is not driven by the perceived and financial cost of capital or Tobin's Q.

We show in Appendix D.3 that the estimates are quantitatively consistent with a standard Q-model that allows for wedges and is calibrated using the assumptions in Philippon (2009). The model predicts a slope coefficient of -1, close to our estimates.

The relation between investment and discount rates is stable across different types of firms. In Figure 7, we plot point estimates and 90 percent confidence intervals for the slope coefficient on the discount rate, estimated on different subsamples of firms. We define the subsamples by splitting the sample at the median for different characteristics (bankruptcy risk, market power, financial constraints, risk, return on equity, size, leverage). All estimates are of similar magnitude to the baseline effect and statistically different from zero. The findings alleviate potential concerns that our results on investment are driven by certain subgroups of firms, such as highly distressed firms.

Our results suggest that discount rate wedges capture a component of investment demand that is distinct from other financial channels. In Table A3, we report that the coefficient on the wedge is robust to individual components of the financial cost of capital, including the credit spread, the risk-free rate, the financial cost of equity, Tobin's Q, and return on equity. Consistent with previous work (Gilchrist and Zakrajšek 2012, López-Salido et al. 2017), we find that the credit spread and Tobin's Q are significantly associated with changes in investment, suggesting that the credit spread and Tobin's Q capture parts of the financial cost of capital that are relevant for investment.

Changes in cash flow expectations also drive investment, as shown by a large literature (Cummins et al. 2006, Greenwood and Hanson 2015, Gennaioli et al. 2016). However, discount rates and wedges are a distinct channel from expectations. Using analyst expectations of earnings growth from the Institutional Brokers' Estimate System, we find that the effect of discount rates and wedges on investment remains stable when controlling for expectations. Overall, the results suggest that the measured discount rates accurately capture a component of firm investment demand, holding constant future expected cash flows.

The measured discount rates are not just relevant for investment in traditional property, plant, and equipment. We find that two other measures of investment, the change in total assets in Table A1 and net investment including intangibles in Table A2, also comove with discount rates and wedges. These findings suggest that discount rates and wedges shape many types of corporate investment.

6 Implications of Discount Rate Wedges

The results so far imply that wedges between the discount rates used by firms and the perceived cost of capital vary over time and affect firm investment. In this section, we argue that these discount rate wedges have broad implications for the link between financial prices and the real economy. We focus on the implications of wedges for two important real phenomena: the recent puzzle of "missing investment" in the US and the sensitivity of real investment to the cost of capital implied by a standard model.

The motivation for the "missing investment" analysis is a recent literature arguing that US investment has been low since 2002, relative to firms' profitability, market value, and the financial cost of capital. The argument is usually made using Q-theory. The decline in the financial cost of capital has increased firms' market value and thereby led to high and rising values of Tobin's Q. According to standard Q-theory, investment should have risen with Tobin's Q. However, if anything, observed investment rates have been low relative to historical standards, leading researchers to argue that there is "missing investment" (Furman 2015, Gutiérrez and Philippon 2017).[24]

We will argue that changes in discount rate wedges can account for a large part of the "missing investment" puzzle. Intuitively, the rising wedges imply that firms have been using increasingly higher discount rates than those assumed by standard Q-theory, which means that firms have been holding back increasingly more investment relative to what Tobin's Q would suggest. To make this point precise, we develop an "adjusted Q," which accurately captures firms' investment demand in the presence of discount rate wedges. Once accounting for the observed rise in discount rate wedges over time, we find that investment is close to the level predicted by the simple adjusted Q-model. This finding suggests that the secular increase in discount rate wedges may account for much of the decoupling between Tobin's Q and investment over this period.

6.1 An Adjusted Q-Model

To assess the magnitude by which discount rate wedges influence corporate investment, we introduce a modified version of the traditional Q-model. We change the standard Q-model along only one dimension, namely by allowing for wedges between discount rates and the financial cost of capital. This minimally invasive approach produces an "adjusted Q," which incorporates wedges and which can be compared to the standard Tobin's Q used in the literature on the missing investment puzzle.

In the adjusted Q-model, as in the standard Q-model, the firm chooses optimal investment I_t by maximizing the discounted value of future profits net of investment costs. In the

[24] The puzzle remains when accounting for intangibles and similar measurement issues (Philippon 2019), since increases in intangible capital account for 30 to 60 percent of the investment shortfall, depending on the exact measurement (Crouzet et al. 2022). Our findings address the remaining investment shortfall not explained by intangibles alone. Throughout this section, we use a measure of aggregate investment from the BEA that already accounts for intangibles. Our adjusted Q therefore captures wedges on both tangible and intangible investment.

standard Q-model, the firm and financial markets discount the firm's cash flows using the financial cost of capital $1 + r^{\text{fin.}}$. In contrast, in the adjusted Q-model, the firm discounts cash flows using $1 + \delta = 1 + r^{\text{fin.}} + \upsilon + \kappa$ (i.e., adding a cost of capital wedge and a discount rate wedge), whereas financial markets still discount using $1 + r^{\text{fin.}}$. In line with how firms operate in practice, we assume that, at any point in time, firms evaluate cash flows earned in different future periods using the same discount rate.[25] The firm's problem is thus:

$$V_0(\upsilon + \kappa, k_t) = \max_{I_t} \quad \sum_{t=0}^{\infty} \frac{\Pi_t(k_t) - I_t - \Phi(I_t, k_t, \xi)}{(1 + r^{\text{fin.}} + \upsilon + \kappa)^t} \tag{11}$$

$$\text{s.t.} \qquad k_{t+1} = I_t + (1 - \xi) k_t, \tag{12}$$

where $\Pi_t(k_t)$ is profits earned at time t using k_t units of capital, I_t is investment at time t, ξ is the depreciation rate of capital, and $V_t(\upsilon + \kappa, k_t)$ is the discounted value of the firm in the eyes of the manager at time t. The function $\Phi(I_t, k_t, \xi)$ represents adjustment costs, which are quadratic in net investment:

$$\Phi(I_t, k_t, \xi) = \frac{\phi}{2} \left(\frac{I_t}{k_t} - \xi \right)^2 k_t,$$

where $\phi \in \mathbb{R}^+$ governs the magnitude of adjustment costs. Analogously to a standard Q-model, optimal investment is:

$$\frac{I_t}{k_t} - \xi = \frac{1}{\phi}(q_t - 1), \tag{13}$$

where q_t is the Lagrange multiplier that captures the marginal value of capital to the firm:

$$q_t = \frac{1}{(1 + \delta)} \frac{\partial V_{t+1}(\upsilon + \kappa, k_{t+1})}{\partial k_{t+1}}.$$

The marginal value of capital q_t is not observed without additional assumptions. The literature usually follows Hayashi (1982) and assumes that the profit function is homogeneous of degree one in k_t. In this case, the marginal value of capital equals the average value of

[25] In theory, if firms expect discount rates to vary in future, they should apply different discount rates to cash flows earned in different future periods. In practice, few, if any, firms do so. To facilitate a precise mapping between the model and the empirically observed discount rates, we therefore follow firms' observed behavior and assume one discount rate.

capital, denoted Q_t:

$$q_t = \frac{1}{(1+\delta)} \frac{\partial V_{t+1}(\upsilon + \kappa, k_{t+1})}{\partial k_{t+1}} = \frac{1}{(1+\delta)} \frac{V_{t+1}(\upsilon + \kappa, k_{t+1})}{k_{t+1}} = Q_t. \tag{14}$$

We can thus measure q_t as the value of the firm's capital relative to its replacement value. We emphasize that $V_t(\upsilon+\kappa, k_t)$ is the value in the eyes of the firm and thus calculated using $r^{\text{fin.}} + \upsilon + \kappa$ as the discount rate. If $\upsilon + \kappa = 0$, such that the firm uses the financial cost of capital as its discount rate, we could estimate Q_t in financial markets using Tobin's Q, denoted by Q_t^{Tobin}. Otherwise, however, one must correct Tobin's Q to obtain the marginal value of capital in the eyes of the firm, as summarized in the following proposition.

Proposition 1 (Adjusted Q) *If the profit and adjustment cost functions are homogeneous of degree one in k_t, the shadow cost of capital on the balanced growth path is:*

$$Q^{\text{Adjusted}} = Q^{\text{Tobin}} \times \frac{1}{(\upsilon + \kappa) \times \text{Dur} + 1}, \tag{15}$$

where Dur is the duration of the firm's future cash flows calculated using $r^{fin.}$ as the discount rate. See Appendix D for derivations.

If the wedges sum to zero ($\upsilon + \kappa = 0$), we can approximate marginal q using Tobin's Q. Intuitively, when wedges are zero, the firm and financial markets use the same discount rate and therefore agree on the value of the profits produced by the capital. If the sum of the wedges is positive ($\upsilon + \kappa > 0$), we need to adjust Tobin's Q downward to correctly measure the marginal value of capital in the eyes of the firm (Q^{Adjusted}). Intuitively, if the firm uses a higher discount rate than the market, it puts a lower value on the profits produced by the capital than the market. The strength of the adjustment naturally depends on the magnitude of the wedges, but also on the duration of the cash flows. Indeed, it is well known that the impact of the discount rate on the value of an asset depends on the duration of the asset's cash flows, which is calculated as the weighted time to maturity of future cash flows. The longer the duration (i.e., the further into the future the average cash flow is earned), the larger the effect of the discount rate on the value of the asset. For this reason, the effect of wedges increases with duration.

6.2 Adjusted Q Accounts for "Missing Investment"

We can measure adjusted Q, given by equation 15, for the US using our new dataset. We calculate Tobin's Q using data on aggregate market value from the Flow of Funds (in the numerator) and data on tangible plus intangible capital from the BEA (in the denominator). We calculate adjusted Q by inserting the average discount rate wedge (κ) for every year in the adjustment factor.[26] We set the cost of capital wedge (υ) equal to zero for this exercise, so that the results are driven by wedges consciously introduced by managers and not by different perceptions about the financial cost of capital. We calculate that the average duration for listed firms over our sample is 20 years, based on the duration of Compustat firms' outstanding debt and equity (for equity, duration is approximated by the price-earnings ratio).[27]

Figure 8 plots Tobin's Q along with our new adjusted Q. Tobin's Q is well above 1 and rises throughout the sample. Standard Q-theory would therefore predict high and rising investment throughout the sample. In contrast, adjusted Q is closer to 1 and relatively stable. Adjusted Q thus corresponds more closely to the relatively low investment observed during this period.

We assess whether the variation in discount rate wedges and adjusted Q is large enough to account for missing investment. We use the method of Gutiérrez and Philippon (2017). We first estimate the relation between aggregate investment and Tobin's Q in the years 1990 to 2002. We then predict what investment since 2002 would have been if the relation between Tobin's Q and investment had remained constant. The difference between actual investment and predicted investment is "missing investment," the cumulative shortfall in investment since 2002 due to the decoupling between Tobin's Q and observed investment. The blue line in Figure 9 shows that this shortfall reached roughly 20 percent of the capital stock in 2019.

We repeat the exercise using adjusted Q. To estimate the relation between adjusted Q and investment in the pre-2002 sample, we need to measure the discount rate wedge before 2002. We exploit survey data from Poterba and Summers (1995) to estimate the discount rate wedge in 1990 and linearly interpolate between this 1990 estimate and our observed

[26] We calculate average κ in year t as the average of $\tilde{\kappa}$ minus the difference between the average discount rate (15.7) and the average discount rate including all corporate overhead cost (11.4). This adjustment affects the level of adjusted Q but not its evolution over time. For a full discussion of κ and $\tilde{\kappa}$, see Section 3.3.

[27] This method of calculating duration is a liability-based approach, focusing on the duration of the cash flows of outstanding debt and equity. It captures the duration of all future cash flows produced by the firm. When we use time-varying price-earnings ratios to calculate duration separately for every year, the divergence between adjusted and Tobin's Q shown in Figures 8 and 9 becomes more pronounced.

wedge in 2003.[28] The red line shows that the investment shortfall relative to adjusted Q is relatively smaller and close to zero. It is also not statistically different from zero, as shown in Table A4. Hence, the secular investment trend observed since 2002 is consistent with the evolution of adjusted Q but not with Tobin's Q.

The view that discount rate wedges have contributed to missing investment finds further support in the firm-level data. The estimate in Table A5 implies that a firm that has increased its discount rate wedge by more, relative to other firms, has experienced a stronger increase in its Tobin's Q. This finding suggests that firms with rising discount rate wedges have disproportionately contributed to the rise in aggregate Tobin's Q.

The results allow us to evaluate competing explanations for the missing investment. One potential explanation is that the marginal profitability of capital has decreased, so that firms have invested less because there are fewer profitable opportunities (Gordon 2018). An alternative explanation is that the gaps between required returns and the perceived cost of capital (i.e., discount rate wedges) have increased, so that firms have not seized existing opportunities that promise returns greater than the perceived cost of capital. Changes in marginal profitability and required returns are typically not directly observed, so it has been difficult to separate the explanations. Our new data reveal that discount rate wedges are sufficient to account for most of missing investment. In this sense, one may not need a large decrease in marginal profitability to explain low investment.

Taken together, the analysis suggests that the increase in discount rate wedges is large enough to account for a large part of missing investment in the 21st century. Understanding why discount rate wedges exist and why they have expanded in recent times is therefore likely to be fruitful for our understanding of the seemingly low investment in recent years. We study drivers of wedges in Sections 7 and 8.

The results on the discount rate wedge also contribute to the debate on whether changing rents or risk premia can explain the falling labor share in national income (Karabarbounis and Neiman 2014, 2019, Rognlie 2019). Growing discount rate wedges imply that firms are gaining rents, which suggests that the falling labor share is, at least in part, driven by rising rents. In contrast, firms perceive that their cost of capital has gone down, which supports

[28]Poterba and Summers report an average real discount rate of $\tilde{\delta}^{\text{real}} = 12.2$ percent in 1990, which is approximately 1.8 percentage points lower than the real discount rate we observe in 2003. We further estimate that the real financial cost of capital fell by approximately 0.5 percentage points between 1990 and 2003. Taken together, these estimates suggest that the wedge in 1990 was 2.3 percentage points lower than in 2003 (where we observe $\kappa = 3.2$ percent). These calculations assume that the overhead fraction in reported discount rates (o) has been constant over time. Consistent with low discount rate wedges around 1990, Summers (1986) documents an average real discount rate of 10 percent in 1986.

the view that changes in risk premia have not fully offset decreases in risk-free rates (Farhi and Gourio 2018).

