Does the Investment Hurdle Rate Buffer Destroy Value?

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Abstract

Nearly eighty percent of CFOs use buffered hurdle rates that exceed their true cost of capital by 5% on average. Classic corporate finance argues that using hurdle rate buffers may destroy value if companies pass up positive net present value projects. But, this ignores the idea that adopting projects changes the boundary of the firm and that the price of inputs and upfront costs are endogenously set by bargaining with counterparties. We develop a theoretical model of delegated bargaining that nests traditional explanations of why firms use buffers. Because hurdle rate buffers convey an advantage over counterparties during project development, using them may create firm value, even though marginal, positive NPV projects get discarded. We use CFO survey data to empirically characterize buffer usage and examine predictions from the model.

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1. Introduction

Standard textbook advice is that companies should pursue all investment projects that are expected to earn positive net present value (NPV). Accordingly, the investment hurdle rate should equal the weighted average cost of capital (WACC). But, in practice, this is not the case. Our CFO survey evidence shows that 78% of companies use hurdle rates that are significantly greater than the WACC, and that the average buffer is about 5%. While they exhibit both cross-sectional and time-series variation, our analysis shows that buffers are used in firms of all sizes, industries, and regions of the world.\(^1\)

Under standard capital budgeting models, relying on a buffer implies massive economy-wide under-investment and misvaluation. Using estimates in our survey evidence, this is equivalent to a negative bias of 4.5% for one-year cash flows and a 37% decrease for perpetual cash flows.\(^2\) Given that 78% of CFO’s use a hurdle rate above their cost of capital, this represents a major aggregate distortion.

Why would companies rely on buffered-up hurdle rates if doing so leads them to pass up or delay value-creating, positive NPV projects? According to our survey results (Figure 1, Panel A)\(^3\), CFOs may inflate hurdle rates because of perceived or real financial constraints (Graham, 2022), idiosyncratic risk (Décaire, 2021), uncertainty about the true cost of capital (Bessembinder and Décaire, 2021), agency problems within the firm (Harris et al., 1982; Harris and Raviv, 1996, 1998; Chen and Jiang, 2004), managerial time constraints (Jagannathan et al., 2016), or for real options effects (McDonald, 2000).

But, given the magnitude of the distortion, one might ask why doesn’t innovation in contracting, governance, hiring, or organizational structure arise to claw back lost firm value?

\(^1\)Jagannathan et al. (2016), Graham (2022), and Gormsen and Huber (2022) provide similar estimates.

\(^2\)We estimate that the average hurdle rate is 13.88\% and the average cost of capital is 8.77\%. Each dollar of perpetual cash flow is worth $7.21 in present value under the hurdle rate, and $11.40 under the cost of capital. This represents a decrease in value of 37\% under the IRR buffer.

\(^3\)The data for this figure come from the 2011q1, 2019q1 and 2022q2 CFO surveys conducted by Duke University’s Global Business Outlook and the Federal Reserve Banks of Richmond and Atlanta. The analysis of these data do not necessarily reflect the views of the Federal Reserve Bank. Table B.2 contains detail on the survey questions and methodology behind Figure 1.
Why doesn’t the market for corporate control, discipline from earnings reporting, or stock market pressure correct this behavior? Ultimately, it is puzzling that such large inefficiencies would persist in the long-run.

Our explanation combines two ideas. First, every project that a firm accepts is an acquisition that changes the boundary of the firm. Thus, up front investment costs are not exogenous, contrary to what most textbooks posit. These costs are in fact the endogenous result of a collection of bargaining outcomes between the firm’s managers and outsiders who provide resources. If sufficient gains through trade exist, investment in positive NPV projects creates a joint surplus, over which the firm and its trading partners negotiate.

For example, suppose that building a new plant requires land. The price that the land sells for (which is part of the up front investment costs, $C_0$) will depend on what it will eventually be used for (the value created by future cash flows) and the relative bargaining power between the firm’s managers and the owners of the property.

The second idea rests on the fact that in corporate settings, employees typically take their CFO’s instructions about the hurdle rate as given, without questioning its accuracy. This common practice gives rise to a bargaining situation in which top executives can alter the firm’s observable preferences to outsiders (Schelling, 1956; Crawford and Varian, 1979; Sobel, 1981) through delegation (Jones, 1989; Fershtman et al., 1991; Burtraw, 1993; Segendorff, 1998). As a result, when the hurdle rate is high, employees are more likely to “bargain hard” or even walk away during negotiations. This can in turn result in the firm obtaining a greater share of the surplus during negotiations. It is important to note that the bargaining advantage provided by a high hurdle rate exists regardless of why the firm has one; that is, whether the CFO strategically sets a high hurdle to aid negotiations, or because the CFO does it for other reasons such as time constraints or imprecision in estimating WACC. 4 As we show in this paper, using an IRR buffer is often optimal and increases firm value.

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4Therefore, our bargaining explanation can co-exist with other hurdle rate buffer explanations. As we will discuss, there is anecdotal evidence that some CFOs do use buffers strategically.
We first develop a theoretical model of delegated bargaining and then test its implications. From first principles, we derive the Nash bargaining solution of the game. Our first result is that parties enjoy a greater share of the surplus when their discount rate is reported to be higher. This is in the spirit of Rubinstein (1982), but distinct. Rubinstein bargaining uses a higher discount to model less patience, so that a party would be vulnerable to waiting to make a deal: a higher discount rate is associated with a lower split of the surplus (Rubinstein and Wolinsky, 1985). Here, the opposite occurs because the value of the outside option is based on the opportunity cost of capital. When a party is required to earn a higher return, their perceived walkaway value increases, and they earn more surplus if a deal is on the table.

So, in the model, while projects with moderate NPV may be bypassed when using an inflated hurdle rate, overall this can still create value due to the bargaining advantage the firm enjoys when negotiating the projects that the firm does undertake. This arises both when the CFO uses a buffer strategically or non-strategically (e.g., based on the explanations in Figure 1), and helps explain why hurdle rate buffers are so widely used.

Using data from CFO surveys, we test the model’s predictions about buffer use on both the extensive and intensive margins. The first testable implication comes from the fundamental premise of the model: project value is a function of bargaining over inputs and outputs. In the data, we show that companies with high asset tangibility or that operate in industries where projects require more property, plant, and equipment have higher buffer use. This result is not obvious from explanations such as financial constraints or idiosyncratic volatility, as these quantities are typically negatively correlated with tangibility (Almeida and Campello, 2007; Fink et al., 2010).

Then, we confirm a second implication of our model that the buffer is larger for firms with higher volatility of the underlying project value (i.e., idiosyncratic project risk), consistent with analysis in Décaire (2021). We also show that buffer use is increasing in uncertainty about the WACC (Bessembinder and Décaire, 2021).

Third, we confirm empirically that buffer use is decreasing in a firm’s cost of capital.
While this is implied by our model, it differs from what one might expect based on buffer explanations in the prior literature. For example, if managers use a higher buffer to compensate for idiosyncratic risk (Décaire, 2021), we would expect there to be, on average, a positive association between the cost of capital and the buffer, since idiosyncratic risk is correlated with systematic risk, empirically. Also, prior explanations based on financial or managerial constraints would also generally predict either no relation between the buffer and cost of capital (since managerial time constraints are likely independent of the cost of capital) or a positive relation (since financial constraints are more likely to bind for high cost of capital firms).

Last, we show that a firm’s bargaining power is negatively correlated with buffer use. This is consistent with the model’s implication that firms that already have strong bargaining power have lower incentives to use buffered-up hurdle rates to further enhance market power. We confirm the expected negative cross-sectional relation using markups based on Baqae and Farhi (2020) and measures of the concentration of a firm’s customer base. Our results complement Gormsen and Huber (2022), who show a positive time-series correlation between buffers and initial bargaining power (as measured by price markups in 2002). The difference in the empirical results stems from the evolution of firms’ markups over time.

Literature Review

The discrepancy between hurdle rates and WACC has been appreciated for decades. Starting with Poterba and Summers (1995), the authors surveyed CEO’s from Fortune 1000 firms and showed that hurdle rates often exceed both the equity holders’ average rates of return and the cost of debt. Many of the firms in their study were in manufacturing, where long-term capital budgeting is required. Unlike our study, though, they did not ask their subjects whether a different WACC was computed and not used. While they did not compute a specific IRR buffer as we do, their findings suggest that the hurdle rates that were used were indeed inflated.

Since that time, many explanations have been proposed for the use of inflated hurdle
rates. Harris and Raviv (1996) provide a theory of internal capital allocation in which there is decentralized information about projects and agency problems within the firm. The goal of headquarters is to manage the tendency for a division to over-invest in new projects. This may arise because divisional managers can employ less effort if more capital is invested (Harris et al., 1982), or because managers are either optimistic or have private benefits when projects are undertaken. Harris and Raviv (1996) posit that a mixture of capital constraints and oversight can help ameliorate these frictions.

Bernardo et al. (2001) investigate these issues in the context of contracting and show that only high-quality projects get funded, and that managers of these receive greater incentive compensation. This stems from information asymmetries between CFOs (headquarters) and divisional managers. Chen and Jiang (2004) investigate this as well and show that asymmetric information is not necessary to cause use of higher hurdle rates. They show that use of an IRR buffer solves an agency problem in which the divisional manager is required to exert costly, non-contractible effort to collect information. In both cases, headquarters must commit to the allocation and compensation schemes. Chen and Jiang (2004) surmise this could arise from the rigidity of the capital budgeting process. The analysis that we provide in our theoretical model supports this claim but shows that such commitment that arises when the CFO (headquarters) determines the hurdle rate and project managers take it as given without verification can lead to bargaining benefits and higher overall valuations.

More recently, other explanations have been offered for the pervasive use of IRR buffers. Jagannathan et al. (2016) posit that IRR buffers arise because of real (or perceived) managerial constraints. They demonstrate this to be the case using survey data. They also quantify the wedge between hurdle rates and the firm’s WACC. Their magnitudes are consistent with the results from our surveys, which is re-assuring. Further, our later surveys confirm their results that this consideration is important for managers. However, as we describe above, one still wonders why firms would leave so much value on the table if they could access labor markets and hire more managers. Our paper addresses this issue directly, both theoretically
Décaire (2021) shows that firms use an IRR buffer when firms face higher idiosyncratic risk. Bessembinder and Décaire (2021) show that uncertainty about discount rates (systematic risk) causes an upward bias in estimated NPVs, leading to higher corporate investment; such a bias should cause managers to adjust their buffers. These predictions are also considered in our model. We also show that they are present in the data, confirming both studies, and we control for these forces when investigating the other implications of our model.

Our paper is also related to Gormsen and Huber (2022), who document time-varying wedges between discount rates and the cost of capital. Important to our work, they fix market power at the beginning of their sample (in 2002) and show that it is positively correlated with their discount rate wedge in future years. In contrast, the theory and empirical work in our paper supports a negative correlation between buffers and market power in the cross-section of firms. In our model, firms that have less bargaining power use a buffer to increase their realized bargaining power in equilibrium. So, while we expect a negative correlation between current period bargaining and buffer use, the dynamic relation between fixed historic market power (as in Gormsen and Huber (2022)) and future IRR buffers is less clear; the positive Gormsen and Huber (2022) relation between fixed, historic bargaining power and the buffer could be consistent with our findings. We revisit the data in Gormsen and Huber (2022) in Section 4.2 and show that companies that had low markups in 2002 gained market power monotonically over 2002-2021. This feature of the data could explain why we document a negative relation in our repeated cross-sections (consistent with our model’s predictions) and Gormsen and Huber (2022) observe a positive correlation over time.

A key contribution of our paper relative to the prior work on the buffer is that we show that buffer can actually be value enhancing. McDonald (2000) posits a very different mechanism that relates buffer use to increases in value. In that paper, an IRR buffer serves as a heuristic that approximates solving a real options problem. Managers have the option to wait to start projects, and thus choose when to optimally exercise an American option.
If the option is sufficiently in the money, they do not wait; this is akin to the project exceeding a high hurdle rate. Even if buffers are used heuristically in this manner, our model suggests that buffers have the added benefit of impacting the surplus the project will achieve conditional on waiting.

As discussed briefly above, our paper adds to the extant bargaining literature. The model explored in Rubinstein (1982) and Rubinstein and Wolinsky (1985) is sequential in which two parties take turns making take-it-or-leave-it offers. Bargaining takes place over time, as long as an agreement has not been met. Each party has a discount rate, which proxies for their eagerness to get to a negotiated deal faster. The solution involves an equilibrium split whereby a higher discount rate yields lower surplus. Our model yields the opposite intuition: having a higher discount rate increases a party’s (perceived) walkaway value because the outside option is more valuable. As such, in our analysis, firms can use this to their advantage when they develop projects.

The organizational structure in our model gives rise to decentralization in which the CFO reports the hurdle rate and the manager develops projects. This is in the spirit of Schelling (1956), Crawford and Varian (1979), and Sobel (1981) who explore how advantage can be gained by distorting the impression or beliefs of a counterparty during negotiation. Explicitly, this can be done via delegation in which a party commits to using a representative without the ability to renegotiate suboptimal outcomes (Jones, 1989; Fershtman et al., 1991; Burtraw, 1993; Segendorff, 1998). The structure of our theoretical construct shares this feature, which we use to model typical organizational behavior.

Finally, our paper adds to the rent-seeking and innovation literature. Nash bargaining in our model yields a surplus share that resembles a classic Tullock contest function (Tullock, 1980), where the fraction is an increasing function of the firm’s hurdle rate. While this arises endogenously, it is natural as it has been used often in the rent-seeking literature to represent the proportion of the market that each party enjoys when new projects or markets arise (Hirshleifer, 1989). Tullock contest functions are commonly used to characterize R&D races.
(D’Aspremont and Jacquemin, 1988; Chung, 1996; Andrei and Carlin, 2022). In fact, Baye and Hoppe (2003) show that rent-seeking competitions, patent-race games, and innovation tournaments are often strategically equivalent to a Tullock contest. What differentiates our work here is that the Tullock contest function arises from delegated bargaining and is a function of the purported cost of capital for each firm. Additionally, the purported hurdle rate also creates spillovers for each firm, in that positive NPV projects may be discarded. This adds to prior work in the rent-seeking literature that considers spillovers where the size of the pie in contests either increases with effort (D’Aspremont and Jacquemin, 1988; Chung, 1996) or shrinks (Alexeev and Leitzel, 1996). Chowdhury and Sheremeta (2011) generalize this to consider linear combinations of effort complementarities in duopoly contests.

The rest of the paper is organized as follows. In the next section we describe the survey and other data that we use, and establish a number of stylized facts about the hurdle rate buffer. In Section 3, we analyze delegated bargaining theoretically and characterize the empirical implications about IRR buffers that arise from the model. In Section 4, we develop a set of four hypotheses and test the model using data from several CFO surveys (Graham, 2022). Section 5 concludes. All proofs are contained in the appendix.

2. Data Description and the Hurdle Rate Buffer

In this section, we describe our data sources, discuss the reasons that firms set their hurdle rates above their cost of capital, and describe variation in the hurdle rate buffer across observable dimensions. We discuss the main variables covered by our CFO surveys in Section 2.1 and discuss the origins of the buffer in Section 2.2. Table B.1 provides variable definitions and Appendix C provides more detail on the CFO Survey.

2.1. CFO Survey Data

Our primary data source comes from several CFO surveys conducted by Duke University. These surveys have been conducted quarterly for over decades; the most recent surveys have
been conducted jointly with the Federal Reserve Banks of Richmond and Atlanta). At several points in time, the survey asked CFOs directly for both their hurdle rate and their weighted average cost of capital. One advantage of gathering data via surveys is that we obtain data directly from each firm’s primary financial decision-maker.

Another advantage is that we are able to gather data via questions that precisely define hurdle rates and other variables versus having to infer or approximate the variables. We ascertain the firms’ weighted average cost of capital by asking CFOs “what do you estimate is your firm’s overall weighted average cost of capital (WACC)?”. To obtain data on hurdle rates, we ask “what is your firm’s hurdle rate (the rate of return that an investment must beat in order to be adopted)?” These questions appeared in each of the six CFO surveys that we analyze and the consistent wording of these questions gives us confidence that our measures capture what we intend.\(^5\)

For sample inclusion, we require that the CFO supply a value for their WACC and hurdle rate. From there, we compute the firm’s hurdle rate buffer as the difference between the hurdle rate and the WACC.

Figure 2 summarizes key characteristics of the survey firms. Panel A shows that firms in our sample are distributed across several industries and that manufacturing firms comprise the largest portion of the sample. Panel B conveys that the sample includes large firms (revenue greater than \(\$1\) billion), as well as smaller firms. Panel C shows that our sample is comprised of both private and public firms. Panel D shows that our sample is relatively evenly distributed across six different surveys that queried CFOs about their hurdle rates.

Table 1 Panel A displays summary statistics of variables related to the hurdle rate and cost of capital. The average hurdle rate in our sample is 13.88\% and the average WACC is 8.77\%, giving rise to an average buffer of just over 5\%. Nearly 78\% of companies use a hurdle rate buffer. Among the firms that have a non-zero buffer, the average size of the buffer 6.6\%.

\(^5\)The surveys are 2011q1, 2012q2, 2017q2, 2017q3, 2019q1 and 2022q2. Appendix C provides detail on the data collection process and the questions posed to CFOs concerning their hurdle rate and cost of capital.
The size of the buffer is consistent with other research (Jagannathan et al., 2016; Graham, 2022; Gormsen and Huber, 2022).

2.2. Why Is There a Hurdle Rate Buffer?

In this section, we establish stylized facts about why firms use buffers and the cross-sectional and time series variation in the intensive and extensive margins of the buffer.

2.2.1. Why Do CFOs Set Hurdle Rates Above the Cost of Capital?

Various frictions may lead a company to set its hurdle rate above the cost of capital. Companies may use a buffer to ration capital, so that they choose just the highest expected returns projects of a given class. This may arise due to constraints on funding, managerial time, non-managerial labor availability, or production capacity (Jagannathan et al., 2016; Graham, 2022). A second set of forces may lead CFOs to set a hurdle rate equal to their perceived cost of capital plus a “fudge factor,” which serves to offset complications from idiosyncratic risk or difficulties in estimating the true cost of capital (Décaire, 2021; Bessembinder and Décaire, 2021), because of agency issues or adverse selection problems within the firm, or because of behavioral forces that lead managers to use overly-optimistic cash flow forecasts as they pitch their projects to upper management (Harris et al., 1982; Harris and Raviv, 1996, 1998; Chen and Jiang, 2004). Third, using a buffer may approximate decision-making that accounts for real options motivations (McDonald, 2000).

On three of the CFO surveys, we asked CFOs "Why do you set your hurdle rate above WACC?", allowing respondents to choose among a list of reasons representing the forces mentioned above (or to write in other explanations). The three surveys were conducted in 2011q1, 2019q1 and 2022q2. The options of available choices varied somewhat between surveys but always included choices related to five of the traditional explanations mentioned above: (i) financing constraints (ii) managerial/resource constraints (iii) project prioritization (iv) idiosyncratic risk/uncertainty and (v) over-optimism/agency. We classify CFO responses concerning why their hurdle rate exceeds WACC under these five qualitative group-
ings, in order to ascertain the relative importance of each in explaining the buffer.

Figure 1 presents the proportion of CFOs that selected reasons that fall within each of the five categorizations of why companies use hurdle rate buffers. Table B.2 describes how we group responses across each survey, as well as details on each sub-sample. Panel A of Figure 1 displays importance of each category across the three surveys. There is reasonable support for each of the five categories. For example, 60% of respondents indicate that they implement a buffer due to project prioritization and more than half indicate that risk or uncertainty in estimating the cost of capital or unmeasured risks lead to buffers. Panel B displays the importance of each reason by survey year. The importance of financing and resource constraints dipped in 2019 when the economy was in a relatively strong position (relative to 2011, where the after-effects of the 2008 crisis were still present; and relative to 2022, with an extremely tight labor market and rising borrowing costs). To emphasize a point made earlier, whether the CFO increases the hurdle rate buffer for one of the "non-strategic" reasons reflected in Figure 1, or to gain strategic negotiating advantage, the bargaining implications derived in our model still hold.

Panel C displays the results conditional on firm size (large firms being those with revenue weakly greater than $1 billion). Financing and resource constraints are relatively more important for small firms. Interestingly, idiosyncratic project risk or uncertainty about WACC or discount rate or other unmeasured risks are much more important for large firms. This may be because (i) large firms are more likely to have numerous diverse projects, with different idiosyncratic risks and (ii) are more likely to use equity markets or issue debt, potentially adding complexity to estimating the cost of capital and the return required by investors.

Taken together, the information in Figure 1 helps us create empirical proxies to measure these buffer explanations, both to explore these explanations directly and to control for these reasons when we explore empirical predictions from the model. Section 4.1 discusses specific variables used to measure buffer explanations, as well as the other non-CFO survey variables.
that we use in our empirical analysis.

2.2.2. Variation in Hurdle Rate Buffers Across Firms, Time, and Geography

Surveys back to the 1980s show that firms’ hurdle rates are on-average relatively constant across time – suggesting that buffers also retain this consistency, or are even growing throughout time (Graham, 2022; Jagannathan et al., 2016; Poterba and Summers, 1995). To ascertain the degree of variation in the buffer in our dataset, Figure 3 investigates the cross-sectional and time series properties of the hurdle rate, the cost of capital, and the buffer. Panel A displays industry average hurdle rates, costs of capital and buffers. The black error-caps on each bar display the within-group inter-quartile range (IQR). It is noteworthy that there is substantial variation within each industry, which is consistent with our model, in which a firm’s position within its industry affects its incentives to use hurdle rate buffers. Also clear is that the buffer is not just an artifact of fixed differences across industries, which will play an important role in our empirical analysis. Leveraging our data’s fine industry classifications, Table B.3 displays average hurdle rate, cost of capital, and the intensive and extensive margins of the buffer across NAICS-2 and CFO survey industries.