6.3 Wedges Lower the Sensitivity of Investment to the Financial Cost of Capital

Going beyond the missing investment puzzle and factor shares, the behavior of discount rate wedges generally affects the sensitivity of investment to the financial cost of capital in standard models. This investment sensitivity matters for the real effects of a range of financial shocks in standard models (e.g., shocks to monetary policy, credit supply, asset prices, etc.). It also plays an important role in the calibration of macroeconomic models (e.g., see discussions in Koby and Wolf 2020 and Reis 2022).

We study how wedges impact the investment sensitivity in the model of adjusted Q. The effect of the financial cost of capital on net investment is:

$$\frac{\partial\left(\frac{I_t}{k_t}-\xi\right)}{\partial r^{\text{fin.}}}=\frac{\partial\delta}{\partial r^{\text{fin.}}}\times\frac{\partial\left(\frac{I_t}{k_t}-\xi\right)}{\partial\delta}=\frac{\partial\delta}{\partial r^{\text{fin.}}}\times\frac{-1}{\phi}\times\frac{\text{Dur}(1+\phi r^{\text{fin.}})-\phi}{1+\text{Dur}(\kappa+\upsilon)}. \tag{16}$$

See Appendix D.3 for the derivation of the second step.

Two channels dampen the investment sensitivity when wedges are positive: a partial transmission channel and a duration channel. First, the partial transmission channel operates through the ratio $\frac{\partial\delta}{\partial r^{\text{fin.}}}$, which measures how strongly firms transmit changes in the financial cost of capital into discount rates. As documented in Section 4, this transmission ratio is substantially smaller than 1, leading to a reduction in the investment sensitivity.

Second, to understand the duration channel, assume (counterfactually) that firms transmit changes in the financial cost of capital one-to-one into discount rates $\left(\text{i.e., } \frac{\partial\delta}{\partial r^{\text{fin.}}}=1\right)$. In this case, higher wedges would still affect the investment sensitivity because greater wedges mechanically reduce the duration of firms' cash flows. In turn, a shorter duration lowers the sensitivity of investment to movements in discount rates (and thus in the financial cost of capital) because discount rates are generally less important for cash flows with short duration. As a result, the duration channel further lowers the investment sensitivity.

We quantify how these two channels affect the sensitivity of investment to the financial cost of capital using our new data. We begin with a baseline case assuming the standard calibration of Philippon (2009), zero wedges, and perfect transmission (see Appendix D.3). The sensitivity in the baseline case is -2. To incorporate the duration channel, we allow for positive wedges but (counterfactually) assume that transmission is perfect (i.e., $\frac{\partial \delta}{\partial r^{\text{fin.}}} = 1$). We set the wedges equal to 6 percentage points, the difference between the average discount rate and an assumed financial cost of capital of 5.5 percent. This changes the sensitivity to -1. Next, we additionally incorporate imperfect transmission by setting $\frac{\partial \delta}{\partial r^{\text{fin.}}} = 0.2$, based on the transmission from the financial cost of capital to discount rates estimated in Section 4.[29] This leads to a sensitivity of -0.2. In sum, wedges affect the investment sensitivity by a factor of 10.

7 Cross-Sectional Drivers of Discount Rate Wedges

The final two sections of the paper study drivers of discount rate wedges. In this section, we describe theories that can account for wedges and we analyze cross-sectional regressions of wedges on firm characteristics. We find that market power, risk, and financial constraints are all associated with greater wedges in the cross-section of firms. In the subsequent Section 8, we will study how market power, risk, and constraints shape the evolution of wedges over time.

7.1 Market Power and Beliefs About Value Creation

There is a widespread belief among managers that discount rate wedges increase firm value. The main reason is that wedges help to ensure that firms earn marginal returns above their perceived cost of capital. This belief reflects a key principle of modern management: firms should be disciplined in their capital allocation and ensure that new investments do not destroy shareholder value (Jensen 1986). Business schools accordingly teach that the expected return on investments must at least equal the cost of capital and investors carefully monitor whether managers adhere to this principle. Given this culture, managers may fixate on earning returns above the perceived cost of capital. In addition, managers may prefer not to reduce their discount rates (even when the perceived cost of capital has fallen) because it may signal to investors that managers are becoming less disciplined in their capital allocation.

To understand whether managers indeed believe that positive wedges and stable discount rates increase firm value, we analyze the qualitative information provided on conference calls. We systematically categorize all statements where managers justify either why their discount

[29] The estimated transmission coefficient is roughly 0.7 from the financial to perceived cost of capital (in Table 3) and 0.3 from the perceived cost of capital to discount rates (in Table 4).

rate is above the perceived cost of capital or why they did not lower their discount rate with the perceived cost of capital. We find that 59 percent of firms argue that wedges and stable discount rates raise firm value because they guard against the return on any project falling below the cost of capital or because they guarantee higher returns to investors.[30] For example, the following quotes are taken from calls where managers have just stated that they have a positive wedge and illustrate managers' motivations.

Kinder Morgan, Kim Dang, CFO, Q2-2013: *"We do not do projects close to our cost of capital. (...) We're not going to take the risk that we have a project come in at or below our cost of capital."*

Lincoln National Corporation, Fred Crawford, CFO, Q3-2009: *"As a matter of being conservative in our approach, we've been hiking up those discount rates quite considerably."*

Ball Corporation, Scott Morrison, CFO, Q3-2015: *"We haven't changed the 9 percent [discount rate]. It's been 9 percent for a long time. In fact, sometimes we get the question, because our weighted average cost of capital is less than 6 percent now, so people have said: Well, why don't you lower the hurdle rate? And we look at this over the long term. On the correlation of value creation, the investors actually start getting paid when we get returns greater than our weighted average cost of capital."*

While managers believe that positive wedges and stable discount rates add value, these decisions come at a cost to profitability in standard, frictionless models. Positive wedges imply that firms require a marginal return to capital above the marginal cost of capital. As a result, firms with wedges violate the Lerner condition, leading to subpar output and profits. The violation of the Lerner condition is, however, less costly for firms with relatively more market power, for two reasons. For one, firms with more market power face more inelastic demand curves. They therefore have to reduce output and profits by less to obtain an equivalent increase in their marginal return (i.e., their discount rate). In addition, firms with more market power may face less scrutiny when they make subpar investment decisions because they make higher book profits on average and are unlikely to go bankrupt even when

[30] The total number of relevant calls (where managers explicitly explain why their wedge is positive or why their discount rate is stable) is 123. The second most common explanation after value is risk and uncertainty, discussed below, with 33 percent.

they do not optimize at the margin. This intuition is consistent with previous work arguing that firms with market power can more easily afford to make suboptimal decisions. For instance, a literature shows that some firms with market power pursue efficiency-enhancing investments only after they experience sudden reductions in their market power, even if the investments were optimal even before the shock (Holmes and Schmitz Jr. 2010). Taken together, firms with more market power may therefore choose greater discount rate wedges and may reduce their discount rates by less when the perceived cost of capital falls.

In Appendix E, we sketch a simple model that illustrates why firms with more market power may choose higher wedges due to their more inelastic demand. In that model, firms trade off two competing forces. On the one hand, we assume that firms value not just profits but also higher wedges. This assumption captures, in a reduced form manner, the managerial perception that wedges raise firm value. Through this channel, a higher wedge increases the perceived value of a given set of profits. This benefit of wedges is similar for firms with high and low market power. On the other hand, higher wedges reduce profits because they violate the Lerner condition. The associated reduction in profits is smaller for firms with more market power. On net, it is therefore optimal for firms with more market power to use higher wedges.

7.2 Idiosyncratic Firm Risk

The second theory is that firms add wedges to reflect firm-specific risk. A firm's cost of capital already captures the compensation for risk required by investors. However, there are a number of reasons why firms might incorporate risk into their discount rates over and above their perceived cost of capital. First, real option theory shows that when investment projects are risky and (fully or partially) irreversible, the optimal investment decision depends on the uncertainty of the cash flows (Abel 1983, Ingersoll Jr. and Ross 1992, Dixit and Pindyck 1994). The more uncertainty, the longer the firm should postpone investing. While in theory the optimal investment decision uses the financial cost of capital as discount rate, a firm can approximate optimal behavior by increasing its wedge in the face of uncertainty (McDonald 2000). To the extent that firms adopt such approximations, firms with more uncertain projects have higher wedges in the cross section.

Second, if a firm's new projects are systematically riskier than its current projects, the firm should use positive discount rate wedges when evaluating new projects. Third, if equity is mispriced, managers may want to adjust discount rates by incorporating corrected risk factors (Stein 1996). Finally, if certain investors are imperfectly diversified, it may be in their interest that the firm uses high discount rate wedges.

The 2020 Association of Finance Professionals Survey finds that close to half of respondents increase discount rates in the face of increased risk. Similarly, 33 percent of managers who justified a positive discount rate wedge on their conference call argue that a positive discount rate wedge is needed to account for risk. The following quote gives an example of such behavior:

Halyard Health Inc., Steve Voskuil, CFO, Q4-2016: *"So that's kind of how we come to the 9 percent [discount rate]. We start with the capital markets' rates and look at our capital structure, and then we add a little bit to that to reflect risk in the portfolio and execution."*

7.3 Financial Constraints

The third theory is that firms face constraints that are not included in standard NPV analyses and that firms add the shadow price of these constraints to their discount rates. For instance, Jagannathan et al. (2016) argue that firms facing organizational constraints include the shadow cost of managerial attention in their discount rates. Similarly, firms may face financing constraints, which means that firms cannot access additional capital and have to rely only on their own cash flows. The perceived cost of capital may not fully reflect such financing constraints because the standard calculation of the cost of capital relies only on required returns on firms' existing liabilities and does not incorporate discontinuous constraints. As a result, firms facing financing constraints may raise their discount rate above their perceived cost of capital.

This theory predicts that firms with more constraints are more likely to have higher discount rates and wedges. The following quote is from a firm whose discount rate exceeds its cost of capital. The quote illustrates how financial constraints can affect discount rates:

Kinder Morgan, Kim Dang, CFO, Q4-2016: *"We are living within our cash flow, meaning that we want to be able to fund our CapEx and our dividend from our cash flow. And so that is the constraint, and so, because we have a limited amount of capital, that is why we have the hurdle rate set at 15 percent IRR for projects."*

7.4 Testing Cross-Sectional Variation in Discount Rates and Wedges

The theories above predict that, in the cross section, firms with higher market power, risk, and financial constraints maintain greater discount rates and greater wedges. We measure firm-level market power using the accounting approach in Baqaee and Farhi (2020), risk using the one-year option-implied equity volatility, and financial constraints using the index by Hadlock and Pierce (2010). Since we are initially interested in cross-sectional variation, we include country and year fixed effects in the regressions. To be consistent with the analysis in Section 8, we average the regressors for the period 2000 to 2002.

In Table 6, the regressors are standardized, so the coefficients estimate the impact of a 1 standard deviation increase. We find that firms with greater market power have higher discount rates (column 1), higher discount rate wedges (column 2), and higher total wedges (discount rate and cost of capital wedge, column 3). The coefficients are statistically significant and economically large, implying a 1.1 percentage point increase in discount rate wedges from a 1 standard deviation increase in market power. We find similar results when we measure market power with the user-cost approach and the De Loecker et al. (2020) measure.

In addition, we find that riskier and financially constrained firms have statistically and economically higher discount rates and wedges. The result on risk is consistent with recent cross-sectional findings by Décaire (2021) and Barry et al. (2023).

8 Accounting for the Dynamics of Discount Rate Wedges

We next study drivers of time variation in wedges. We find that most of the increase in discount rate wedges since 2002 is driven by firms with high market power. We also find that changes in risk play a role in fluctuations in wedges.

8.1 The Secular Increase in Wedges and Market Power

Firms with more market power are less likely to adjust discount rates when the financial cost of capital falls, as explained in Section 7.1. Consistent with this argument, we find that firms with high market power have kept their discount rates steady in recent decades, while firms with low market power have decreased their discount rates as the financial cost of capital has fallen.

We first illustrate this finding using a simple sample cut. We split the sample into two groups based on firms' average market power between 2000 and 2002 according to the accounting approach. We calculate the average discount rate in each year separately for each group. We do so in firm-year panel regressions that include firm fixed effects, such that the results are driven by within-firm variation in discount rates (as in Section 4.2).

Figure 10 plots the resulting time series of discount rates for the high- and low-market power groups (as three-year moving averages normalized to zero in 2002). Discount rates of firms with high market power have been relatively stable since 2002 and, if anything, have increased slightly, even though the financial and perceived costs of capital have trended downward over this period. In contrast, discount rates of firms with low market power have fallen. These patterns are consistent with the view that competitive pressures force firms to adjust discount rates with decreases in the cost of capital.

We test these dynamics formally in Table 7. We regress firm-level discount rates and wedges on a series of interaction terms. We include firm fixed effects so results are again driven by within-firm variation in discount rates and wedges over time. We first interact market power with a time trend. The results show that firms with higher initial market power (averaged over 2000-2002) increased their discount rate (column 1) and their wedges (columns 4 and 7) by significantly more between 2002 and 2021. The point estimate implies that a standard deviation increase in market power is associated with a 2.5 percentage point increase in the discount rate wedge over the sample (coefficient of 0.13*19 years).

We next interact market power with the country-level average perceived cost of capital, finding that firms with higher market power reacted significantly less to changes in the perceived cost of capital (columns 2, 5, and 8). The magnitude is such that a firm whose market power is 1 standard deviation higher incorporates a percentage point shock to the perceived cost of capital by 0.5 percentage points less. The interaction of market power with the predicted firm-level perceived cost of capital also supports this conclusion, although estimates are less precise because of the estimated cost of capital (columns 3, 6, and 9). In Tables A6 and A7, we find similar results when we measure market power with the user-cost approach and the De Loecker et al. (2020) measure.

We carry out additional tests in Table A8. In columns 1 to 3, we estimate similar trends on market power when we exclude industries that were affected by prominent secular shocks over the sample period. In particular, communication firms (which include search engines and social media websites) were affected by digitization, health care firms by government intervention, and utilities firms by new energy technologies and government regulation. In columns 4 to 6, we investigate whether the role of market power was different for firms that invested more in intangibles. We find stable coefficients on market power and small, insignificant coefficients on market power interacted with the firm-level ratio of intangible to tangible investment. We emphasize that the results in Table A8 are consistent with previous work showing that industry-specific secular shocks and intangible investments have affected firms. However, the results show that market power affected discount rates and investment through a channel that is distinct from these forces.