Panel B shows that the size of the buffer is relatively constant across survey years. Panel C shows that there is a clear difference in the size of the buffer for small versus large firms. For firms with less than $1 billion in sales revenue, the average buffer is 5.8%, whereas for firms with revenue above $1 billion, the average buffer is 3.8%. Though not shown in the figure, among firms with a non-zero buffer, the average buffer for small/large firms is 6.9%/5.3%.

Panel D shows that the buffer is remarkably similar across regions of the world, despite variation in the buffer and the cost of capital (see also Gormsen and Huber, 2022). We also examine the properties of the extensive margin of the buffer in Figure B.1. The extensive

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6For example, the average buffer in Mining/Construction is approximately 6%, and the inter-quartile range is 0% to roughly 9%.
7We use data on company names and the Infogroup dataset to match survey firms to their NAICS codes. The CFO Survey industry code is supplied by the CFO directly and roughly equates to one-digit SIC codes.
margin patterns in the appendix figure are very similar to the intensive margin results just discussed as shown in Figure 3.

2.2.3. Hurdle Rate Buffers, WACC, and Realized Returns

The hurdle rates we gather from surveys are used as a benchmark against which expected returns of prospective projects are compared. To gain perspective on the realized returns earned by corporate investment, we calculate the return on invested capital (ROIC) for the portion of our sample that can be matched to Compustat. Figure 4 displays the average hurdle rate and WACC for this subsample and the cross-sectional average ROIC. It shows that on average ROIC is greater than WACC, which is consistent with the companies in our sample on average choosing positive NPV projects (and creating value via their investments).

The figure also explores the relation between ROIC and the hurdle rate. If companies strictly followed an investment rule of choosing projects that are expected to surpass the hurdle rate, and the process were unbiased, one might expect ROIC to equal or exceed the hurdle rate. Though we can not test the following directly, the fact that ROIC is less than the hurdle rate on average is instead consistent with a "fudged up" hurdle rate, for example being selected to offset optimism in cash flows provided by managers; therefore, we control for optimism in some empirical specifications below. Finally, given that ROIC is calculated from archival data, the relative relation between ROIC and survey-based WACC and hurdle rate measures is generally reassuring about the quality of our survey data.

The evidence presented in this Section confirms two key features of hurdle rate buffers in our data. First, firms use buffers for different reasons, primarily to ration project choice because of constraints, or to counteract frictions in the firm’s organizational structure or capital budgeting process (Figure 1). Second, while average buffers are relatively constant across observable dimensions, there is considerable variation, confirming that the buffer is not an artifact of differences in financial practice across, e.g., industries (Figure 3). Both points motivate and discipline the model in Section 3 and subsequent empirical analyses in Section 4.
3. The Model

3.1. Preliminaries

Consider an unlevered firm that employs a CFO who is tasked with calculating a hurdle rate for the firm’s activities. We assume that the CFO of firm $F$ uses an asset pricing model that computes the cost of capital $W_F = 1 + r^{wacc}_F$. The CFO reports a hurdle rate $H_F$ to other employees in the firm, which is taken at face value and is not verified. As such, the CFO has discretion to truthfully report the real $H_F = W_F$, or she may use an IRR buffer and report a higher gross hurdle rate $H_F = \tau_F$ to others in the firm.

Reasons for reporting $\tau_F > W_F$ may be strategic or non-strategic. We say that a strategic IRR buffer is purposeful in that it is designed to take advantage of the delegated-bargaining organizational structure of the firm (to be described shortly). Non-strategic reasons are the result of compensating for a (perceived) lack of precision in estimating $W_F = 1 + r^{wacc}_F$, conservatism, managerial or financial constraints, the overconfidence of project managers, or agency and adverse selection issues within the firm.

Employees within the firm who identify and manage projects are called delegates. The firm invests a fixed amount of capital $x_F$ in each project. For any given project, we begin by considering that it is necessary for the firm to require one asset from an outside business partner (e.g., land, equipment, materials). If the delegate fails to secure the necessary asset, the entire project becomes infeasible. In Section 3.2.2, we generalize this to consider $N$ outside entities/assets.

The outside business partner, $O$, also has a CFO and a delegate who represent its interests. The business partner invests $x_O$ in the asset and has a required return. In the same way, though, the delegate for the outside business partner is either endowed with their true cost of capital $H_O = W_O = 1 + r^{wacc}_O$ or a gross hurdle rate that includes an IRR buffer $H_O = \tau_O$.

The projects that the primary firm has access to are heterogeneous. Assume that the values from these investment opportunities are uniformly distributed across the support
\[ V \sim U[0, \bar{V}] \]. Given that \( x_F \) and \( x_O \) are fixed, there exists a unique \( R \) associated with each project. Assume that both delegates and CFO’s have full information about this distribution.

When assets are acquired, delegated Nash bargaining takes place, with \( \theta \) surplus being allocated to the firm and \( (1 - \theta) \) going to trading partner. Both delegates report their respective hurdle rates to each other, \( H_F \) and \( H_O \). If the return that each receives from trade does not meet their respective hurdle rates, the parties walk away and the project is not undertaken.

For each potential trade, Nash bargaining maximizes

\[
\max_s (s_F - d_F)^\alpha (s_O - d_O)^\beta,
\]

where \( s \equiv \{s_F, s_O\} \) is the surplus allocated to each party and \( d \equiv \{d_F, d_O\} \) is each party’s disagreement payoff.

**Lemma 1.** For any feasible \( R \), suppose that \( s = \{\theta(x_F + x_O)R, (1 - \theta)(x_F + x_O)R\} \), \( d = \{x_FH_F, x_OH_O\} \), and \( \alpha = \beta = 1 \). Then,

\[
\theta = \frac{1}{2} + \frac{x_FH_F - x_OH_O}{2(x_F + x_O)R}.
\]

In Lemma 1, the total surplus equals the return on investment \( R \) times the total capital invested \((x_F + x_O)\). If the two managers walk away, they believe that they can invest their capital in an alternative at their hurdle rate. The solution in (2) shows that the split of the surplus depends on each firm’s purported hurdle rate. The two parties split the surplus equally, with an added amount going to the party with the higher rate: \( \theta \) is increasing in \( H_F \) and decreasing in \( H_O \).

The use of discount rates in \( \theta \) is in the spirit of Rubinstein bargaining, but distinct. Because Rubinstein bargaining is sequential, the party with less patience (higher discount rate) earns a lower split of the surplus. Here, the opposite occurs since the value of the outside option is based on the opportunity cost of capital. When a party is required to
earn a higher return, their walkaway value increases, and they earn more surplus if a deal is feasible.

Having shown that bargaining will depend on the costs of capital of each firm, going forward we assume that $\alpha = x_F H_F$ and $\beta = x_O H_O$. This is for tractability, but still yields a bargaining outcome with similar properties. In this case, we define the surplus as the total dollar value of the project above and beyond the value each firm would achieve if they invested $x$ dollars at their hurdle rate. Specifically, the total surplus is defined as $(x_F + x_O)R - (x_F H_F + x_O H_O)$. Firms bargain over the total surplus and receive zero if they walk away (i.e., they invest at their required rate of return instead of the project, which means that the NPV is 0).

**Lemma 2.** For any feasible $R$, suppose that $s = \{\theta[(x_F + x_O)R - (x_F H_F + x_O H_O)], (1 - \theta)[(x_F + x_O)R - (x_F H_F + x_O H_O)]\}$, $d = \{0, 0\}$, $\alpha = x_F H_F$, and $\beta = x_O H_O$. Then,

$$\theta = \frac{x_F H_F}{x_F H_F + x_O H_O}. \quad (3)$$

According to Lemma 2, the firm and its trading partner can increase their respective bargaining power by reporting a higher hurdle rate. Equation (3) is increasing in $H_F$ and decreasing in $H_O$, just as in Lemma 1. In the equilibrium that we derive below, this may make it attractive for both parties to use IRR buffers. As we will see however, the offsetting cost will be that positive NPV projects are lost because of the exaggeration of reported hurdle rates.

Interestingly, the expression in (3) resembles a 2-firm, logit Tullock contest function (Tullock, 1980), where each party gains a share of the value from the project (Hirshleifer, 1989). This is natural here as a bargaining payoff because Tullock contest functions are commonly used to characterize the gains from innovation in the rent seeking literature (D’Aspremont and Jacquemin, 1988; Chung, 1996; Baye and Hoppe, 2003; Andrei and Carlin, 2022).^8

^8Chowdhury and Sheremeta (2011) generalize Tullock contest functions to consider linear combinations of
3.2. Strategic Use of IRR Buffers

3.2.1. Single-firm IRR Buffer

Firm’s may use a buffer for a variety of reasons. In this section, we start by characterizing the buffer that maximizes firm value if it is used purposefully by the CFO to increase bargaining power. This will serve as a benchmark to compare cases where firms utilize a buffer for other reasons, such as constraints on managerial time or capital.

It is instructive to start by assuming that the outside business partner does not use an IRR buffer. Nash bargaining takes place over each project value $V = (x_F + x_O)R$. From (3), if the firm does not use an IRR buffer, its split is given by

$$\theta_N = \frac{x_F W_F}{x_F W_F + x_O W_O}.$$ 

Firm value is computed as

$$V_N = \int_V^\bar{V} \theta_N dV,$$

where $V \equiv x_F W_F + x_O W_O$. As such, $V$ measures the minimum value a project yields so that both parties can receive sufficient surplus to participate. Simplification yields

$$V_N = \frac{x_F W_F \bar{V}}{x_F W_F + x_O W_O} - x_F W_F. \quad (4)$$

Now consider that an IRR buffer may be used strategically by the firm when the outsider does not (e.g., when the outsider cannot credibly commit through delegated bargaining). The firm solves

$$\max_{\tau_F \geq W_F} V_B = \int_{\bar{V}} V \theta_B dV, \quad (5)$$

effort complementarities in duopoly contests. See also D’Aspremont and Jacquemin (1988), Chung (1996), and Alexeev and Leitzel (1996).
where $H_F = \tau_F$ is the buffered (gross) hurdle rate and

$$\theta_B = \frac{x_F \tau_F}{x_F \tau_F + x_O W_O}.$$  

We restrict $\tau_F \geq W_F$ because it is a dominated strategy to choose a lower cost of capital than $W_F$; in that case the firm would reduce its bargaining power and accept negative NPV projects. So, when a positive IRR buffer is used, $V' \equiv x_F \tau_F + x_O W_O$, which is larger than $V$. The lower limit of the integral increases because some positive NPV projects are rejected and the firm’s delegate walks away.

So, the CFO faces a tradeoff. Using a higher buffer increases $\theta_B$, but raises $V'$: Bargaining power increases, but more positive NPV projects are discarded.

**Proposition 1.** For bargaining as in (3), when the firm uses a positive IRR buffer and the outsider does not, the optimal buffered hurdle rate is given by

$$\tau_F^* = \frac{\sqrt{V x_O W_O} - x_O W_O}{x_F},$$  

and the resulting value to the firm is given by

$$V_B^* = \bar{V} + x_O W_O - 2\sqrt{\bar{V} x_O W_O}.  \tag{7}$$

The change in value resulting from use of the buffered hurdle rate is strictly positive, that is,

$$\Delta V = V_B^* - V_N^* = \frac{x_O W_O \bar{V}}{x_F W_F + x_O W_O} + (x_F W_F + x_O W_O) - 2\sqrt{\bar{V} x_O W_O} > 0.  \tag{8}$$

$\Delta V$ is increasing in $\bar{V}$ and decreasing in $x_F$ and $W_F$.

We can use (6) to determine a condition that characterizes when a positive buffer is used
(extensive margin), that is when $\tau_F > W_F$. A positive buffer is used if

$$(1 - \theta_F)\bar{V} > x_F W_F + x_O W_O. \quad (9)$$

The firm is more likely to use the buffer when its starting bargaining power is lower ($\theta_F$), its own cost of capital is lower ($W_F$), and when there are more high potential project values ($\bar{V}$). The upper bound of the project values $\bar{V}$ also proxies for the uncertainty faced by managers, since the variance of the distribution increases with $\bar{V}$. If (9) is not satisfied, then the CFO reports $W_F$ to its management.

The model may also be interpreted quantitatively. Figure 5 plots a surface for an example where $W_O = 1.15$ and $x_F = x_O = 1$. Panels (a) and (b) show how the optimal buffer varies as a function of $\bar{V}$ and both $W_F$ and $\theta_N$, respectively. Note that holding $W_O$, $x_F$ and $x_O$ fixed, there is a one-to-one mapping from $W_F$ to $\theta_N$. Therefore the difference between Panels (a) and (b) is the scale of the axis. By inspection, use of the buffer is more likely with higher $\bar{V}$ and lower $W_F$ (or $\theta_N$).

As a specific example, suppose the firm’s cost of capital is 7% ($W_F = 1.07$) and that $\bar{V} = 4.7$ (implies that the upper limit is roughly double that of $V$). Then, the optimal hurdle rate is 16.5% (a buffer of 9.5%). From (8), this implies an increase in firm value of 0.349%. By contrast, if we were to ignore the bargaining benefit of the buffer, we would conclude that a buffer of 9.5% would lead to a value loss of 8% for these same assumptions.

Also according to Proposition 1, if an IRR buffer is used, the intensive margin implications are that buffers are more attractive for high potential project values and less attractive for higher firm investment and when there is a higher cost of capital. The relationship is more subtle between $\Delta V$ and $x_O W_O$. This stems from a non-monotonic relationship between the use of the IRR buffer ($\tau_F^*$) and $x_O W_O$. Taking the following derivative

$$\frac{\partial \tau^*}{\partial W_O} = x_O \left( \frac{\bar{V}}{2x_F \sqrt{\bar{V} x_O W_O}} - \frac{1}{x_F} \right).$$
demonstrates that the relationship is positive only if $\bar{V} > 2\bar{V}'_F$. The same is true for the derivative with respect to $x_O$. When the surplus gained from a larger share of projects is higher than the value lost from forgoing positive NPV projects, the firm’s IRR buffer is increasing in $x_O W_O$. Otherwise, if $\bar{V} < 2\bar{V}'$, the cost of lost positive NPV projects dominates and the buffer is smaller. Given this, a similar non-monotonic relationship between $\Delta V$ and $x_O W_O$ also exists, and is derived in Lemma A.1 in the appendix.

### 3.2.2. Competitive IRR Buffers

Now consider that each player $i \in \{F, O\}$ chooses an IRR buffer $\tau_i \geq W_i$ to maximize

$$\max_{\tau_i} V_F = \int_{\bar{V}''}^{\bar{V}} \theta dV,$$

conditional on their counterparty acting optimally as well. Now, the lower limit of integration is defined as $\bar{V}'' = x_F \tau_F + x_O \tau_O$, which is the purported minimum project value that can meet both parties’ required returns under the buffered IRR hurdle rates. Let us assume that (9) holds for both parties, so that autarky is not a part of the equilibrium.9

**Proposition 2.** *For bargaining as in (3) there exists a unique symmetric Nash equilibrium in which the optimal buffered hurdle rates are given by

$$\tau^*_F = \frac{\bar{V}}{4x_F}, \quad \tau^*_O = \frac{\bar{V}}{4x_O}$$

and the value for each firm is

$$V^*_F = V^*_O = \frac{\bar{V}}{4}.$$*

Compared to the case in which IRR buffers are infeasible, the deadweight loss is

$$Loss = \frac{\bar{V}}{2} - (x_F W_F + x_O W_O).$$

9A condition similar to (9) can be derived for the outsider.
The comparative statics implied by Proposition 2 are straightforward. For each counterparty, the IRR buffer is increasing in the potential value of projects ($\bar{V}$) and decreasing in the scale of each party’s investment.

However, while there is a deadweight loss, this is not necessarily a Prisoner’s dilemma. Let us compare each party’s value when both use an IRR buffer to the case where neither (are allowed to) do so.

$$\Delta V_F = \bar{V} \left( \frac{1}{2} - \theta \right) - x_F(\tau_F - W_F) \quad (13)$$

$$\Delta V_O = \bar{V} \left( \theta - \frac{1}{2} \right) - x_O(\tau_O - W_O). \quad (14)$$

The first term in both expressions is the change in value due to a gain or loss in bargaining power. By inspection, it is clear that one party gains and one loses. The second term is negative for both parties and represents the loss of otherwise feasible positive NPV projects. So, one party unequivocally loses value, but the other may gain based on the underlying parameters. From (13), the firm is net positive with IRR buffers if

$$\frac{\bar{V}}{4} - \theta \bar{V} + x_F W_F > 0 \quad \Leftrightarrow \quad \frac{\bar{V}}{4\theta} - (\bar{V} - \bar{V}) > 0.$$ 

This is more likely to be the case if the firm starts with low bargaining power when IRR buffers are not used (feasible). The corresponding condition for the outsider is

$$\frac{\bar{V}}{4} - (1 - \theta) \bar{V} + x_O W_O > 0 \quad \Leftrightarrow \quad \frac{\bar{V}}{4(1 - \theta)} - (\bar{V} - \bar{V}) > 0.$$ 

We conclude this section by considering that $n$ parties take part in the investment. The primary firm is indexed as $i = 1$, and remainder are in $\{2, \ldots, n\}$. For tractability, suppose that the returns (instead of project values) from potential projects are uniformly distributed
across the support \( R \sim U[0, \bar{R}] \), and that each party’s share of the project is

\[
\theta_i = \frac{H_i}{\sum_{j \in N} H_j},
\]

where \( N \equiv \{1, \ldots, n\} \). As such, \( \theta_i \) still takes the form of a Tullock contest function, but we operate in return space as opposed to project value space.

**Proposition 3.** *For bargaining as in (15) there exists a unique symmetric Nash equilibrium in which the optimal buffered hurdle rates are given by

\[
\tau^* = \frac{(n - 1)\bar{R}}{n^2} \quad (16)
\]

and the value for each counterparty is

\[
V^* = \frac{\bar{R}}{n^2}. \quad (17)
\]

The structure of the equilibrium in Proposition 3 resembles that of Proposition 2, except that we now have a comparative static on the number of counterparties at the bargaining table. The equilibrium IRR buffer is strictly decreasing \( n \).

### 3.3. Non-Strategic Use of IRR Buffers

In this section, we show that the model’s main results continue to hold when the model considers non-strategic reasons as the source of IRR buffers. For ease of exposition, in what follows, we continue to assume that potential projects are uniformly distributed across the support \( R \sim U[0, \bar{R}] \). As in Section 3.2, we start again by considering that the primary firm uses a buffer but their trading partner does not. Then, we extend the analysis to competitive buffers.
3.3.1. Imprecise Estimation of WACC

According to Bessembinder and Décaire (2021) and Krüger et al. (2015), managers may face the inability to precisely estimate \( W_F \). This may be the result of model uncertainty or inherent estimation error. To be account for this, or to be conservative, CFOs may use a buffer, which we denote by \( b \).

With a buffer \( H_F = W_F + b \), the Nash Bargaining split is

\[
\theta_B = \frac{H_F}{H_F + W_O}
\]

and the value of the firm can be calculated as

\[
V_B = \frac{W_F \bar{R} + b \bar{R}}{W_F + b + W_O} - (W_F + b).
\]

Proposition 4. When the CFO uses a buffered hurdle rate, \( H_F = W_F + b \) to adjust for imprecision in estimating \( W_F \), the value of the firm increases if

\[
V_B > V_N \iff \frac{\bar{R}W_O - (W_F + W_O)^2}{(W_F + W_O)} > b.
\]

According to Proposition 4, if the buffer \( b \) is sufficiently low, firm value rises because the bargaining benefit outweighs the loss incurred by discarding marginal positive NPV projects. It is instructive to write the inequality in (20) as

\[
V_B > V_N \iff (\bar{R} - \bar{R}^N) - \theta_N \bar{R} > b,
\]

where \( \bar{R}^N \) is the lower bound of feasible projects when no IRR buffer is used. This expression indicates that, because the range of projects \( (\bar{R} - \bar{R}^N) \) can be considered a measure of uncertainty, according to (21) firm value rises when the CFO faces more risk and uses a
reasonable buffer to account for lack of precision in her estimate of \( W_F \). Last, according to (21), if the firm already enjoys sufficient bargaining power without a buffer (\( \theta_N \) is large), this makes it less likely that using a buffer adds value. In this case, foregoing positive NPV projects is too costly.