We also test whether cross-sectional differences in risk and financial constraints explain the evolution of discount rates and wedges. We find no evidence that riskier or financially constrained firms changed their discount rates by more in Tables A9 and A10.

Finally, firms with high market power have also invested less than other firms, consistent with the greater increases in their discount rate wedges. In Table A11, we find that the capital stock of firms with high initial market power has been growing more slowly since 2002, both in an unweighted regression and when weighting by size to approximate the aggregate dynamics. A 1 standard deviation increase in market power is associated with a 1 to 2 percent relative decrease in the capital stock in every additional year since 2002. This result supports the view that firms with greater initial market power have disproportionately contributed to the missing investment phenomenon.

Taken together, the results show that market power has limited the extent to which firms have incorporated the secular decline in the financial cost of capital into their discount rates, which has ultimately reduced investment.

8.2 Fluctuations in Wedges and Risk

Real options theories predict that increases in firm-level risk raise discount rate wedges by more for firms with more irreversible investment projects, as explained in Section 7.2. We test this prediction by regressing discount rates and wedges on the interaction of option-implied volatility and asset irreversibility, conditional on firm fixed effects. We measure irreversibility using the index by Kim and Kung (2017), averaged at the firm level over the sample period. In Table 8, we find that changes in risk affect discount rates and wedges of firms with high irreversibility more strongly. The results support the view that time variation in risk can lead to time variation in wedges through the real options channel.

Standard measures of risk have fluctuated significantly in recent years. For instance, aggregate option-implied volatility, the probability of a rare disaster (Martin 2017), and policy uncertainty (Baker et al. 2016) increased before and during the financial crisis of 2008 and fell thereafter. These factors may thus have contributed to an increase in discount rate wedges around 2008. Moreover, to the extent that disaster risk and economic policy uncertainty have increased in recent decades, risk may have also contributed to the upward trend in the wedge.[31]

9 Conclusion

This paper presents a new dataset on firms' discount rates and perceived cost of capital, augmented with measures of the financial cost of capital and investment.

We use the new data to assess whether firms follow the stylized view and move discount rates with financial prices. We find that firms incorporate changes in financial prices into their perceived cost of capital. Discount rates also move with the perceived cost of capital, but far below the one-to-one mapping assumed by standard models. This pattern leads to large and time-varying wedges between discount rates and the perceived cost of capital. We show that changes in discount rate wedges, as measured in the conference call data, predict future changes in investment at the firm level.

The average US firm in our sample has increased its discount rate wedge by 2.5 percentage points between 2002 and 2021. The rising wedge implies that firms have invested substantially less relative to what we would expect given the secular decline in the financial cost of capital since 2002. Using an adjusted Q-model, we show that the increase in the average wedge is large enough to account for the low levels of aggregate US investment (relative to financial prices) in recent decades. Moreover, we show that the sensitivity of investment with respect to the financial cost of capital falls by a factor of ten once one accounts for discount rate wedges in an otherwise standard Q-model.

We explore drivers of discount rate wedges and find that firms with greater market power, risk, and financial constraints maintain higher wedges. More relevant to the secular relation between investment and financial prices, we show that firms with high market power in 2002 have been responsible for the increase in discount rate wedges since 2002. While firms with high market power have increased their wedges, firms with low market power have maintained relatively stable wedges. Similarly, firms with high market power in 2002 have invested less

[31] This finding is distinct from increasing risk premia studied by Farhi and Gourio (2018). Risk premia influence discount rates through the financial cost of capital, whereas in our analysis, risk generates a distinct, and potentially larger, impact on discount rates through wedges chosen by managers.

since 2002. The findings suggest that weak competition in output markets allows firms to increase wedges and shapes the evolution of investment.

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Figure 1
Histograms of Discount Rates and the Perceived Cost of Capital

Panel A plots a histogram of discount rates (in percent) using all firm-quarter observations with observed discount rates. The sample runs from 2002 to 2021. The right-most bar combines all observations greater than 35 percent. Panel B plots the corresponding histogram for the perceived cost of capital.

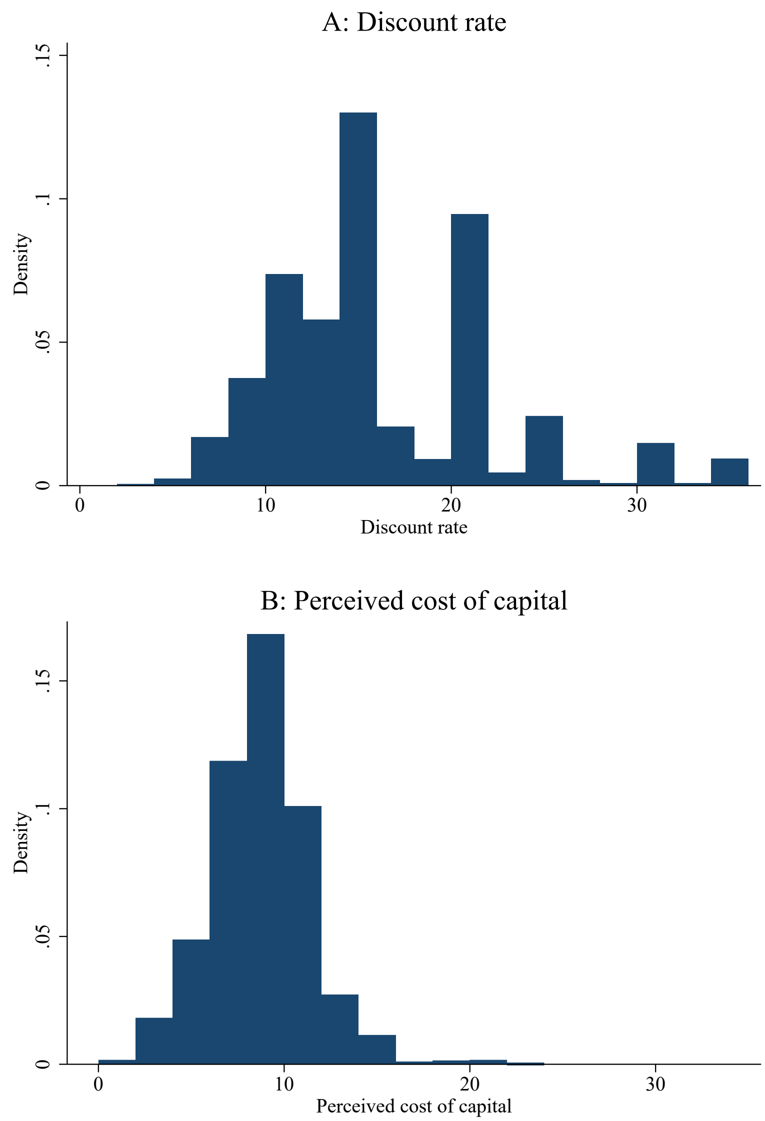

Figure 2
The Time Series of Corporate Discount Rates

The figure plots the raw average discount rate, perceived cost of capital, and perceived cost of debt by year for US firms. The variables are in percent and measured using conference calls.

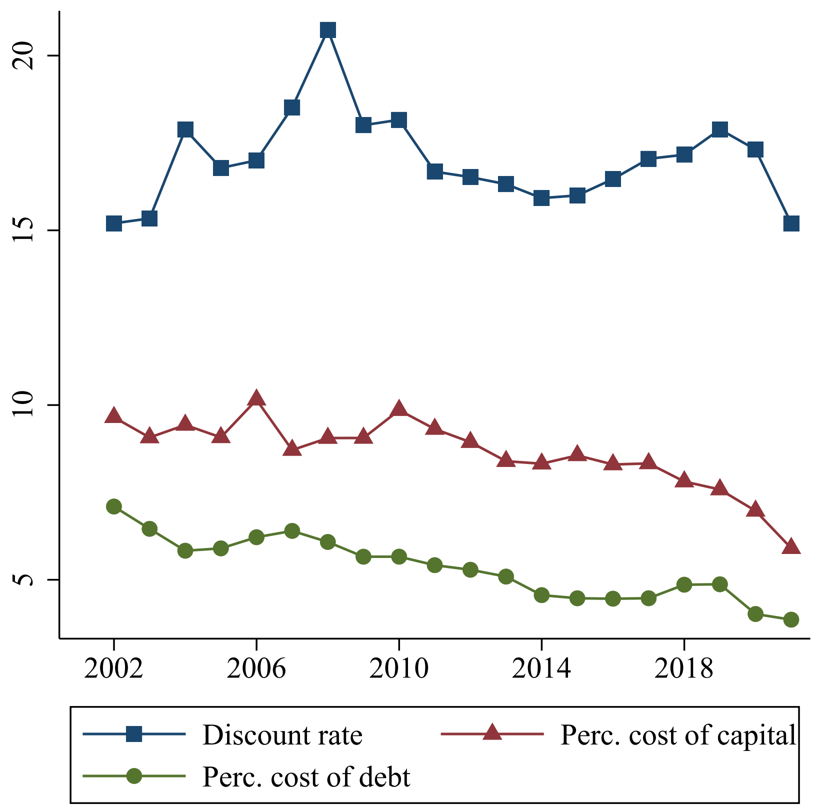

Figure 3
Time Variation in the Perceived Cost of Equity

Panel A plots the average perceived cost of equity (measured using conference calls) and expected stock returns by year (measured using asset prices). We estimate the average perceived cost of equity in each year using a firm-year panel that includes firm fixed effects. The figure adds in the unconditional mean and plots three-year moving averages. Two measures of expected stock returns are based on the earnings yield, one assuming a real growth of 2 percent ("earnings yield") and the other a real growth of 4 percent ("earnings yield (high growth)"). The "constant risk premium" measure is the risk-free rate plus a long-run market risk premium of 6 percent, as is often taught to MBA students (Cochrane 2011). Panel B plots the perceived cost of equity in excess of the risk-free interest rate and the three measures of expected stock returns in excess of the risk-free interest rate.

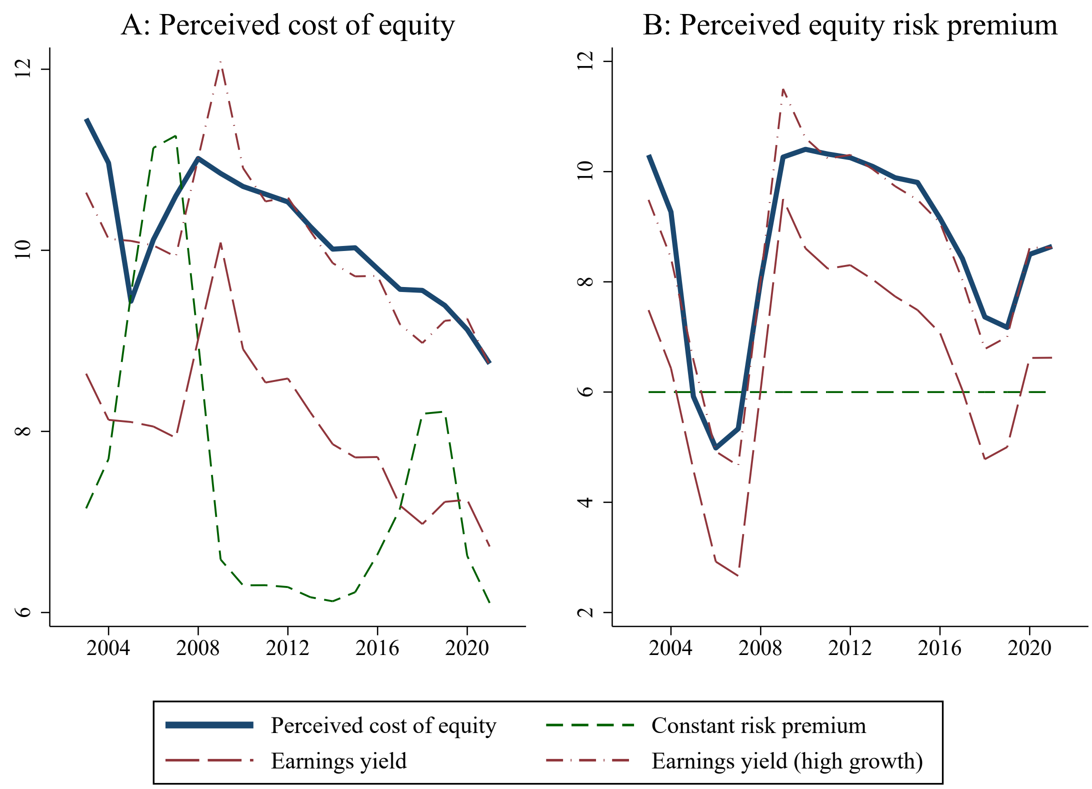

Figure 4
The Share of Unchanged Discount Rates and Perceived Costs of Capital

The red line plots the share of firms that have not changed their discount rate, relative to each firm's first observation of discount rate, by the number of years that have passed since the first observation. The blue line plots the share of firms that have not changed their perceived cost of capital. The starting point 0 on the horizontal axis indicates the quarter of the first observation, where by definition all observations are unchanged relative to the first observation. The second point on the horizontal axis (labeled 0-1) indicates observations from the year immediately following the first observation. The third point on the horizontal axis (labeled 1-2) indicates observations from the second year following the first observation, and so on. Ten years after the first observation, 40 percent of firms have an unchanged discount rate (relative to the first discount rate observation) and 5 percent of firms have an unchanged perceived cost of capital (relative to the first perceived cost of capital observation).