### 3.3.2. Financial and Managerial Constraints

Now, we consider that the CFO chooses a hurdle rate \( H_F > W_F \) to accommodate an exogenous constraint that is based on time or financial resources. Suppose that the firm only has financial resources to initiate the fraction \( f \) of the potential projects such that \( 0 < f \leq 1 \). Likewise, it can only consider a fraction \( m \) of the projects due to managerial constraints such that \( 0 < m \leq 1 \). Define \( k \equiv \min\{f, m\} \). Given this, the value of the firm with a buffer is

\[
V_B = \int_{\bar{R}}^{R_H} \theta_H dR,
\]

where the share of the surplus the firm receives is

\[
\theta_H = \frac{H_F}{H_F + W_O}.
\]

**Proposition 5.** When only \( k \) fraction of projects can be considered because of constraints, the CFO sets a buffered hurdle rate

\[
H_F = (1 - k)(\bar{R} - W_O) + kW_F.
\]  

It follows that \( H_F > \tau_F^* \) iff

\[
k < \frac{\bar{R} - \bar{R}'}{R - \bar{R}}
\]

where \( \bar{R}' \) and \( \bar{R} \) are defined as in Section 3.2.1. Finally,

\[
V_B > V_N \iff (\theta_H - \theta_N) > (1 - k)(1 - \frac{W_F + W_O}{R}).
\]
The results in Proposition 5 are straightforward. First, the hurdle rate is a decreasing function of $k$. By construction, the less constrained the firm is (higher $k$), the less of an IRR buffer it needs to use. Second, (23) tells us that if the firm is sufficiently constrained, it will set a hurdle rate above what is optimal under the strategic considerations in Section 3.2.1, which is suboptimal. However, the use of the IRR buffer due to constraints increases firm value if (24) holds. This will arise when the gain in bargaining power is higher, the firm is less constrained, and the range of projects is larger. The latter finding is similar to the risk/variance result that we derived in Proposition 4.

4. Model Predictions and Empirical Evidence

In Section 4.1, we present empirical predictions from the models described in Section 3 and explain how we test these predictions in the data. We then perform a detailed empirical analysis of the determinants of the buffer and test the predictions of the model in Section 4.2.

4.1. Hypothesis Development

We first outline several empirical predictions implied by Propositions 1-5. These predictions are summarized in Table 2. Then, we introduce the empirical variables we use to test these predictions while stating each hypothesis. Details on the construction of these variables can be found in Table B.1 and summary statistics in Table 3.

We start by outlining predictions relating the buffer to four underlying characteristics of the firms and projects: the company’s industry, volatility of project returns, cost of capital, and bargaining power. We explore predictions related to both the use of a buffer (hereafter, the extensive margin) and the size of the buffer conditional on use (the intensive margin). A given company or project characteristic (e.g., project volatility) is predicted to relate to the extensive margin if it impacts the likelihood the buffer is value-increasing in our model, and is predicted to impact the intensive margin if it impacts the size of the buffer used. Note that for the cases in which the buffer arises exogenously (Propositions 4 and 5), the model
makes no predictions on the intensive margin since the buffer is set for other reasons. Our extensive margin predictions in these cases are based on the exogenous buffer’s impact on value.

Our first hypothesis comes from the basic premise of the model that project value is a function of bargaining over inputs and outputs. We expect a buffer is less likely to arise or increase value in, for example, industries where inputs are purchased at liquid market prices. In such a case, buffers arising due to other constraints are sub-optimal, and as a result such constraints would be less likely to persist over the long run. Therefore, we predict that buffer use will be positively correlated with industries where a given project’s inputs or outputs are large and specific to the project (e.g., land).

**Hypothesis 1a.** *Companies are more likely to use a hurdle rate buffer if they operate in industries where projects require more property, plant, and equipment (PPE).*

**Hypothesis 1b.** *Conditional on use, the size of the buffer is larger in industries where more PPE is required for projects.*

This prediction generally differs from predictions of non-strategic buffer explanations (that do not account for the effect of bargaining on project outcomes), thus distinguishing our analysis from these other buffer explanations. For example, because financial constraints are decreasing in tangibility (Almeida and Campello, 2007), explanations for the buffer based on such constraints alone would lead to the opposite prediction. We similarly would expect the opposite prediction if the buffer is a response only to idiosyncratic risk, since idiosyncratic volatility is expected to decrease in tangibility (Fink et al., 2010). Since there is no obvious relation between managerial time constraints and tangibility, the time-constraint explanation for the buffer has no clear prediction on this dimension absent the bargaining effect.

To test Hypothesis 1, we use two proxies to identify industries in which bargaining is likely to play a role. First, we group firms into industry groupings based on the type of underlying investments (e.g., fixed assets vs human capital). The four groups are: 1) Manufacturing,
Construction, Mining and Energy, 2) Finance, 3) Services, Communications, and Media, and 4) Healthcare, Pharma, and Tech. Second, we measure each industry’s average asset tangibility (defined as net PPE scaled by total assets) of Compustat firms at the NAICS-4 industry level.$^{10}$

Our second prediction is that buffer use and size generally increases with the volatility of firms’ project returns. Many existing explanations for the buffer relate either directly or indirectly to volatility. For example, Décaire (2021) finds evidence consistent with firm using buffers in order to compensate for idiosyncratic volatility. Similarly, buffers put in place due to financial constraints will also likely relate to the volatility of a firm’s projects since volatility and constraints are likely related. In the model, volatility is a function of $\bar{V}$ in Propositions 1 and 2 and of $\bar{R} - \bar{R}^N$ in Propositions 4 and 5. In the single firm strategic case (Proposition 1), it is easy to see from Equation (9) that the use of the buffer increases in $\bar{V}$. In both the single firm strategic case and the competitive buffer case (Proposition 2), it is straightforward to see that $\tau^*$ is increasing in $\bar{V}$. Similarly, in both cases where the buffer is exogenously used, the value, $\Delta V$ is increasing in $\bar{R} - \bar{R}^N$. However, the relation between buffer use and volatility is more nuanced. Because of the lower bound on acceptable projects, any increase in the volatility of underlying project value also necessarily raises the average project value (or return). Therefore, while our empirical prediction on volatility is similar to prior studies, we expect such relation only unconditionally with respect to average project quality.

**Hypothesis 2a.** Buffer use is more likely for firms with higher volatility of underlying project values.

**Hypothesis 2b.** Conditional on use, the size of the buffer is larger for firms with volatility of underlying project values.

$^{10}$A regression of firm-level tangibility on NAICS-4 fixed effects gives an $R^2$ of $\approx 0.62$, whereas including year fixed effects only increases this to $\approx 0.635$, thus there is little gained from using a time-varying industry-level measure of tangibility.
As noted above, our prediction on volatility aligns with the explanation for the buffer put forth by Décaire (2021) and by explanations based on financial constraints. Thus, we are both testing these predictions using survey data and controlling for volatility as we examine other model predictions. Buffers due to managerial time constraints alone would not obviously vary with project volatility absent a systematic relation between managerial time demands and idiosyncratic risk.

To capture idiosyncratic risk, we measure the standard deviation of sales to lagged assets of Compustat firms within a CFO survey firm’s NAICS-4 industry the quarter previous to the survey quarter. When industry sales volatility is large, it suggests that firms’ underlying projects are also more volatile, all else equal.

A third pair of hypotheses are based on the model’s prediction that buffer use decreases in the firm’s cost of capital. In the single firm strategic case, the buffer used decreases in the cost of capital on both the extensive and intensive margins. To see the former, note that Equation (9) is less likely to hold as $W_F$ increases. For the intensive margin, if we write $\tau^* = W_F + b$, for any $\tau^*$ the buffer is decreasing as $W_F$ increases. We get the same prediction on the extensive margin for the non-strategic case where a buffer is given exogenously (Proposition 4). When firms set a buffer to constrain the number of projects taken (due to financial or managerial constraints) as in Proposition 5, the impact of $W_F$ on the use of a buffer is ambiguous.

**Hypothesis 3a.** Buffer use is less likely for firms with a higher cost of capital.

**Hypothesis 3b.** Conditional on use, the size of the buffer is smaller for firms with a higher cost of capital.

It is worth pointing out that Hypothesis 3 distinguishes our theory from other buffer explanations because the predictions differ from what we would expect for buffer explanations that do not consider the impact of the cost of capital on bargaining. For example, if managers use a higher buffer to compensate for idiosyncratic risk (Décaire, 2021), we would expect
there to be, on average, a positive association between the cost of capital and the buffer—because idiosyncratic risk is positively correlated with systematic risk. Prior explanations based on financial or managerial constraints would also generally predict either no relation (since managerial time constraints are likely independent of the cost of capital) or a positive relation (since financial constraints are more likely to bind for high cost of capital firms).

In contrast, Hypothesis 3 indicates that our model predicts a negative relation between the hurdle rate buffer and the cost of capital because firms with a higher cost of capital already have more bargaining power, all else equal. In this situation, any incremental benefit of more bargaining power is outweighed by the value lost from good projects ruled out by a higher buffer, on net leading to a negative relation between the cost of capital and the buffer.

Finally, the fourth set of predictions relate to our model predicting a systematic relation between the buffer and a firm’s bargaining power. For the single firm case, we can use (9) to predict that increasing bargaining power decreases use of a buffer. For the intensive margin, according to Proposition 1,

$$b = \sqrt{V x_O W_O - x_O W_O} - W_F,$$

and therefore $\frac{\partial b}{\partial W_F} < 0$. If we hold, $x_O$, $x_F$, and $W_O$ fixed, then $\frac{\partial W_F}{\partial \theta} > 0$. This implies that $\frac{\partial b}{\partial \theta} < 0$. So, we expect the buffer to decrease in bargaining power on the intensive margin.

In the competitive model, according to (12), $\Delta V$ is decreasing in $\theta$, so we expect firms to use buffers less on the extensive margin. Also, according to Propositions 4 and 5, higher bargaining power is associated with decreased likelihood of buffer use the extensive margin: The left-hand side of (21) is decreasing in $\theta_N$, as is equation (24).

**Hypothesis 4a.** Buffer use is less likely when a firm has more bargaining power.

**Hypothesis 4b.** Conditional on use, the size of the buffer is smaller for a firm with higher bargaining power.
There is no immediate analogous prediction related to bargaining power from buffer explanations based on idiosyncratic risk, financial constraints, or managerial constraints alone. However, our prediction differs from that in Gormsen and Huber (2022), who posit that market power should be positively related to buffer use, as firms with more market power can cater to investors through their discount rate. We discuss these differing predictions in more detail below, in the context of the empirical analysis.

To test Hypothesis 4, we measure bargaining power in two ways. First, we measure markups using the methodologies presented in Baqae and Farhi (2020) and De Loecker et al. (2020), where higher markups proxy for more bargaining power. Second and separately, using financial disclosures on corporate customers, we measure the concentration of a firm’s customer base. The higher the customer concentration, the more reliant the firm is on a single customer, and therefore the lower is the firm’s bargaining power, all else equal.

4.2. Empirical Analysis of the Buffer

We now provide a deeper analysis of the hurdle rate buffer, using the simple empirical evidence from Section 2 and the model predictions made in Section 4.1 as a guidance. In our regression analysis, all continuous variables are standardized to unit variance except for the firm’s cost of capital. Table 1 displays summary statistics for variables related to the buffer and Table 3 displays the same for our industry-level variables. Figure B.2 presents pair-wise correlations between these variables.

4.2.1. The Determinants of the Hurdle Rate Buffer

In Table 4, we analyze the determinants of the whether firms use a hurdle rate buffer and if so, how large it is. Panel A presents analysis concerning the extensive margin of whether a firm uses a buffer; Panel B displays evidence about the factors that drive the intensive margin (the magnitude of the buffer). Because the specifications in both panels are very similar, we discuss them together.

We first note that both the probability of using a buffer and the size of the buffer itself
are decreasing in a firm’s cost of capital, which supports Hypothesis 3 above. A one percent increase in the cost of capital predicts a 2.5 to 3 percentage point (pp) drop in the probability of using the buffer, and roughly a 0.3 pp drop in size of the buffer.\(^{11}\)

Other research shows that estimation error or uncertainty about WACC and/or discount rates affects corporate investment (Krüger et al., 2015; Bessembinder and Décaire, 2021). While not directly related to our bargaining model, this should affect hurdle rate buffers in our data. We use the volatility of the CAPM beta within the CFO survey firm’s NAICS-4 industry the quarter previous to the survey quarter to proxy for this uncertainty (Bessembinder and Décaire, 2021).\(^ {12}\) Table 4 shows that beta volatility is positively correlated with both the use and magnitude of the buffer.

Our proxy for idiosyncratic project risk, industry sales volatility, is strongly related to the intensive margin of the buffer, but is not significant on the extensive margin (see Hypothesis 2). Combined with the previous paragraph, this suggests that, after controlling for estimation uncertainty in WACC, even for firms that estimate their cost of capital very well, idiosyncratic project risk leads to a larger buffer.

The regressions contain a number of control variables. Large firms are both less likely to use a positive buffer and have smaller-sized buffers, reinforcing the findings from Figure 3, Panel C. Public firms are slightly more likely to use a positive buffer, but show no difference in the size of the buffer. Whether or not a firm has a credit rating has no effect on either margin. To the extent that having a credit rating is a reasonable measure of financing constraint (Faulkender and Petersen, 2005), we do not find evidence in our sample that the ability to access public debt markets is a primary determinant of the buffer.

The CFO survey asks CFOs to rate their level of optimism about their own firm’s

\(^{11}\)If we condition on firms that set their hurdle rate above WACC, the effect of a one percent increase in the cost of capital leads to about a 0.2 percentage point drop in the buffer, as in columns 4-6 of Table 4, Panel B.

\(^{12}\)When this measure is high, firms within an industry vary substantially in the level of return investors require in order to bear the firm’s underlying risk. Even for firms not publicly traded, this measure proxies for the required rate of return demanded by investors if the business activities and underlying cash flow risk of private and public firms within an industry are similar.
prospects and the US economy more generally. Columns 4 and 7 of Panel A and columns 4 and 8 of Panel B include these variables in our baseline regressions. We find that own-firm optimism is positively related to buffer use and the size of the buffer, even after controlling for US economy optimism. This suggests that CFOs compensate for (potential) firm-wide over-optimism by setting a larger buffer. We note that in contrast, if firm-optimism is correlated with higher confidence of project success and this were the dominant effect, we would expect to find a negative relation between optimism and the buffer.

4.2.2. Tests of Formal Hypotheses

**Hypothesis 1. Broad Industry Differences and Industry Tangibility**

We first test for differences in the use and size of the buffer across general industry classification. Table 5 Panel A shows that firms in manufacturing, construction, mining and energy industries are 7.2 percentage point more likely to use a buffer, and also use significantly larger buffers (0.795 pp larger) than firms in other industries, even after controlling for industry risk and the firm’s cost of capital. These are the types of industries in which project inputs tend to be larger (e.g., investment in machinery) and project-specific.

We complement this analysis by examining the relationship between the buffer and industry tangibility in Table 5 Panel B. This provides a direct measure of industry-level project inputs to strengthen the analysis in Panel A. Panel B shows that a one standard deviation increase in industry tangibility increases the probability of using a buffer by $\approx 3.5$ pp and increases the size of the buffer $\approx 0.3 - 0.4$ pp.

**Hypothesis 2. Volatility of Underlying Project Value**

As explained in Section 4.1, the model predicts a higher likelihood of using a positive buffer and a larger buffer if a firm’s underlying project risk is higher. We refer to Table 4 to discuss the role of this project risk (proxied by sales volatility). While our model predicts a positive

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13The question asks CFOs to rate their level of optimism on a 0-100 scale, with 0 being the least optimistic.
correlation between project volatility and the extensive margin of the buffer, we find no relation in Panel A. However, industry sales volatility has a large effect on the intensive margin of the buffer – a one standard deviation increase in sales volatility leads to a $\approx 0.4$ pp increase in the size of the buffer (Panel B).

**Hypothesis 3. The Firm’s Cost of Capital**

As can be seen in Tables 4 and 5, the cost of capital is strongly negatively related to both the extensive and intensive margins of the buffer. From Table 4, a one percent increase in the cost of capital predicts a 2.5 to 3 percentage point drop in the probability of using the buffer, and roughly a 0.3 pp drop in size of the buffer.$^{14}$

This negative correlation is noteworthy with respect to several existing explanations of why firms set hurdle rates above WACC (as presented in Figure 1). According to these explanations, if either uncertainty about a firm’s true WACC or project-specific idiosyncratic risk are large, then we would expect the cost of capital and the buffer to be positively correlated: As the required return of projects increases, so too would these two sources of uncertainty; therefore, managers would build in a larger buffer as the cost of capital increases. Likewise, similar logic holds true for junior manager over-optimism – the more optimistic these delegates are, the higher a buffer the CFO would require, all else equal.

Based on estimates from Table 4, Figure 6 illustrates the negative relation between the cost of capital and the buffer. Panel A displays predicted probabilities that a firm uses a positive buffer for different costs of capital. Going from a cost of capital of 5% to 15%, the probability that a company uses a buffer drops from $\approx 87\%$ to $\approx 60\%$.

Panel B displays a binned scatterplot of the size of a firm’s (intensive margin) buffer and its cost of capital. The strong negative relation between the two variables is apparent. We note that the regression used to estimate this figure controls for both size and industry

$^{14}$If we condition on firms that set their hurdle rate above WACC, the effect of a one percent increase in the cost of capital leads to about a 0.2 percentage point drop in the buffer, as in columns 4-6 of Table 4, Panel B.
fixed effects. While the model makes several predictions about the size and likelihood of the buffer across industries, the negative relation between the buffer and the cost of capital should exist for all types of firms that strategically set buffers.

A natural question is whether the negative relation between the buffer and the cost of capital holds within the subset of firms with high cost of capital. Because the number of projects decreases in the project’s return, it may be that high WACC firms are forced to decrease their buffers to find feasible projects. This could lead to less variation in the buffer among the firms with higher costs of capital.\textsuperscript{15} Figure B.3 estimates the relation between the buffer and WACC for high, medium and low WACC firms and shows that the negative relation exists within each subset, even among firms with a high cost of capital (15% or greater).

**Hypothesis 4. Bargaining Power in Negotiations**

Our final hypothesis predicts a negative relation between the size and use of the hurdle rate buffer and a firm’s degree of bargaining power when negotiating with customers and suppliers. Bargaining power in the model is relative, thus in our empirical analysis we seek to analyze the role of the firm’s own level of bargaining power, and separately that of its trading partners.

*Markups.* To proxy for the firm’s own bargaining power, we use markups, a common proxy for market power (e.g. De Loecker et al., 2020). Our primary measure is the “accounting” markup developed in Baqaee and Farhi (2020) and analyzed also in Gormsen and Huber (2022). To leverage our full survey sample, based on Compustat firms we aggregate markups to the NAICS-3 by year and match to our survey firms.\textsuperscript{16}

\textsuperscript{15}Variation might also be limited if project prioritization were the primary driver of the buffer. Low WACC firms can easily prioritize projects, whereas high WACC firms cannot.

\textsuperscript{16}The industry-level for most of the variables in our analysis are at the NAICS-4 level; however, our bargaining power measures are all at the NAICS-3 level. We do this to mimic the industry level that Baqaee and Farhi (2020) focus on in their analysis, and also because we estimate the output elasticities used in Table B.4 at the NAICS-3 level. Table B.1 provides detail on the exact construction.
Table 6 displays the analysis of Hypothesis 4. It shows that a one standard deviation increase in industry markups reduces the likelihood of using a buffer by $\approx 2 - 2.5$ pp and decreases the size of the buffer by about 0.5 pp. To put this in context, moving from the 10th to the 90th percentile markup would reduce the size of the buffer by 1.1pp, approximately a 20% reduction relative to the average buffer.

Gormsen and Huber (2022) find that the buffer is positively related to market power and that market power has allowed firms to increase their discount rates over time. At first glance, this seems to contradict our findings; however, upon closer examination, it does not. Gormsen and Huber (2022) fix their measure of market power as the firm’s markup in 2002 (the beginning of their sample period) and show a positive correlation between the year-by-year buffer and the 2002 value of the markup\(^{17}\), whereas we allow the markup to vary by year. In Figure 7, we study the evolution of markups of Compustat firms to contextualize the finding in Gormsen and Huber (2022).\(^{18}\) Panel A shows that average markups have increased dramatically throughout time (as in De Loecker et al., 2020). Panel B splits the sample by high/low markup in 2002 and plots the average growth in markups since 2002, showing that the majority of the increase in average markup is concentrated in firms that had low markups in 2002. In Panel C, we update the ranking each year (as in our analysis and in De Loecker et al., 2020). Panels B and C clarify the issue with fixing market power to its 2002 value: while market power has increased for firms that currently have high-markups in a given year, this is driven by large growth in markups from low-2002 markup firms, not from high-2002 markup firms increasing their relative market power.

Taken together, the results in Gormsen and Huber (2022) and Figure 7 in our paper provide a time-series experiment in which some firms experienced growth in their market power and subsequently reduced their hurdle rates. This is entirely consistent with our

\(^{17}\)Specifically, Figure 7 shows that firms with low markups in 2002 decreased their hurdle rates over time, but that high-markup firms maintained them over time (or slightly increased them).

\(^{18}\)This figure uses accounting markups from Baqae and Farhi (2020), our main measure of markups and the same used in Gormsen and Huber (2022). Figure B.4 displays similar results using markups estimated from the firm’s production function, as in De Loecker et al. (2020)
Hypothesis 4. In our tests, we allow market power to change by year and find a strong negative relation with the buffer, consistent with one of the key implications from our model. 