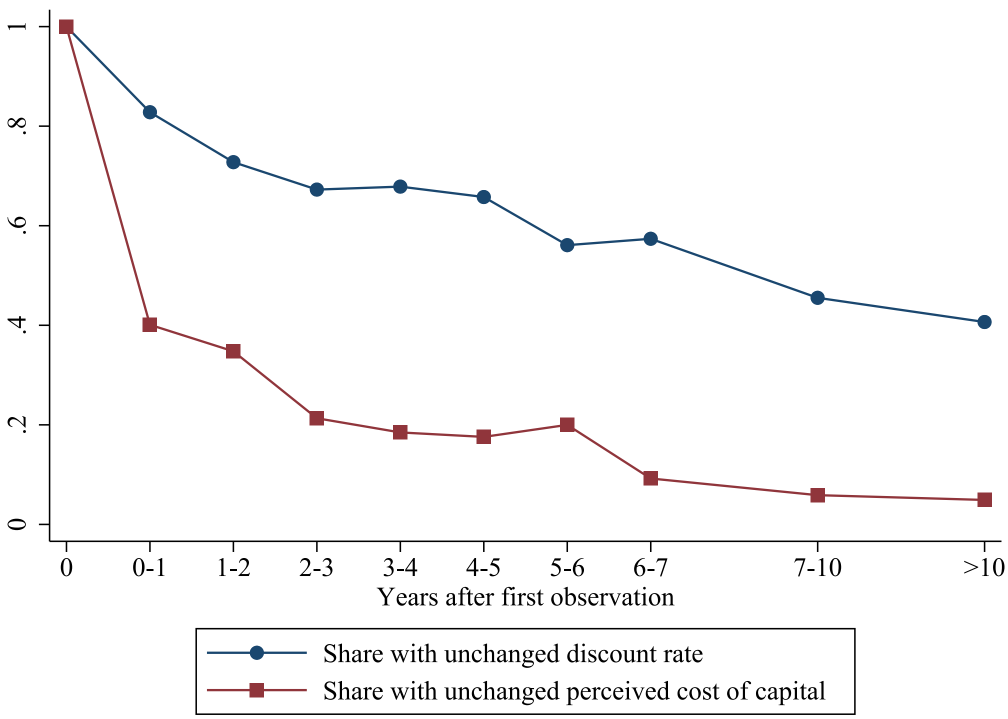

Figure 5
The Discount Rate Wedge in the US

The figure plots the average discount rate wedge $\tilde{\kappa}$ (difference between discount rate and perceived cost of capital) for US firms in percentage points. We isolate variation over time in discount rates by controlling for time-invariant differences across firms. Specifically, we regress firm discount rates on year and firm fixed effects (using the full sample of 1,210 US discount rates). We then measure the average "within-firm" discount rate in every year by adding the estimated year fixed effect to the unconditional mean. We follow an analogous procedure to create the average "within-firm" perceived cost of capital in every year (using the full sample of 1,240 US discount rates). The difference between the two series is the average "within-firm" discount rate wedge. We plot a three-year moving average of the resulting average discount rate wedge.

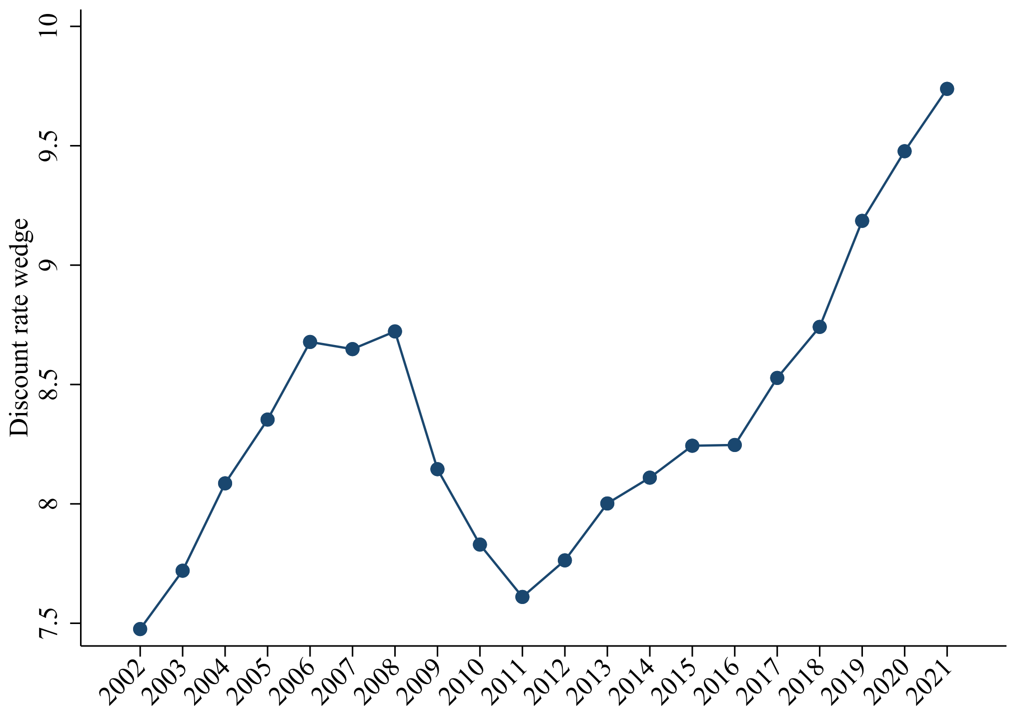

Figure 6
Discount Rates and Investment in the US

The figure plots the time series of the average discount rate and aggregate net investment rate in the US. Discount rates are in percent and measured using conference calls. The net investment rate is from the BEA, in percent of the capital stock at the start of the year, and measured one year ahead relative to discount rates and the year on the axis.

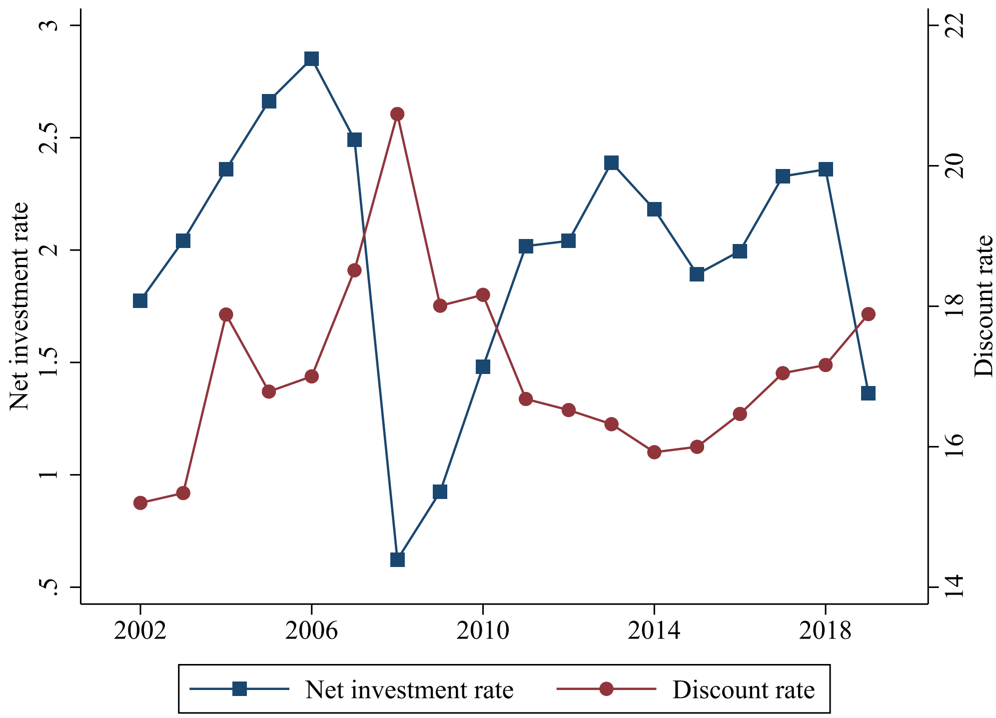

Figure 7
The Response of Investment to Discount Rates Across Firm Types

The figure plots the relation between investment and discount rates for different subsamples of firms. The subsamples are defined by splitting the sample at the sample median of the characteristic given on the horizontal axis. Bankruptcy risk is measured using the Z-score. Market power is measured using the accounting method in Baqaee and Farhi (2020). Risk is measured using option-implied volatility of equity. Financial constraints are measured using the index by Hadlock and Pierce (2010). Size is measured using market value. Each plotted coefficient is based on a separate regression. The specifications are identical to column 2 of Table 5. The square measures the magnitude of the coefficient on the discount rate. The thin line measures the 90 percent confidence interval of the coefficient.

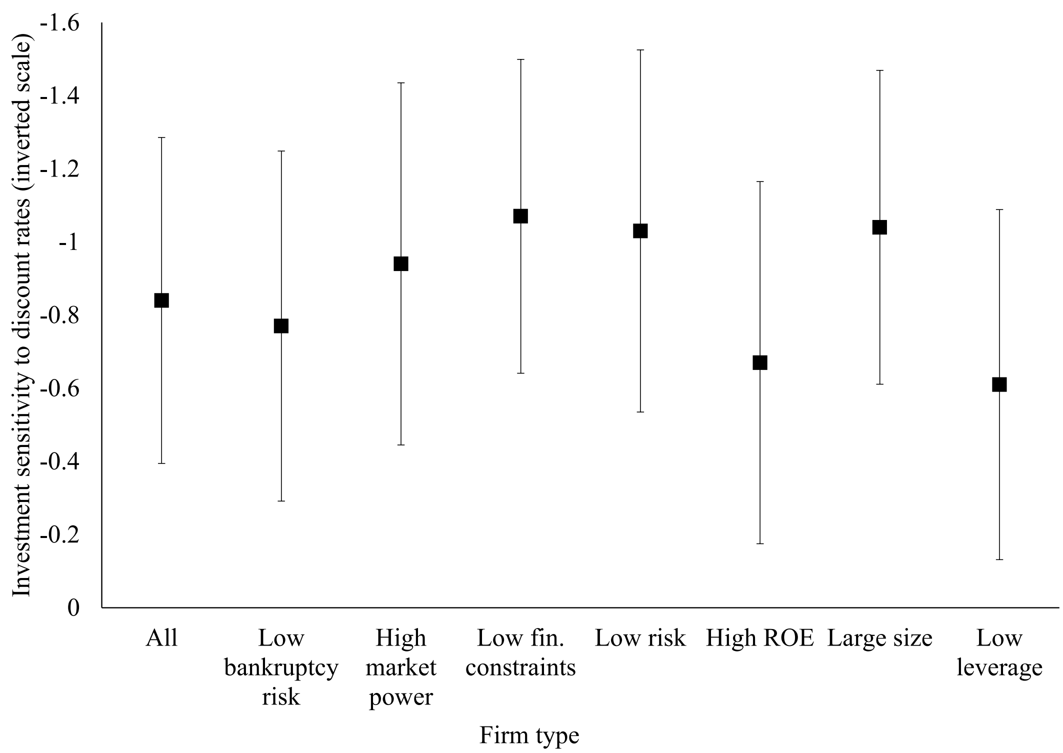

Figure 8
Adjusted Q

The figure plots Tobin's Q and adjusted Q. We calculate Tobin's Q using data on market value from the Flow of Funds (in the numerator) and data on tangible plus intangible capital from the BEA (in the denominator). Adjusted Q is calculated by adjusting Tobin's Q for the average wedge between discount rates and the perceived cost of capital, as explained in the text.

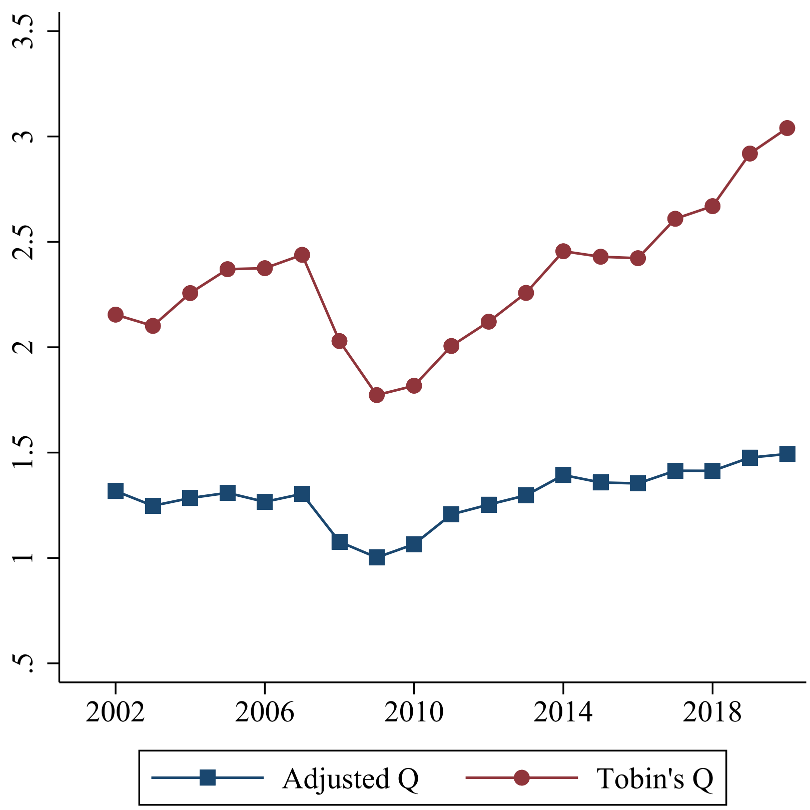

Figure 9
Adjusted Q and Missing Investment

The figure plots the cumulative investment shortfall in the US in percent of the capital stock. We separately estimate the investment shortfall implied by Tobin's Q and by adjusted Q. We calculate Tobin's Q using data on market value from the Flow of Funds (in the numerator) and data on tangible plus intangible capital from the BEA (in the denominator). Adjusted Q is calculated by correcting Tobin's Q for the wedge between discount rates and the perceived cost of capital, as explained in the text. We estimate the relation between investment and Q using data for 1990-2002, separately for each type of Q. For the years after 2002, we then calculate cumulative residuals between observed investment and the values predicted by the 1990-2002 data. The pre-2002 adjusted Q is based on backwards extrapolated discount rate wedges (see text for details). 95 percent confidence intervals (shaded region) are calculated using Newey-West standard errors adjusted for 5 lags. Investment is aggregate US investment from the BEA, which includes intangibles.