Customer Concentration. The relative bargaining power of a given company can be measured relative to the market position of its customers – because the firm negotiates with customers. We proxy for the bargaining power of a seller/supplier based on the level of concentration in the firm’s sales. We use data from the Compustat Segments file to measure firm-level customer sales concentration, which pulls data from company filings about firms’ large customers. That is, we calculate Herfindahl–Hirschman Index (HHI) of each firm’s sales to its corporate customers (Patatoukas, 2012). To match to our survey data, we take quarter $\times$ NAICS-4 averages of this measure and match to each firm in the survey by its industry. The measure is bounded between zero and one – when it is closer to zero, the sales of firms in an industry are spread more evenly across a larger number of corporate customers, indicating more bargaining power for the firm relative to its customers. Likewise, given that this is a customer-based measure of concentration, when this measure approaches one, the seller firm has less bargaining power, all else equal, because the seller is more reliant on fewer customers to generate its revenue. In Table 7, we relate this measure to survey firms’ buffers. Columns 1-3 analyze the extensive margin and columns 4-6 analyze the intensive margin. We find no relation between customer concentration and the extensive margin of the buffer. Taken together with the previous table, this suggests that a firm’s bargaining power (as proxied by markups) is more important for the binary decision of whether to use a buffer. In terms of the intensive margin, Columns 4-6 show that a one-standard deviation increase in customer concentration leads to about a 0.3pp reduction in the buffer.

5. Conclusion
References


Gormsen, Niels Joachim, and Kilian Huber, 2022, Corporate discount rates, *Available at SSRN* .


Figure 1: Reasons that Companies Set Hurdle Rates Above the Cost of Capital

This figure displays qualitative reasons why firms set their hurdle rates above WACC. Results are taken from three editions of the Duke CFO survey (2011q1, 2019q1, 2022q2) which asked CFOs “Why do you set your hurdle rate above WACC?” Because possible answers vary survey, we group possible survey responses into five distinct reasons that hurdle rates are set above WACC. Table B.2 displays these groupings and provides further detail on how the question was asked on each survey. Panel A displays the percentage of CFOs that fall within each category. Panel B displays the results split by survey year; the label “2011” refer to response from the 2011q1 survey, “2019” refers to the 2019q1 survey and “2022” refers to the 2022q2 survey, the latter conducted in conjunction with the FED. In Panel C, we split firms into small (revenue less than $1 billion) and large (revenue greater than or equal to $1 billion).
Figure 2: Sample Demographics

This figure displays demographic splits for all CFOs that provide both a hurdle rate and cost of capital (WACC) in the Duke CFO Survey.
Figure 3: Time Series and Cross-Sectional Differences in Hurdle Rates and the Cost of Capital

This figure displays the within-group average and interquartile range (IQR) of CFO survey firm hurdle rates, WACCs and hurdle rate buffers across several observable characteristics. For example, Panel A displays the statistics across CFO survey industries. The average buffer for firms in Mining/Construction is about 6%, and the 75th and 25th percentiles within-group are roughly 9% and 0%, respectively.
Figure 4: Return on Invested Capital, Hurdle Rate and WACC for CFO Survey Compustat Firms

This figure displays a time series of average Return on Invested Capital (ROIC) for CFO Survey firms that also appear in Compustat, for comparison with the cross-sectional average hurdle rate and cost of capital (WACC) for these same firms. ROIC is defined as

\[ ROIC_t = \frac{EBIT_t(1 - tax_t)}{ICAPT_t - 1}, \]

where \( ICAPT \) is the firm’s invested capital (i.e., the sum of long-term book debt and equity). We take trailing four-quarter sums of \( EBIT(1 - tax) \), and divide by \( ICAPT \) from the previous fiscal year. See Table B.1 for more details.
Figure 5: Model Implied Relation between IRR Buffer, Cost of Capital, Project Volatility, and Bargaining Power

This figure plots the buffer implied by Proposition (1) for various values of $\bar{V}$ and $W_F$ (Panel (a)) or $\theta_N$ (Panel (b)). For both panels, $W_O = 1.15$ and $x_F = x_O = 1$.

(a) Relation between Buffer and $W_f$ and $\bar{V}$

(b) Relation between Buffer and $\theta_N$ and $\bar{V}$
Figure 6: The Relation Between the Cost of Capital and Hurdle Rate Buffers

This figure displays the effect of a firm’s cost of capital on the extensive and intensive margins of the buffer. Panel A displays estimated probabilities that a firm uses a buffer for different costs of capital. Each navy point on the plot displays the estimated probability of a positive buffer, given that level of cost of capital. For example, for a cost of capital of 5%, $\Pr[Hurdle > WACC] \approx 87\%$. Conversely, for a cost of capital of 15%, $\Pr[Hurdle > WACC] \approx 60\%$. The gray shaded areas are 95% confidence intervals. This panel is estimated using column 5 of Table 4, Panel A. Panel B displays a binned scatter plot of a firm’s (intensive margin) buffer and the cost of capital. We estimate the figure using column 3 of Table 4, with 100 bins, and each blue point represents a bin.
This figure displays how the markups of Compustat firms have evolved through time. We estimate markups using the accounting method described in Baqaee and Farhi (2020) (see Table B.1 for details on construction). Panel A displays average markups for Compustat firms by year. Panel B splits the sample by above/below median markup in 2002 and plots average percentage changes in markup (relative to 2002) by year for each group. Panel C updates the ranking of markups each year (as in De Loecker et al., 2020). We require that firms have a non-missing markup in 2002 for inclusion in both panels.
Table 1: Summary Statistics

This table displays the number of observations, averages, standard deviations, and quartiles of variables related the hurdle rate and the cost of capital.

<table>
<thead>
<tr>
<th>Variable</th>
<th>N</th>
<th>Mean</th>
<th>Std Dev</th>
<th>25%</th>
<th>50%</th>
<th>75%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hurdle Rate</td>
<td>1,232</td>
<td>13.879</td>
<td>5.977</td>
<td>10</td>
<td>12.750</td>
<td>16</td>
</tr>
<tr>
<td>Cost of Capital</td>
<td>1,232</td>
<td>8.769</td>
<td>4.211</td>
<td>5.500</td>
<td>8.800</td>
<td>11</td>
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<tr>
<td>Buffer (Intensive margin)</td>
<td>1,232</td>
<td>5.111</td>
<td>5.376</td>
<td>0.787</td>
<td>4</td>
<td>7.500</td>
</tr>
<tr>
<td>Buffer</td>
<td>Buffer &gt; 0</td>
<td>957</td>
<td>6.579</td>
<td>5.248</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Buffer (Extensive Margin)</td>
<td>1,232</td>
<td>0.777</td>
<td></td>
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<td></td>
</tr>
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</table>
Table 2: Empirical Predictions of Model Propositions

This table summarizes the direction of the prediction relation between buffer use on the intensive margin (Int.) and extensive margin (Ext.) and four firm characteristics: cost of capital, volatility of project returns, bargaining power, and asset tangibility. We summarize the direction of the relation implied by Proposition 1-5 in our model.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Strategic 1-firm</td>
<td>−</td>
<td>−</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Strategic 2-firm</td>
<td>−</td>
<td>−</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Exog. buffer - uncertainty</td>
<td>−</td>
<td>−</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Exog. buffer - constraints</td>
<td>+/−</td>
<td>+/−</td>
<td>+/−</td>
<td>+/−</td>
</tr>
</tbody>
</table>

*: If $\Delta V$ is positive, then it must be that $\theta < \frac{1}{2}$.
Table 3: Summary Statistics for Industry-Level Variables

This table displays summary statistics for the industry-level variables we explore in Section 4. Detailed variable definitions are available in Table B.1.

<table>
<thead>
<tr>
<th>Variable</th>
<th>N</th>
<th>Mean</th>
<th>Std Dev</th>
<th>25%</th>
<th>50%</th>
<th>75%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beta Volatility</td>
<td>1,232</td>
<td>0.686</td>
<td>0.234</td>
<td>0.535</td>
<td>0.687</td>
<td>0.834</td>
</tr>
<tr>
<td>Sales Volatility</td>
<td>1,232</td>
<td>0.145</td>
<td>0.078</td>
<td>0.095</td>
<td>0.135</td>
<td>0.184</td>
</tr>
<tr>
<td>Tangibility</td>
<td>1,232</td>
<td>0.231</td>
<td>0.159</td>
<td>0.120</td>
<td>0.194</td>
<td>0.297</td>
</tr>
<tr>
<td>Markup</td>
<td>1,232</td>
<td>1.088</td>
<td>0.175</td>
<td>1.016</td>
<td>1.059</td>
<td>1.106</td>
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<td>Markup (Alternative)</td>
<td>1,232</td>
<td>1.094</td>
<td>0.098</td>
<td>1.056</td>
<td>1.101</td>
<td>1.149</td>
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<td>Customer Concentration</td>
<td>1,232</td>
<td>0.292</td>
<td>0.198</td>
<td>0.113</td>
<td>0.316</td>
<td>0.426</td>
</tr>
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</table>
Table 4: Determinants of the Extensive and Intensive Margin of the Buffer

This table explores the determinants of the extensive and intensive margins of the hurdle rate buffer. In Panel A, we focus on the extensive margin (i.e., the dependent variable is the binary variable Uses Buffer \{0,1\}). The first four columns display linear probability models (OLS) and columns 5-7 display logistic regressions. In Panel B, we focus on the intensive margin. The variables Industry Beta Volatility, Industry Sales Volatility, Firm-Level Optimism and US Economy Optimism are standardized to mean zero, unit variance. All variables are defined in detail in Table B.1. In columns 4 and 7 of Panel A and columns 4 and 8 of Panel B, the number of observations drops as we do not have optimism forecasts from every respondent. Standard errors are clustered at the survey industry × survey quarter and displayed in parentheses below the coefficient. The $R^2$ in columns 5-7 of Panel A is the pseudo-$R^2$ from the logistic regression. ***, **, * denote significance at 1%, 5%, 10%.