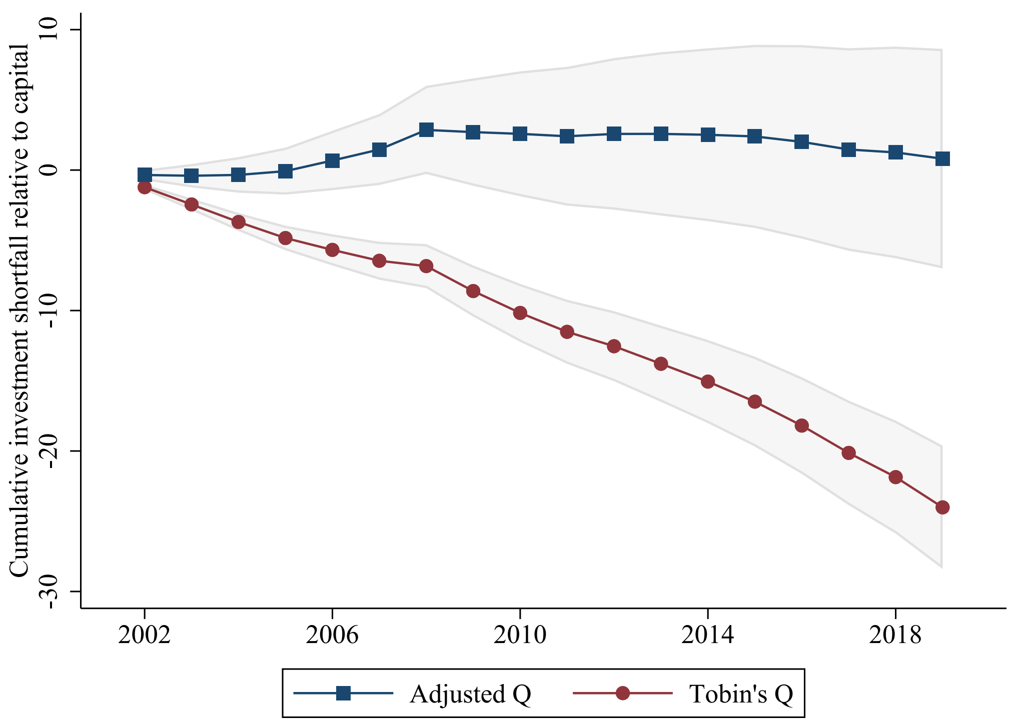

Figure 10
Market Power and the Secular Evolution of Discount Rates

The figure plots the average discount rate for high- and low-markup firms over time. We group firms into high- and low-markup firms based on the average markup of the firm between 2000 and 2002. Markups are measured using the accounting method following Baqaee and Farhi (2020). For each group, we estimate the average annual discount rate in panel regressions that include firm fixed effects. We plot a three-year moving average of the resulting time series for discount rates and subtract the 2002 value from both series, so that they start at zero.

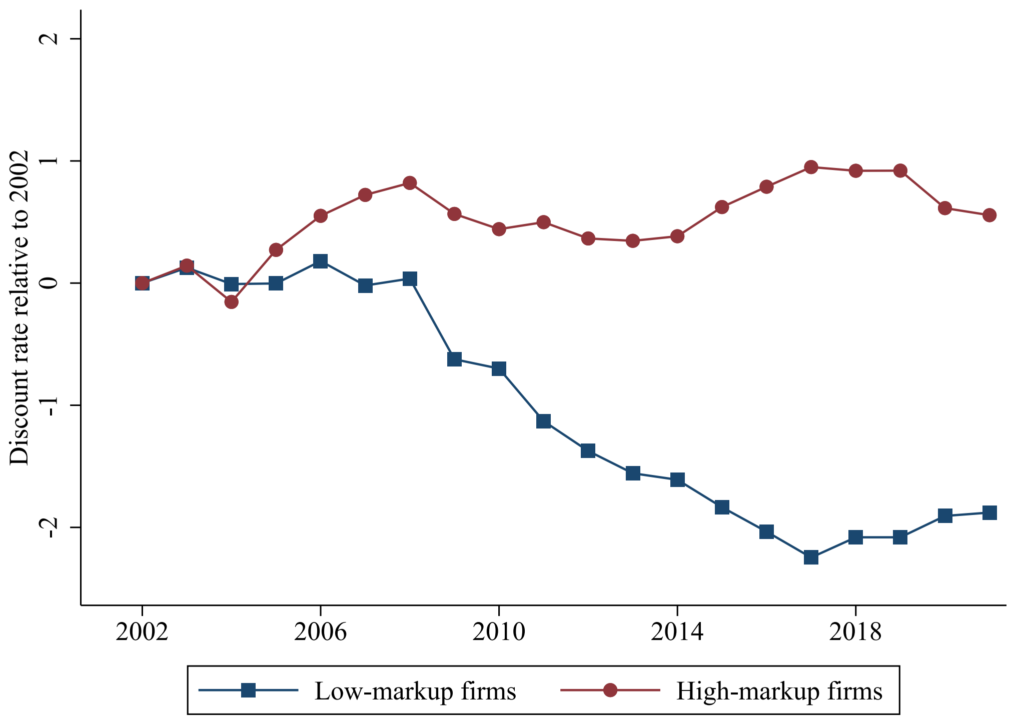

Table 1
Summary Statistics

Panel A reports summary statistics for the new dataset at the firm-quarter level. For the variables based on manual reading of conference calls (discount rate, perceived cost of capital, perceived cost of debt, perceived cost of equity), we report statistics for all firm-quarter observations that we can observe in the conference calls. For market value and the return on equity, we report statistics (from Compustat) for all firm-quarter observations where we observe at least one discount rate, perceived cost of capital, perceived cost of debt, or perceived cost of equity in the conference calls. Panel B reports different measures of firm returns over the period 2002 to 2021. The discount rates are averages over the full conference call sample (column "raw average") and over the observations where firms include all corporate overhead costs in their cash flows, as opposed to adjusting their discount rates (column "without overhead adjustment"). The remaining columns report value-weighted averages for US firms from Compustat. ROA is return on total assets, defined as [earnings before interest] over [total assets]. ROIC is return on invested capital, the balance sheet analogue to the average rate of return on investment projects. We define it as [earnings before interest] over [long-term book debt plus book equity minus cash minus financial investments]. All variables are in percent, except for market value.

Panel A: Statistics from the dataset based on conference calls

	N	Mean	p5	p95
Discount rate	2,740	15.7	8	29
Perceived cost of capital	2,681	8.4	4	13
Perceived cost of debt	4,844	4.8	1.8	8.5
Perceived cost of equity	363	10.1	5	15
Market value (million USD)	6,168	13,446	342	51,812
Return on equity	5,569	10	-6.5	28

Panel B: Comparing discount rates to realized returns

	Discount rates		Compustat returns	
	Raw average	Without overhead adjustment	ROA	ROIC
Average	15.7	11.4	5.3	13.5

Table 2
Representativeness

Panel A reports characteristics of firms for three samples: firms for which we observe at least one discount rate; at least one perceived cost of capital; and at least one perceived cost of equity or debt. Characteristics are measured in percentile ranks relative to the universe of firms in Compustat in the same year and same country of listing. A mean value close to 50 indicates that the average rank of firms in our dataset is close to the average rank of firms in the Compustat year-country population. Financial constraints are measured using the index by Hadlock and Pierce (2010). Panel B reports firm-level panel regressions using a dataset at the firm-quarter level. The outcome is 100 when we observe the firm's discount rate (columns 1 and 2), the perceived cost of capital (columns 3 and 4), or the perceived cost of debt or equity (columns 5 and 6) in the given quarter, and 0 otherwise. The samples in Panel B include the full panel of firm-quarter observations between 2002 and 2021 for all firms, for which we observe at least once a discount rate, perceived cost of capital, perceived cost of debt, or perceived cost of equity. The regressors are in percentile ranks relative to the universe of firms in Compustat in the same year and country of listing. Standard errors (in parentheses) are clustered by firm. Statistical significance is denoted by *** p<0.01, ** p<0.05, * p<0.1.

Panel A: Characteristics of included firms in cross-sectional percentiles

	Firms with observed discount rates			Firms withobserved perc. cost of capital			Firms with observed perc. cost of debt/equity		
	mean	min	max	mean	min	max	mean	min	max
Market value	83.06	3.00	100.00	79.40	8.54	100.00	84.48	7.60	100.00
Return on equity	59.80	0.81	100.00	58.29	0.23	100.00	58.37	0.15	100.00
Book-to-market	49.41	0.17	100.00	47.34	0.16	100.00	46.60	0.26	100.00
Investment rate	53.64	0.32	100.00	53.95	1.36	100.00	53.35	0.13	100.00
Physical capital to assets	58.98	2.16	100.00	59.69	2.36	100.00	65.08	2.00	100.00
Z-score (bankruptcy risk)	47.57	0.77	99.02	48.83	2.31	98.98	37.14	1.40	99.36
Financial constraints	20.46	0.05	100.00	23.03	0.05	90.67	23.86	0.05	91.52
Leverage	60.44	1.17	100.00	59.27	0.53	100.00	62.10	0.84	100.00

Panel B: Within-firm variation in characteristics and timing of inclusion

	(1)	(2)	(3)	(4)	(5)	(6)
	Discount rate observed in quarter		Perc. cost of capital observed in quarter		Perc. cost of equity or debt observed in quarter	
Z-score (bankruptcy risk)	0.00081		0.00047		-0.00068	
	(0.0018)		(0.0015)		(0.0022)	
Return on equity		0.00096		0.0011		0.0025*
		(0.0013)		(0.0012)		(0.0015)
Book-to-market		0.00046		0.0013		-0.0024
		(0.0018)		(0.0014)		(0.0019)
Investment rate		-0.0016		0.00043		-0.000032
		(0.0012)		(0.0011)		(0.0015)
Financial constraints		0.0016		0.0037		0.0016
		(0.0027)		(0.0039)		(0.0040)
Leverage		-0.00091		0.00066		0.0090***
		(0.0023)		(0.0020)		(0.0027)
Observations	228,501	235,329	228,501	235,329	228,501	235,329
FE	Firm/year	Firm/year	Firm/year	Firm/year	Firm/year	Firm/year
Within R^2	2.6e-06	0.000020	9.1e-07	0.000036	1.4e-06	0.00020

Table 3
The Perceived and the Financial Cost of Capital

Panel A reports results of panel regressions of the perceived cost of capital on measures of the financial cost of capital (see Section 2.4 for definitions). We scale the financial cost of equity by 1 minus firm leverage and the financial cost of debt by firm leverage. The dataset is at the firm-quarter level and runs from 2002 to 2021. Standard errors (in parentheses) are clustered by firm. The left- and right-hand side variables are in percent. Panel B reports results of panel regressions of the perceived cost of debt in financial variables. The long-term rate is the long-run yield on government debt in the firm's country of listing. Interest expenses are the firm's current interest expenses relative to current outstanding debt. Leverage is the firm's book debt relative to book debt plus equity. Beta is the firm's CAPM market beta. Statistical significance is denoted by *** p<0.01, ** p<0.05, * p<0.1.

	(1)	(2)	(3)	(4)	(5)	(6)
Panel A	Perceived cost of capital					
Fin. COC (country level)	0.85***	0.74***				
	(0.12)	(0.19)				
Fin. COC (firm level)			0.70***	0.46***		
			(0.079)	(0.13)		
Fin. cost of equity (scaled, firm level)					0.76***	0.40**
					(0.091)	(0.17)
Fin. cost of debt (scaled, firm level)					0.57***	0.60***
					(0.095)	(0.14)
Observations	1,895	1,895	1,983	1,983	1,983	1,983
FE	Country	Firm	Country	Firm	Country	Firm
R^2	0.090	0.88	0.13	0.87	0.14	0.87
Within R^2	0.040	0.078	0.095	0.072	0.098	0.074

	(1)	(2)	(3)	(4)	(5)	(6)
Panel B	Perceived cost of debt					
Long-term rate (country level)	0.34***	0.28***	0.33***	0.28***	0.34***	0.28***
	(0.043)	(0.057)	(0.043)	(0.056)	(0.043)	(0.056)
Interest expenses (firm level)	0.31***	0.20***	0.29***	0.20***	0.29***	0.20***
	(0.028)	(0.031)	(0.028)	(0.031)	(0.028)	(0.031)
Leverage ratio			0.93***	0.12	0.83***	0.056
			(0.20)	(0.45)	(0.20)	(0.44)
Beta					0.40**	0.25
					(0.18)	(0.20)
Observations	2,967	2,967	2,967	2,967	2,967	2,967
R-squared	0.509	0.856	0.522	0.856	0.524	0.856
FE	Country	Firm	Country	Firm	Country	Firm
R^2	0.51	0.86	0.52	0.86	0.52	0.86
Within R^2	0.37	0.27	0.39	0.27	0.39	0.27

Table 4
Discount Rates and the Perceived Cost of Capital

The table reports results of panel regressions of discount rates on the perceived cost of capital. The regressor of interest in columns 1 to 3 is the perceived cost of capital, measured using conference calls. The regressor of interest in columns 4 to 6 is a predicted measure of the perceived cost of capital. The prediction relies on a lasso procedure where the inputs are the components of the CAPM-based firm-level financial cost of capital, as explained in the text. The dataset is at the firm-quarter level and runs from 2002 to 2021. Standard errors (in parentheses) are clustered by firm. The left- and right-hand side variables are measured in percent. Statistical significance is denoted by *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

	(1)	(2)	(3)	(4)	(5)	(6)
Perceived COC (observed)	0.68***	0.43***	0.37***			
	(0.099)	(0.12)	(0.11)			
Perceived COC (predicted)				1.06***	0.36**	0.26*
				(0.36)	(0.16)	(0.14)
Observations	257	257	257	1,820	1,820	1,820
FE	Country	Firm	Firm/year	Country	Firm	Firm/year
p-value(slope = 1)	0.0013	3.1e-06	6.1e-08	0.87	0.000084	3.0e-07
R^2	0.28	0.99	0.99	0.10	0.97	0.97
Within R^2	0.17	0.37	0.24	0.024	0.020	0.0065

Table 5
Investment and Discount Rates

The table reports results of panel regressions of the annual net investment rates, measured one year ahead, on discount rates. Net investment of firm i is from Compustat and measured as $(\text{CAPEX}^i_{t+1} - \text{Depreciation}^i_{t+1})/\text{PPEN}^i_t$, winsorized at the 2.5^{th} and 97.5^{th} percentiles. Right-hand side variables are measured at time t. The discount rate wedge $\tilde{\kappa}$ is the discount rate minus the perceived cost of capital (predicted as in Table 4). The discount rate and cost of capital wedge, $\tilde{\kappa}+\upsilon$, is the discount rate minus the CAPM-based financial cost of capital. The financial COC is the CAPM-based firm-level financial cost of capital. Tobin's Q is the market-to-book value of debt and equity. The dataset is at the firm-quarter level and runs from 2002 to 2021. Standard errors (in parentheses) are clustered by firm. The left- and right-hand side variables are measured in percent, except the wedges are in percentage points. Statistical significance is denoted by *** p<0.01, ** p<0.05, * p<0.1.

	(1)	(2)	(3)	(4)	(5)
Discount rate	-0.93***	-0.91***			-0.79***
	(0.28)	(0.27)			(0.30)
Discount rate wedge $\tilde{\kappa}$			-0.91***		
			(0.26)		
Discount rate and COC wedge $\tilde{\kappa}+\upsilon$				-0.91***	
				(0.27)	
Perceived COC (predicted)			-0.70		1.48
			(1.02)		(1.56)
Fin. COC (firm level)				-1.06	-0.70
				(0.66)	(1.01)
Tobin's Q					0.26**
					(0.11)
Observations	1,381	1,381	1,381	1,381	1,237
FE	Firm	Firm/year	Firm/year	Firm/year	Firm/year
R^2	0.86	0.87	0.87	0.87	0.87
Within R^2	0.036	0.035	0.035	0.035	0.024

Table 6
Differences in Discount Rates and Wedges Across Firms

The table reports results of panel regressions of discount rates, discount rate wedges, and discount rate and cost of capital wedges on three regressors. The discount rate wedge $\tilde{\kappa}$ is the discount rate minus the perceived cost of capital (predicted as in Table 4). The discount rate and cost of capital wedge, $\tilde{\kappa} + \upsilon$, is the discount rate minus the CAPM-based financial cost of capital. The first regressor is market power, measured using the accounting method in Baqaee and Farhi (2020). The second is risk, measured using option-implied volatility of equity. The third is financial constraints, measured using the index by Hadlock and Pierce (2010). The right-hand side variables are firm-level averages between 2000 and 2002. The dataset is at the firm-quarter level and runs from 2002 to 2021. Standard errors (in parentheses) are clustered by firm. The left-hand side variables are in percent. The three regressors are standardized, so that the coefficients estimate the impact of a 1 standard deviation increase. The specification includes fixed effects for firm country of listing, year, and whether the discount rate includes all corporate overhead costs. Statistical significance is denoted by *** p<0.01, ** p<0.05, * p<0.1.

	(1) Discount rate	(2) $\tilde{\kappa}$	(3) $\tilde{\kappa} + \upsilon$
Market power (2002)	1.05**	0.91**	0.94**
	(0.43)	(0.43)	(0.44)
Risk (2002)	1.59***	1.21**	1.10**
	(0.53)	(0.49)	(0.50)
Fin. constraints (2002)	0.66*	0.67*	0.66*
	(0.35)	(0.34)	(0.34)
Observations	794	794	794
FE	Country/year/type	Country/year/type	Country/year/type
R^2	0.28	0.27	0.26
Within R^2	0.097	0.073	0.067

Table 7
Market Power and the Secular Evolution of Discount Rates and Wedges

The table reports results of panel regressions of firm-level discount rates, discount rate wedges, and discount rate and cost of capital wedges on firm-level market power (averaged over 2000 to 2002) interacted with three different variables: calendar year, mean perceived cost of capital in the firm's country of listing, and the perceived cost of capital at the firm level (predicted as in Table 4). The specifications include these variables on their own as well as interacted with average market power in 2000-2002. The table reports the slope coefficients for the interaction terms. The discount rate wedge $\tilde{\kappa}$ is the discount rate minus the perceived cost of capital (predicted as in Table 4). The discount rate and cost of capital wedge, $\tilde{\kappa} + \upsilon$, is the discount rate minus the CAPM-based financial cost of capital. The dataset is at the firm-quarter level and runs from 2002 to 2021. Standard errors (in parentheses) are clustered by firm. The left-hand side variables are in percent. Market power is standardized, so that the coefficients estimate the impact of a 1 standard deviation increase, and measured using the accounting method in Baqaee and Farhi (2020). Statistical significance is denoted by *** p<0.01, ** p<0.05, * p<0.1.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
		Discount rate		$\tilde{\kappa}$	$\tilde{\kappa}$	$\tilde{\kappa}$	$\tilde{\kappa}+\upsilon$	$\tilde{\kappa}+\upsilon$	$\tilde{\kappa}+\upsilon$
Market power (2002)*Year	0.13*			0.12*			0.12**		
	(0.069)			(0.062)			(0.063)		
Market power (2002)*Perc. COC (country mean)		-0.45**			-0.37**			-0.40**	
		(0.19)			(0.17)			(0.16)	
Market power (2002)*Perc. COC (firm level)			-0.33			-0.33			-0.35
			(0.23)			(0.23)			(0.25)
Observations	949	949	949	949	949	949	949	949	949
FE	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm
R^2	0.97	0.97	0.97	0.97	0.96	0.97	0.96	0.96	0.96
Within R^2	0.12	0.045	0.047	0.053	0.019	0.066	0.050	0.021	0.078

Table 8
Firm-level Risk and Fluctuations in Discount Rates and Wedges

The table reports results of panel regressions of firm-level discount rates, discount rate wedges, and discount rate and cost of capital wedges on firm-level option-implied volatility interacted with asset irreversibility. The discount rate wedge $\tilde{\kappa}$ is the discount rate minus the perceived cost of capital (predicted as in Table 4). The discount rate and cost of capital wedge, $\tilde{\kappa} + \upsilon$, is the discount rate minus the CAPM-based financial cost of capital. Irreversibility is the negative of asset redeployability from Kim and Kung (2017), averaged between 2002 and 2021. The dataset is at the firm-quarter level and runs from 2002 to 2021. Standard errors (in parentheses) are clustered by firm. The left-hand side variables are in percent. Statistical significance is denoted by *** p<0.01, ** p<0.05, * p<0.1.

	(1) Discount rate	(2) $\tilde{\kappa}$	(3) $\tilde{\kappa} + \upsilon$
Risk*Irreversibility (2002)	18.1*	22.8**	27.6**
	(10.1)	(10.9)	(11.7)
Risk	8.58*	7.33	6.74
	(4.88)	(5.39)	(5.74)
Observations	872	872	872
FE	Firm	Firm	Firm
R^2	0.96	0.96	0.95
Within R^2	0.022	0.046	0.093

Online Appendix to
“Corporate Discount Rates”

Appendix A Figures and Tables

Figure A1

Non-Zero Changes in Discount Rates and the Perceived Cost of Capital

Panel A plots a histogram of the difference between a firm's discount rate in a given quarter and the firm's first observed discount rate. The plotted difference is in percentage points and annualized (i.e., normalized by the years between the quarter of observation and the quarter of the first observation). The sample includes only observations with non-zero changes (i.e., observations where the firm's discount rate in the given quarter differs from the first observed discount rate). The sample runs from 2002 to 2021. The left-most bar combines all changes below -4 percentage points. The right-most bar combines all observations greater than 4 percentage points. Panel B plots the corresponding histogram for the perceived cost of capital.

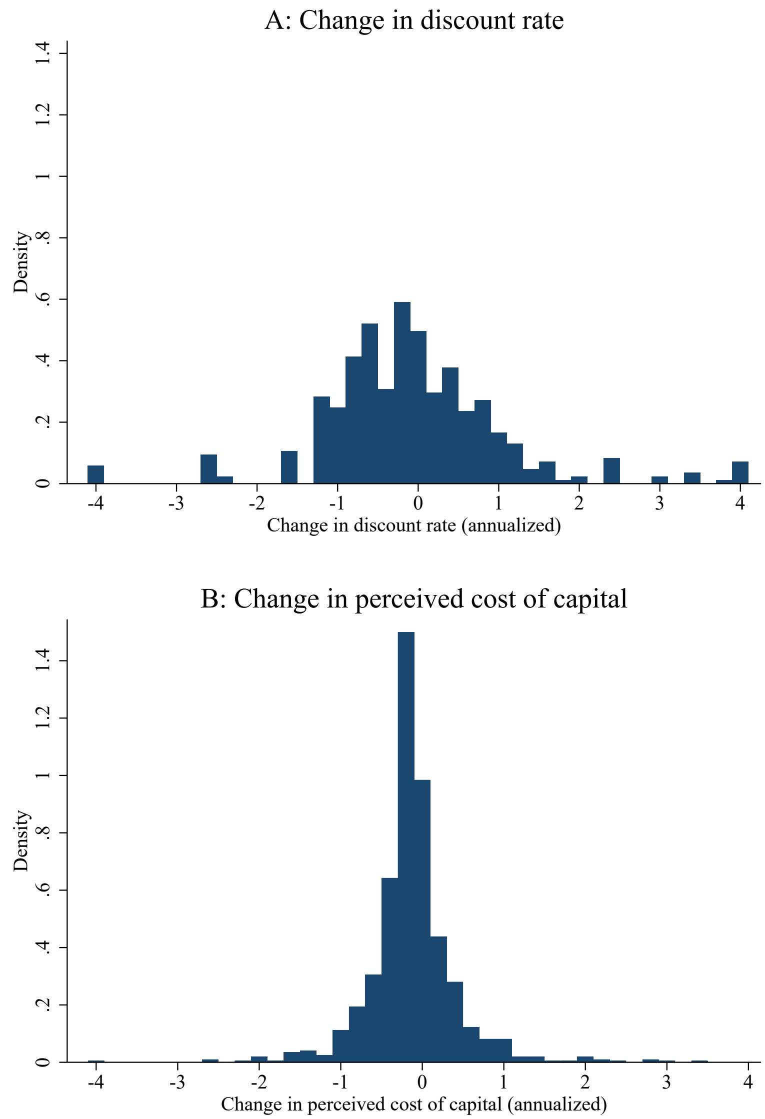

Figure A2
Tobin's Q, Adjusted Q, and Net Investment

The figure plots Tobin's Q and adjusted Q along with the net investment rate. The construction of adjusted Q is described in the text. The net investment rate is from the BEA and in percent of the capital stock at the start of the year. The sample runs from 1990 to 2021.

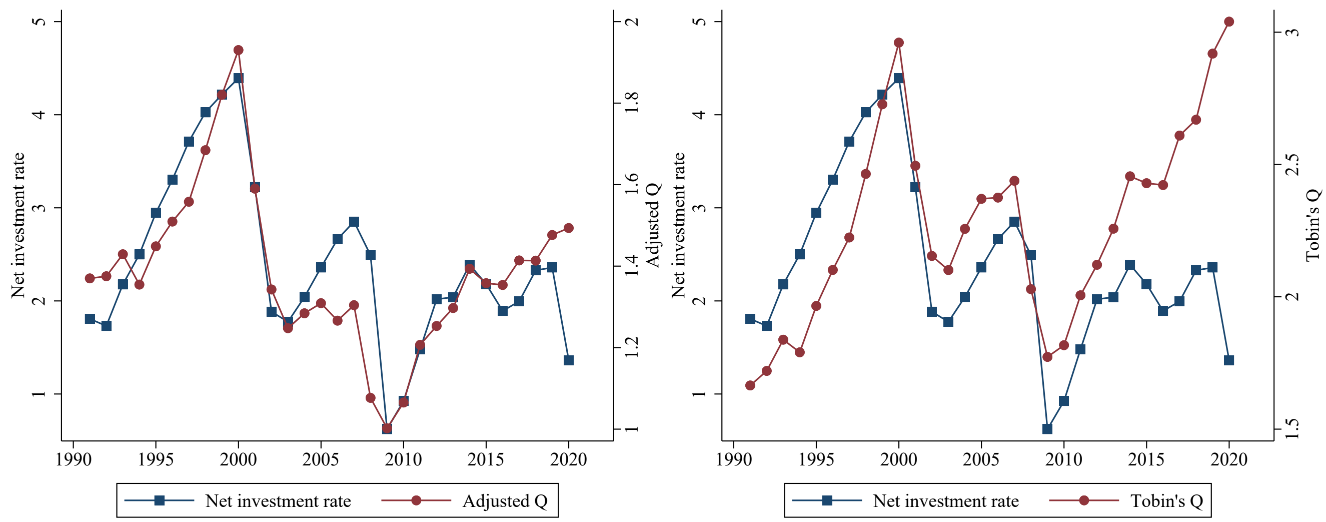

Table A1
Asset Expansion and Corporate Discount Rates

The table reports results of panel regressions of firm-level asset expansion, measured using Compustat as $\text{Assets}^i_{t+1}/\text{Assets}^i_t$, winsorized at the 2.5^{th} and 97.5^{th} percentiles, on discount rates. Right-hand side variables are measured at time t. The financial COC is the CAPM-based firm-level financial cost of capital. Tobin's Q is the market-to-book value of debt and equity. The dataset is at the firm-quarter level and runs from 2002 to 2021. Standard errors (in parentheses) are clustered by firm. The left- and right-hand side variables are measured in percent, except the wedges are in percentage points. Statistical significance is denoted by *** p<0.01, ** p<0.05, * p<0.1.

	(1)	(2)	(3)	(4)	(5)
Discount rate	-0.81***	-0.89***			-0.84**
	(0.27)	(0.29)			(0.40)
Discount rate wedge $\tilde{\kappa}$			-0.82***		
			(0.30)		
Discount rate and COC wedge $\tilde{\kappa} + \upsilon$				-0.89***	
				(0.29)	
Perceived COC (predicted)			-3.53***		-4.04**
			(1.14)		(2.00)
Fin. COC (firm level)				-1.59*	1.36
				(0.81)	(1.23)
Tobin's Q					1.46***
					(0.34)
Observations	1,668	1,668	1,668	1,668	1,305
FE	Firm	Firm/year	Firm/year	Firm/year	Firm/year
R^2	0.61	0.64	0.65	0.65	0.68
Within R^2	0.0072	0.0088	0.016	0.0099	0.053

Table A2
Investment Including Intangibles and Corporate Discount Rates

The table reports regressions of firm-level net investment rates (in tangible and intangible capital) on discount rates. We measure investment in intangible capital as R&D expenditures plus adjusted Selling and General Administrative expenses, as described in Eisfeldt and Papanikolaou (2014). We measure investment in tangible capital as in Table 5. The net investment rate including intangibles is winsorized at the 2.5$^{\text{th}}$ and 97.5$^{\text{th}}$ percentiles. Right-hand side variables are measured at time t. The financial COC is the CAPM-based firm-level financial cost of capital. Tobin's Q is the market-to-book value of debt and equity. The dataset is at the firm-quarter level and runs from 2002 to 2021. Standard errors (in parentheses) are clustered by firm. The left- and right-hand side variables are measured in percent, except the wedges are in percentage points. Statistical significance is denoted by *** p<0.01, ** p<0.05, * p<0.1.

	(1)	(2)	(3)	(4)	(5)
Discount rate	-0.28	-0.31**			-0.43***
	(0.17)	(0.12)			(0.14)
Discount rate wedge $\tilde{\kappa}$			-0.30**		
			(0.12)		
Discount rate and COC wedge $\tilde{\kappa} + \upsilon$				-0.31***	
				(0.12)	
Perceived COC (predicted)			-0.71**		0.089
			(0.31)		(0.49)
Fin. COC (firm level)				-0.75***	-0.48
				(0.21)	(0.35)
Tobin's Q					0.17**
					(0.070)
Observations	1,279	1,279	1,279	1,279	1,138
FE	Firm	Firm/year	Firm/year	Firm/year	Firm/year
R^2	0.91	0.92	0.92	0.92	0.93
Within R^2	0.033	0.041	0.047	0.058	0.079

Table A3
Investment, Wedges, and Components of the Financial Cost of Capital

The table reports results of panel regressions of net investment rates on discount rates. Net investment of firm i is from Compustat and measured as $(\text{CAPEX}^i_{t+1} - \text{Depreciation}^i_{t+1})/\text{PPEN}^i_t$, winsorized at the 2.5$^{\text{th}}$ and 97.5$^{\text{th}}$ percentiles. Right-hand side variables are measured at time t. The discount rate and cost of capital wedge, $\tilde{\kappa} + \upsilon$, is the discount rate minus the CAPM-based financial cost of capital. The remaining regressors of interest are components of the financial cost of capital. The credit spread is the difference between the representative corporate bond yield and the risk-free rate in the country of firm i in quarter t. The risk-free rate is the yield on government debt in the country of listing of firm i in quarter t. We scale the credit spread and risk-free rate by the leverage of firm i, since firms with higher leverage are more exposed to movements in the bond yield and risk-free rate. The financial cost of equity is the CAPM-based financial cost of equity, scaled by 1 minus firm leverage. Tobin's Q is the market-to-book value of debt and equity. The dataset is at the firm-quarter level and runs from 2002 to 2021. Standard errors (in parentheses) are clustered by firm. The left- and right-hand side variables (apart from Tobin's Q) are measured in percent, except the wedges are in percentage points. Statistical significance is denoted by *** p<0.01, ** p<0.05, * p<0.1.

	(1)	(2)	(3)
Discount rate and COC wedge $\tilde{\kappa} + \upsilon$	-0.76***	-0.86***	-0.96***
	(0.22)	(0.29)	(0.31)
Credit spread (scaled)	-0.95*		-1.00*
	(0.53)		(0.56)
Risk-free rate (scaled)	-1.53		-0.95
	(1.04)		(1.81)
Fin. cost of equity (scaled)		-0.43	0.11
		(0.77)	(0.73)
Tobin's Q			1.43***
			(0.46)
ROE			0.094
			(0.064)
Observations	1,381	1,381	1,084
FE	Firm	Firm	Firm
R^2	0.86	0.86	0.87
Within R^2	0.042	0.033	0.064

Table A4
Missing Investment

The table reports results of annual time series regressions of net investment on Tobin's Q, adjusted Q, and variables capturing trends. The construction of adjusted Q is described in the text. We consider calendar year and a post-2002 dummy as trend variables. Net investment is calculated from the BEA tables. The sample runs from 1990 to 2020. Standard errors (in parentheses) are calculated using the Newey-West method adjusted for 5 lags. Statistical significance is denoted by *** p<0.01, ** p<0.05, * p<0.1.

	(1)	(2)	(3)	(4)
Tobin's Q	2.13***	1.37***		
	(0.34)	(0.46)		
Adjusted Q			3.46***	3.44***
			(0.55)	(0.73)
Year	-0.09***		-0.02	
	(0.01)		(0.02)	
Post-2002 indicator		-1.23***		-0.16
		(0.27)		(0.36)
Observations	30	30	30	30
R^2	0.72	0.62	0.70	0.68

Table A5
Tobin's Q and Wedges at the Firm Level

The table reports results of panel regressions of firm-level Tobin's Q on firm-level wedges. The discount rate wedge $\tilde{\kappa}$ is the discount rate minus the perceived cost of capital (predicted as in Table 4). The discount rate and cost of capital wedge, $\tilde{\kappa} + \upsilon$, is the discount rate minus the CAPM-based financial cost of capital. Tobin's Q is the market-to-book value of debt and equity. The dataset is at the firm-quarter level and runs from 2002 to 2021. Standard errors (in parentheses) are clustered by firm. The wedges are measured in percentage points. Statistical significance is denoted by *** p<0.01, ** p<0.05, * p<0.1.

	(1)	(2)
Discount rate wedge κ	0.20***	
	(0.078)	
Discount rate and COC wedge $\kappa + \upsilon$		0.17***
		(0.058)
Observations	685	685
FE	Firm	Firm
R^2	0.79	0.79
Within R^2	0.015	0.012

Table A6
Robustness: Market Power (User-Cost Approach) and the Secular Evolution of Discount Rates and Wedges

The table replicates Table 7, relying on the user-cost approach as in Baqaee and Farhi (2020) to measure market power.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Discount rate			$\tilde{\kappa}$	$\tilde{\kappa}$	$\tilde{\kappa}$	$\tilde{\kappa}+\upsilon$	$\tilde{\kappa}+\upsilon$	$\tilde{\kappa}+\upsilon$
Market power (2002)*Year	0.13**			0.11**			0.12**		
	(0.050)			(0.049)			(0.049)		
Market power (2002)*Perc. COC (country mean)		-0.49***			-0.39**			-0.43**	
		(0.17)			(0.18)			(0.18)	
Market power (2002)*Perc. COC (firm level)			-0.36*			-0.36*			-0.39*
			(0.19)			(0.19)			(0.20)
Observations	918	918	918	918	918	918	918	918	918
FE	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm
R^2	0.97	0.96	0.97	0.96	0.96	0.96	0.95	0.95	0.96
Within R^2	0.13	0.052	0.057	0.060	0.024	0.073	0.058	0.025	0.085

Table A7

Robustness: Market Power (De Loecker et al. 2020 Measures) and the Secular Evolution of Discount Rates and Wedges

The table replicates Table 7, relying on the market power measure of De Loecker et al. (2020).

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
		Discount rate		$\tilde{\kappa}$	$\tilde{\kappa}$	$\tilde{\kappa}$	$\tilde{\kappa}+\upsilon$	$\tilde{\kappa}+\upsilon$	$\tilde{\kappa}+\upsilon$
Market power (2002)*Year	0.18**			0.17**			0.19***		
	(0.079)			(0.075)			(0.071)		
Market power (2002)*Perc. COC (country mean)		-0.41			-0.35			-0.36	
		(0.28)			(0.29)			(0.29)	
Market power (2002)*Perc. COC (firm level)			-0.49**			-0.49**			-0.60**
			(0.23)			(0.23)			(0.24)
Observations	791	791	791	791	791	791	791	791	791
FE	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm
R^2	0.97	0.96	0.96	0.96	0.96	0.96	0.96	0.95	0.96
Within R^2	0.18	0.052	0.044	0.11	0.022	0.058	0.11	0.020	0.082

Table A8

Additional Tests: Market Power and the Secular Evolution of Discount Rates and Wedges

The table reports additional tests based on the specifications in Table 7. We investigate whether the role of market power is driven by certain industries or is different for firms with a larger share of intangible investment. In columns 1 to 3, we exclude firms in communication services, health care, and utilities (according to the Global Industry Classification Standard). During our sample period, communication services was affected by digitization, health care by government interventions, and utilities by new energy technologies and government regulation. In columns 4 to 6, we interact market power (2002)*year with the firm-level ratio of intangible investment relative to tangible investment. The intangibles ratio is standardized, so that the coefficients estimate the impact of a 1 standard deviation increase. The specifications also include all the variables on their own. We measure investment in intangible capital as R&D expenditures plus adjusted Selling and General Administrative expenses, as described in Eisfeldt and Papanikolaou (2014). We measure investment in tangible capital as in Table 5. The table reports the slope coefficients for the interaction terms. The discount rate wedge $\tilde{\kappa}$ is the discount rate minus the perceived cost of capital (predicted as in Table 4). The discount rate and cost of capital wedge, $\tilde{\kappa} + \upsilon$, is the discount rate minus the CAPM-based financial cost of capital. The dataset is at the firm-quarter level and runs from 2002 to 2021. Standard errors (in parentheses) are clustered by firm. The left-hand side variables are in percent. Market power is standardized, so that the coefficients estimate the impact of a 1 standard deviation increase, and measured using the accounting method in Baqaee and Farhi (2020). Statistical significance is denoted by *** p<0.01, ** p<0.05, * p<0.1.

	(1) Discount rate	(2) $\tilde{\kappa}$	(3) $\tilde{\kappa} + \upsilon$	(4) Discount rate	(5) $\tilde{\kappa}$	(6) $\tilde{\kappa} + \upsilon$
Market power (2002)*Year	0.14**	0.13*	0.14**	0.13*	0.12*	0.12**
	(0.071)	(0.064)	(0.064)	(0.068)	(0.062)	(0.063)
Market power (2002)*Year*Intangibles ratio				0.0011	0.0014	0.0014
				(0.00097)	(0.0011)	(0.0014)
Observations	855	855	855	949	949	949
FE	Firm	Firm	Firm	Firm	Firm	Firm
Sample	No communication/health/utilities			Full	Full	Full
R^2	0.97	0.96	0.96	0.97	0.97	0.96
Within R^2	0.12	0.062	0.060	0.13	0.085	0.10

Table A9
Firm-level Risk and the Secular Evolution of Discount Rates and Wedges

The table reports results of panel regressions of firm-level discount rates, discount rate wedges, and discount rate and cost of capital wedges on firm-level risk (averaged over 2000 to 2002) interacted with three different variables: calendar year, mean perceived cost of capital in the firm's country of listing, and the perceived cost of capital at the firm level (predicted as in Table 4). The specifications include these variables on their own as well as interacted with average risk in 2000-2002. The table reports the slope coefficients for the interaction terms. The discount rate wedge $\tilde{\kappa}$ is the discount rate minus the perceived cost of capital (predicted as in Table 4). The discount rate and cost of capital wedge, $\tilde{\kappa} + \upsilon$, is the discount rate minus the CAPM-based financial cost of capital. The dataset is at the firm-quarter level and runs from 2002 to 2021. Standard errors (in parentheses) are clustered by firm. The left-hand side variables are in percent. Risk is standardized, so that the coefficients estimate the impact of a 1 standard deviation increase, and measured using the option-implied volatility of equity. Statistical significance is denoted by *** p<0.01, ** p<0.05, * p<0.1.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
		Discount rate		$\tilde{\kappa}$	$\tilde{\kappa}$	$\tilde{\kappa}$	$\tilde{\kappa}+\upsilon$	$\tilde{\kappa}+\upsilon$	$\tilde{\kappa}+\upsilon$
Risk (2002)*Year	-0.100			-0.093			-0.10		
	(0.072)			(0.075)			(0.080)		
Risk (2002)*Perc. COC (country mean)		0.098			0.079			0.083	
		(0.19)			(0.16)			(0.16)	
Risk (2002)*Perc. COC (firm level)			0.19			0.19			0.16
			(0.15)			(0.15)			(0.16)
Observations	1,142	1,142	1,142	1,142	1,142	1,142	1,142	1,142	1,142
FE	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm
R^2	0.97	0.96	0.96	0.96	0.96	0.96	0.95	0.95	0.96
Within R^2	0.056	0.0056	0.017	0.040	0.015	0.093	0.037	0.020	0.095

Table A10
Financial Constraints and the Secular Evolution of Discount Rates and Wedges

The table reports results of panel regressions of firm-level discount rates, discount rate wedges, and discount rate and cost of capital wedges on firm-level financial constraints (averaged over 2000 to 2002) interacted with three different variables: calendar year, mean perceived cost of capital in the firm's country of listing, and the perceived cost of capital at the firm level (predicted as in Table 4). The specifications include these variables on their own as well as interacted with average financial constraints in 2000-2002. The table reports the slope coefficients for the interaction terms. The discount rate wedge $\tilde{\kappa}$ is the discount rate minus the perceived cost of capital (predicted as in Table 4). The discount rate and cost of capital wedge, $\tilde{\kappa} + \upsilon$, is the discount rate minus the CAPM-based financial cost of capital. The dataset is at the firm-quarter level and runs from 2002 to 2021. Standard errors (in parentheses) are clustered by firm. The left-hand side variables are in percent. Financial constraints are standardized, so that the coefficients estimate the impact of a 1 standard deviation increase, and measured using the index by Hadlock and Pierce (2010). Statistical significance is denoted by *** p<0.01, ** p<0.05, * p<0.1.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Discount rate			$\tilde{\kappa}$	$\tilde{\kappa}$	$\tilde{\kappa}$	$\tilde{\kappa}+\upsilon$	$\tilde{\kappa}+\upsilon$	$\tilde{\kappa}+\upsilon$
Fin. constraints (2002)*Year	-0.022			-0.016			-0.021		
	(0.028)			(0.028)			(0.032)		
Fin. constraints (2002)*Perc. COC (country mean)		-0.083			0.071			0.064	
		(0.15)			(0.14)			(0.15)	
Fin. constraints (2002)*Perc. COC (firm level)			0.15			0.15			0.27
			(0.15)			(0.15)			(0.17)
Observations	1,328	1,328	1,328	1,328	1,328	1,328	1,328	1,328	1,328
FE	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm
R^2	0.97	0.97	0.97	0.96	0.96	0.97	0.96	0.96	0.96
Within R^2	0.043	0.0052	0.030	0.0017	0.0053	0.051	0.0013	0.0093	0.058

Table A11
Firm Market Power and Investment Over Time

The table reports results of regressions of the firm-level capital stock (measured as log PPEN from Compustat) on firm-level market power (averaged over 2000 to 2002) interacted with calendar year. The table reports the slope coefficient on the interaction term. The dataset is at the firm-quarter level for US firms and runs from 2002 to 2019. Standard errors (in parentheses) are clustered by firm. Market power is standardized, so that the coefficients estimate the impact of a 1 standard deviation increase, and measured using the accounting method in Baqaee and Farhi (2020). Statistical significance is denoted by *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

	(1)	(2)
Market power (2002)*Year	-0.013**	-0.021**
	(0.0068)	(0.0094)
Observations	6,987	6,987
FE	Firm/year	Firm/year
Weight	None	Capital stock
R^2	0.98	0.98
Within R^2	0.012	0.032

Appendix B Firms' Optimal Investment Decision According to the Textbook Model

In general, firms should use the stochastic discount factor to discount cash flows associated with investment projects. Textbooks nonetheless tend to present a simpler rule based on a discount rate. The idea behind both approaches is the same—to maximize shareholder value—and in many models, the two approaches leads to similar outcomes, as long as the firm is considering a representative project (i.e., the risk of the project is the same as the risk of the firm's existing assets). For illustrative purposes, we compare the two rules using a simple project with uncertain returns. This project generates expected revenue $\mathbb{E}_t[\text{Revenue}_{t+j}]$ at time $t+j$ and costs Cost_t at time t.

Using the Stochastic Discount Factor The first decision rule is that the firm should accept the project if the net present value, discounted using the stochastic discount factor M_{t+j}, is positive:

$$\mathbb{E}_t\left[\text{M}_{t+j}\text{Revenue}_{t+j}\right] - \text{Cost}_t > 0. \tag{A1}$$

Using the definition of covariance, we can rewrite equation A2 as:

$$\mathbb{E}_t\left[\text{Return}_{t,t+j}\right] > R^f_{t,t+j} - \text{Cov}_t\left[\text{M}_{t+j}, \text{Return}_{t,t+j}\right] R^f_{t,t+j}, \tag{A2}$$

where $R^f_{t,t+j} = \mathbb{E}_t\left[\text{M}_{t+j}\right]^{-1}$ is the risk-free interest rate between t and $t+j$ and $\text{Return}_{t,t+j} = \frac{\text{Revenue}_{t+j}}{\text{Cost}_t}$ is the return to the project.

Using a Discount Rate The second rule is set out in Section 1 in the main paper. It states that the firm should invest if the expected return is above the discount rate. This rule can also be formulated as saying that the firm should invest if the net present value of the project, discounted using a discount rate δ_t, is positive:

$$\sum_{s=0}^{\infty}(1+\delta_t)^{-s}\,\mathbb{E}_t[\text{Revenue}_{t+s} - \text{Cost}_{t+s}] = (1+\delta_t)^{-j}\,\mathbb{E}_t[\text{Revenue}_{t+j}] - \text{Cost}_t > 0. \tag{A3}$$

We can rewrite equation A3 as:

$$\mathbb{E}_t \left[\text{Return}_{t,t+j}\right] > (1+\delta_t)^j. \tag{A4}$$

The two rules in equations A2 and A4 are equivalent, as long as the firm sets the discount rate such that:

$$(1+\delta_t)^j = R^f_{t,t+j} - \text{Cov}_t \left[\text{M}_{t+j}, \text{Return}_{t,t+j}\right] R^f_{t,t+j}. \tag{A5}$$

To determine this discount rate, the firm can use information from asset markets. Assume that the firm just issues one financial asset (e.g., only equity). By definition, the expected return to the financial asset of firm i over one period is equal to 1 plus the firm's "financial cost of capital," given by r^{fin}_{it}. The basic asset pricing equation implies that the expected return to the financial asset over the lifetime of the project is:

$$(1+r^{\text{fin}}_{it})^j = \mathbb{E}_t \left[R^i_{t,t+j}\right] = R^f_{t,t+j} - \text{Cov}_t \left[\text{M}_{t+j}, R^i_{t,t+j}\right] R^f_{t,t+j}. \tag{A6}$$

If the covariance between the stochastic discount factor and the project return is identical to the covariance between the stochastic discount factor and the financial asset return (i.e., $\text{Cov}_t \left[\text{M}_{t+j}, R^i_{t,t+j}\right] = \text{Cov}_t \left[\text{M}_{t+j}, \text{Return}_{t,t+j}\right]$), then the rules in equations A2 and A4 are equivalent for a firm that sets the discount rate equal to its financial cost of capital. Intuitively, if the project under consideration exhibits the same risk profile as the firm's existing investments, then the financial cost of capital tells the firm how financial markets price the risk of the project.

Generalizations The above results generalize to firms with multiple liabilities (e.g., debt and equity). In such cases, r^{fin}_{it} is the weighted average cost of capital, where the expected return is separately estimated for each asset type and weights are calculated using the value of outstanding assets of that type relative to firm total assets, accounting for differential tax treatments of different assets.

The results can also be extended to investments with more complex cash flows. For instance, consider an investment consisting of multiple sub-projects, indexed by s, where each project requires a cost at time t and pays uncertain revenue in one period $t+j$. In that case, the firm could still apply a decision rule as in equations A2 and A4, by summing over each individual sub-projects s.

If $\text{Cov}_t\left[\text{M}_{t+j}, R^i_{t,t+j}\right] \neq \text{Cov}_t\left[\text{M}_{t+j}, \text{Return}_{t,t+j}\right]$, then firms cannot infer the riskiness of an individual project using expected returns on the firm's existing financial assets. Instead, firms should then adjust the discount factor by a project-specific risk premium.

Appendix C Details on Measurement

Appendix C.1 Extraction of Paragraphs from Conference Calls

The Thomson One database contains transcripts of conference calls held since January 2002. We download all calls in English that were available on September 9, 2021. Using an automatic text search algorithm, we identify relevant paragraphs in all 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 cost of capital, discount rates, and investment. 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, IRR. We identify roughly 74,000 such paragraphs.

We match the firm name listed on Thomson One to Compustat by using a fuzzy merge algorithm, checking each match by hand. Ultimately, we link 88 percent of paragraphs to a Compustat firm. We combine the relevant paragraphs into data entry sheets of 500 paragraphs each. To facilitate manual data entry, we include the date of the call, firm name, and blank columns for all financial figures of interest in the sheet. These figures are:

- 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

Appendix C.2 Data Entry Team

We read through each paragraph and enter the figures into the sheets. A total of 15 undergraduate research assistants contributed to the data collection. The average team size at any point in time was 5. Our research team met on a weekly basis to discuss individual cases and to coordinate on consistent guidelines.

We train all assistants in how discounting cash flows and firm investment work. Each assistant reads roughly 2,000 randomly selected paragraphs for training, which we check and discuss. All paragraphs entering the final dataset were read at least twice, by different assistants, to minimize errors. The authors also checked all outlier observations in the distribution of discount rates and changes in discount rates.

Appendix C.3 Guidelines for Manual Data Entry

We establish clear rules for which figures should be recorded. For the main analysis of this paper, we are interested in discount rates (as hurdle rate, premium or fudge factor over the cost of capital, or required IRR) and the internally calculated perceived cost of capital (as OCC or WACC). However, we include a larger set of terms, listed above, among the keywords and in the data entry sheets to ensure that our team differentiates required from expected and realized IRR as well as from various types of other returns. (The difference between how managers use the terms IRR and ROIC in practice is noteworthy. IRR usually refers to the marginal return on an individual project, while ROIC refers to operating profits relative to the entire value of capital on the firm's balance sheet.)

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., US figures for a US 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 (0.7 percent of discount rate observations) and pre-tax cost of capital (1.9 percent of cost of capital observations). 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 occasionally mention a "levered" discount rate (only 1.7 percent of discount rate observations), 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 D Details on the Model of Adjusted Q

In this section, we derive the the relation between adjusted Q and Tobin's Q as well as the effect of discount rates on investment in a model of adjusted Q. The basic model is laid out in Section 6.1. The only modification that we make to the standard Q-model is that we allow for positive discount rate wedges and positive cost of capital wedges. Readers who are only interested in how we use the new data to quantify the model-implied effect of the discount rate on the net investment rate may like to jump straight to Appendix D.3

Appendix D.1 Optimal Investment Rate

We work out the optimal net investment rate and adjusted Q in a model of a firm on a balanced growth path. The profit function $\Pi_t(k_t)$ is homogeneous of degree 1 in k_t, so it can be written as:

$$\Pi_t(k_t) = \Pi_k k_t, \tag{A7}$$

where $\Pi_k > 0$ is a constant. As a result, the value function is homogeneous of degree 1 in k_t and can be written as:

$$V(\upsilon + \kappa, k_t) = (1 + \delta) q k_t, \tag{A8}$$

where q is a constant that measures the marginal value of capital in the eyes of the firm when future cash flows are discounted at rate δ. Hence, q is by definition the adjusted Q on the balanced growth path: $q = Q^{\text{Adjusted}}$.

We can rewrite the model of equation 12 in recursive form by substituting equations A7 and A8 into equation 12:

$$(1 + \delta) q k_t = \max_{I_t} \quad \Pi_k k_t - I_t - \Phi(I_t, k_t, \xi) + q k_{t+1}. \tag{A9}$$

Taking the first-order condition for the right-hand side of equation A9 gives the optimal net investment rate, which is also the growth rate of the firm and which we label g to simplify notation going forward:

$$\frac{I_t}{k_t} - \xi = \frac{1}{\phi}(q - 1) = g. \tag{A10}$$

Dividing both sides of equation A9 by k_t, while taking the optimal net investment rate g from equation A10 as given, renders an equation for adjusted Q:

$$(\delta - g) q = \Pi_k - \frac{I_t}{k_t} - \Phi(\frac{I_t}{k_t}, 1, \xi). \tag{A11}$$

Appendix D.2 Adjusted Q and Tobin's Q

Equation A11 already contains adjusted Q, the marginal value of capital in the eyes of the firm (i.e., using the discount rate δ). We next derive Tobin's Q, the marginal value of capital in the eyes of financial markets (i.e., using the discount rate $r^{\text{fin.}}$). To do so, we follow an analogous approach to the one we took to derive A11. We again take as given the net investment rate g, which is determined by the firm in equation A10. However, to derive Tobin's Q, we discount future cash flows in equation A9 using $r^{\text{fin.}}$ instead of δ. This then renders:

$$(r^{\text{fin.}} - g)Q^{\text{Tobin}} = \Pi_k - \frac{I_t}{k_t} - \Phi(\frac{I_t}{k_t}, 1, \xi). \tag{A12}$$

We follow previous work and term the inverse of $r - g$ the duration of firm's cash flows, which is observed in financial data as the price-earnings ratio of a firm (e.g., Gormsen and Lazarus 2023). This relation can also be directly derived from the Gordon growth model for asset prices:

$$\text{Dur} = \frac{1}{r^{\text{fin.}} - g}. \tag{A13}$$

We derive the relation between adjusted Q and Tobin's Q by taking the ratio of equations A11 and A12. We then rewrite the ratio in terms of duration by inserting A13:

$$q = Q^{\text{Tobin}} \frac{1}{\text{Dur}(\upsilon + \kappa) + 1} = Q^{\text{Adjusted}}. \tag{A14}$$

Hence, adjusted Q is a scaled version of Tobin's Q, where the scaling factor depends on the duration of cash flows and wedges.

Appendix D.3 The Effect of the Discount Rate on the Net Investment Rate in the Model of Adjusted Q

We rewrite the firm's choice of optimal net investment rate (which we denote by $g = \frac{I_t}{k_t} - \xi$) by combining equations A10 and A11:

$$g = \delta - \sqrt{\frac{2(\xi + \delta - \Pi_k) + \delta^2\phi}{\phi}}. \tag{A15}$$

We differentiate A15 with respect to an exogenous shock to the discount rate. This reveals how changes in the discount rate affect the net investment rate:

$$\frac{\partial g}{\partial \delta} = 1 - \frac{1 + \delta\phi}{\sqrt{\phi(2(\xi + \delta - \Pi_k) + \delta^2\phi)}}. \tag{A16}$$

We can rewrite equation A16 in terms of duration:

$$\frac{\partial g}{\partial \delta} = -\frac{1}{\phi} \times \frac{\text{Dur}(1 + \phi r^{\text{fin.}}) - \phi}{1 + \text{Dur}(\kappa + \upsilon)}, \tag{A17}$$

using the definition of $\text{Dur} = \frac{1}{r-g}$ and replacing g as in equation A15.

We use our new data to measure the objects in equation A16. The average discount rate (of firms that fully account for overhead) in our data is 11.4 percent. The average duration of cash flows of listed US firms, using data from Compustat, is close to 20 years (van Binsbergen 2020). Following Philippon (2009), we assume an adjustment cost parameter typical of the literature of $\phi = 10$. Finally, assuming that the average financial cost of capital is 5.5 percent (Graham and Harvey 2018) and inserting these figures into equation A16, we find that the model-implied effect of the discount rate on the net investment rate is -0.96.

Appendix E Model of Market Power and the Choice of Wedges

We introduce a very simple model that allows us to analyze the costs and benefits of discount rate wedges. We simplify the Q-model from Section 6.1 by assuming zero depreciation, no adjustment costs, and only two time periods. Output $Q(k)$ equals capital k, so that $Q(k) = k$. Profits in the simplified model are $\Pi(k) = P(k)Q(k)$ where $P(k) = k^{-\theta}$. The parameter θ increases with the extent of market power, where $0 < \theta < 0.5$. For simplicity, we set $\upsilon = 0$ and focus on the choice of the discount rate wedge κ.

We slightly modify the firm's objective function to allow for benefits from wedges. The key new assumption is that firms value each unit of profits by more if they have a higher discount rate wedge. Firms maximize:

$$\max_{k,\kappa} \quad \kappa \times \Pi(k) \tag{A18}$$

$$\text{s.t.} \quad \Pi'(k) = r^{\text{fin.}} + \kappa. \tag{A19}$$

The constraint reflects that the marginal return to capital $\Pi'(k)$ must equal the discount rate $r^{\text{fin.}} + \kappa$. In the absence of the first term κ in the objective function, the firm would choose the same optimal level of capital as in the adjusted Q-model of Section 6.1.

In setting the optimal wedge $\kappa*$, firms trade off two forces. On the one hand, a higher wedge increases the perceived value of a given set of profits. On the other hand, a higher wedge reduces investment and profits (i.e., a non-zero wedge violates the Lerner condition). This reduction in profits is smaller for firms with more market power, as they can obtain an increase in prices (and thus marginal returns) at a relatively lower reduction in output.

Given that the benefit of a wedge is symmetric with respect to market power but that the cost falls in market power, it is optimal for firms with more market power to use a higher wedge:

$$\frac{\delta\kappa*}{\delta\theta} > 0. \tag{A20}$$