### Panel A: Extensive Margin of Buffer

<table>
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<tr>
<th>Variable</th>
<th>Linear Probability Model</th>
<th>Logit</th>
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<td>(2)</td>
<td>(3)</td>
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<td>-0.028***</td>
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<tr>
<td></td>
<td>(0.003)</td>
<td>(0.003)</td>
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<tr>
<td>Industry Beta Volatility</td>
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<td>0.031***</td>
</tr>
<tr>
<td></td>
<td>(0.011)</td>
<td>(0.011)</td>
</tr>
<tr>
<td>Industry Sales Volatility</td>
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<tr>
<td></td>
<td>(0.016)</td>
<td>(0.016)</td>
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<td></td>
<td>(0.036)</td>
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<td>Public Firm</td>
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<td></td>
<td>(0.044)</td>
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<tr>
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<td>(0.029)</td>
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<tr>
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<td>US Economy Optimism</td>
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<td>1,232</td>
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<td>R-squared</td>
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<tr>
<td>Size FE</td>
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<td>Yes</td>
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<tr>
<td>Credit Rating FE</td>
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Cluster: Industry × Quarter

51
Table 4: Continued

**Panel B: Intensive Margin of Buffer**

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<th></th>
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<th>(3)</th>
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<th>(5)</th>
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<td>-0.310***</td>
<td>-0.313***</td>
<td>-0.317***</td>
<td>-0.194***</td>
<td>-0.179***</td>
<td>-0.178***</td>
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<tr>
<td></td>
<td>(0.045)</td>
<td>(0.045)</td>
<td>(0.045)</td>
<td>(0.054)</td>
<td>(0.055)</td>
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<td></td>
<td>(0.150)</td>
<td>(0.148)</td>
<td>(0.179)</td>
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<td>0.341**</td>
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<tr>
<td></td>
<td>(0.148)</td>
<td>(0.148)</td>
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<td>Firm-Level Optimism</td>
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<td>0.515**</td>
<td>0.436*</td>
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<td>(0.212)</td>
<td>(0.237)</td>
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<td>US Economy Optimism</td>
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<td>-0.478</td>
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<td></td>
<td>(0.269)</td>
<td>(0.318)</td>
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<td>Observations</td>
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<td>1,232</td>
<td>947</td>
<td>957</td>
<td>957</td>
<td>957</td>
<td>750</td>
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<td>Survey Quarter FE</td>
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Cluster: Industry \times Quarter
Table 5: Differences in the Buffer: By Broad Industry Category and Industry Tangibility

This table explores how the buffer varies across broad industry categories and across industry tangibility. In Panel A, we regress the buffer (extensive and intensive margins) on indicator variables that cover the different industries in our sample. Columns 1-4 focus on the extensive margin; columns 5-8 focus on the intensive margin. Panel B explores how the buffer varies by industry tangibility (i.e., the ratio of property, plant and equipment to total fixed assets). Columns 1-3 focus on the extensive margin; columns 4-6 focus on the intensive margin. The variables Industry Tangibility, Industry Beta Volatility and Industry Sales Volatility are standardized to mean zero, unit variance. All variables are defined in detail in Table B.1. Standard errors are clustered at the survey industry × survey quarter and displayed in parentheses below the coefficient. ***, **, * denote significance at 1%, 5%, 10%.

### Panel A: Broad Industry Categories

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Cluster: Industry × Quarter
Table 5: Continued

**Panel B: Industry Tangibility**

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54
Table 6: The Buffer and Industry Markups

This table explores how bargaining power affects the buffer. Our measure of bargaining power is the “accounting” markup from Baqee and Farhi (2020), which we aggregate to the NAICS-3 by year level and match to our CFO survey data by their industries. Columns 1-3 focus on the extensive margin; columns 4-6 focus on the intensive margin. The variables Industry Markup, Industry Beta Volatility and Industry Sales Volatility are standardized to mean zero, unit variance. All variables are defined in detail in Table B.1. Standard errors are clustered at the survey industry × survey quarter and displayed in parentheses below the coefficient. ***, **, * denote significance at 1%, 5%, 10%.

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Cluster: Industry × Quarter
Table 7: The Buffer and Industry Customer Concentration

This table explores how the bargaining power of a firm’s customers affects the buffer. Our measure of customer bargaining power is customer concentration: the HHI of firms sales to corporate customers (Papatoukas, 2012). We aggregate to the NAICS-3 by year level and match to our CFO survey data by their industries. Columns 1-3 focus on the extensive margin; columns 4-6 focus on the intensive margin. The variables Industry Customer Concentration, Industry Beta Volatility and Industry Sales Volatility are standardized to mean zero, unit variance. All variables are defined in detail in Table B.1. Standard errors are clustered at the survey industry × survey quarter and displayed in parentheses below the coefficient. ***, **, * denote significance at 1%, 5%, 10%.

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A. Appendix

Proof of Lemmas 1 and 2

1. If 
   \( s = \{\theta(x_F + x_O)R, (1-\theta)(x_F + x_O)R\} \), 
   \( d = \{x_FH_F, x_OH_O\} \), 
   and \( \alpha = \beta = 1 \), then (1) becomes
   \[
   \max_\theta \left( \theta(x_F + x_O)R - x_FH_F \right) \left( (1-\theta)(x_F + x_O)R - x_OH_O \right). \tag{A.1}
   \]
   Expansion yields
   \[
   \theta(1-\theta)[(x_F + x_O)R]^2 - \theta(x_F + x_O)Rx_OFH_F - (1-\theta)(x_F + x_O)Rx_FH_F + x_FH_Fx_OH_O. 
   \]
   Taking first-order conditions,
   \[
   (1-2\theta)[(x_F + x_O)R]^2 + (x_F + x_O)Rx_FH_F - (x_F + x_O)Rx_OH_O = 0. 
   \]
   Solving for the Nash split yields
   \[
   \theta = \frac{1}{2} + \frac{x_FH_F - x_OH_O}{2(x_F + x_O)R}. 
   \]

2. If 
   \( s = \{\theta[(x_F + x_O)R - (x_FH_F + x_OH_O)], (1-\theta)[(x_F + x_O)R - (x_FH_F + x_OH_O)]\} \), 
   \( d = \{0, 0\} \), 
   \( \alpha = x_FH_F \), 
   and \( \beta = x_OH_O \), then (1) becomes
   \[
   \max_\theta \left( \theta[(x_F + x_O)R - (x_FH_F + x_OH_O)] \right) x_FH_F \left( (1-\theta)[(x_F + x_O)R - (x_FH_F + x_OH_O)] \right) x_OH_O. \tag{A.2}
   \]
   Taking first-order conditions,
   \[
   \frac{1}{(\theta-1)\theta} \left[ \left( \theta((R - H_F)x_F + (R - H_O)x_O) \right)^{H_Fx_F} \right] 
   \left[ ((\theta - 1)(H_F - R)x_F + (O - R)x_O) \right]^{H_Ox_O} \left( H_F(\theta - 1)x_F + H_O\theta x_O \right) = 0 \tag{A.3}
   \]
   Solving for the Nash split yields
   \[
   \theta = \frac{x_FH_F}{x_FH_F + x_OH_O}. 
   \]
Proof of Proposition 1

Integrating (5) over all incentive compatible gross returns ($V'$ to $V$) yields

$$V_B = \left. \frac{x_F \tau}{x_F \tau + x_O W_O} V \right|_{V'}.$$

Subbing in $V' = x_F \tau + x_O W_O$ yields the following:

$$V_B = \frac{x_F \tau}{x_F \tau + x_O W_O} [V - (x_F \tau + x_O W_O)].$$

Simplifying gives the expression for the value of the firm in terms of $\tau$:

$$V_B = \frac{x_F \tau V}{x_F \tau + x_O W_O} - x_F \tau. \quad (A.4)$$

Taking the derivative of (A.4) with respect to $\tau$ yields the optimal hurdle rate

$$\frac{\partial V_B}{\partial \tau} = \frac{x_F \tau (x_F \tau + x_O W_O) - x_F^2 \tau V}{(x_F \tau + x_O W_O)^2} - x_F = 0$$

$$\Rightarrow \quad V x_O W_O = (x_F \tau + x_O W_O)^2$$

$$\Rightarrow \quad x_F \tau = \sqrt{V x_O W_O} - x_O W_O. \quad (A.5)$$

The optimal $\tau$ is therefore given by

$$\tau^* = \frac{\sqrt{V x_O W_O} - x_O W_O}{x_F},$$

which is (6) in the text. It follows that $\tau^* > W_F$ if (9) holds. Otherwise, $\tau^* = W_F$.

Plugging (6) into (A.4) for $\tau$ gives us the value of the project at the optimal IRR hurdle rate

$$V_B^* = \frac{\bar{V} (\sqrt{V x_O W_O} - x_O W_O)}{\sqrt{V x_O W_O}} - \sqrt{V x_O W_O} + x_O W_O$$

which simplifies to

$$V_B^* = \bar{V} + x_O W_O - 2\sqrt{V x_O W_O}.$$

This is (7) in the text. The change in value, $\Delta V$, from using a buffered hurdle rate is calculated as the difference between $V_N$ from (4) and $V_B$ from (7)

$$\Delta V = \bar{V} + x_O W_O - 2\sqrt{V x_O W_O} - \frac{x_F W_F \bar{V}}{x_F W_F + x_O W_O} + x_F W_F$$

$$\Rightarrow = (1 - \frac{x_F W_F}{x_F W_F + x_O W_O}) \bar{V} + x_F W_F + x_O W_O - 2\sqrt{V x_O W_O}. \quad (A.6)$$
It is straightforward to show that $\Delta V > 0$. We can re-write (A.6) as

$$\Delta V = \frac{x_O W_O \tilde{V}}{V} + V - 2V',$$

or

$$\Delta V = (V')^2 + V^2 - 2V'V.$$

This expression on the right side is of the form $a^2 + b^2 - 2ab$, which is strictly greater than zero for all values of $a$ and $b$. Therefore, A.7 is always positive.

Finally, the comparative statics are proven by straightforward differentiation.

1. $$\frac{\partial \Delta V}{\partial \bar{V}} = 1 - \frac{\sqrt{V} x_O W_O}{V} - \frac{x_F W_F}{x_F W_F + x_O W_O} > 0$$

To see this, note that $\bar{V}' = \sqrt{V} x_O W_O$. Subbing in leads to

$$1 - \frac{\bar{V} - x_F W_F}{V} > 0$$

$$\Rightarrow \bar{V} - \bar{V}' - \frac{\bar{V} x_F W_F}{V} > 0$$

$$\Rightarrow \bar{V} V - \bar{V}' V - \bar{V} x_F W_F > 0$$

$$\Rightarrow \bar{V} V - \bar{V} x_F W_F > \bar{V}' V$$

$$\Rightarrow \bar{V} (V - x_F W_F) > \bar{V}' V$$

$$\Rightarrow \bar{V} (x_O W_O) > \bar{V}' V$$

$$\Rightarrow (\bar{V}')^2 > \bar{V}' V.$$

The final expression holds because $\bar{V}' > V$.

2. $$\frac{\partial \Delta V}{\partial W_F} = x_F \left(1 - \frac{\bar{V} x_O W_O}{(x_F W_F + x_O W_O)^2}\right) < 0$$

To see this, note that $\bar{V} x_O W_O = (\bar{V}')^2$ and $(x_F W_F + x_O W_O)^2 = V^2$. Subbing in leads to

$$x_F \left(1 - \frac{(\bar{V}')^2}{V^2}\right) < 0$$

Since $\bar{V}' > V$, this expression holds.

3. $$\frac{\partial \Delta V}{\partial x_F} = W_F \left(1 - \frac{\bar{V} x_O W_O}{(x_F W_F + x_O W_O)^2}\right) < 0$$

The proof is the same as 2. above.
Lemma A.1. From the solution in Proposition 1, the following comparative statics exist:

1. $\frac{\partial \tau^*}{\partial W_O}$ and $\frac{\partial \tau^*}{\partial x_O}$ are positive if $\tilde{V} > 2\tilde{V}'_F$.
2. $\frac{\partial \Delta V}{\partial W_O}$ and $\frac{\partial \Delta V}{\partial x_O}$ are positive if $(\bar{V} + \theta \bar{V}) > \frac{\bar{V} \bar{V}'}{\bar{V}}$.

Proof

1. 
\[
\frac{\partial \tau^*}{\partial W_O} = x_O \left( \frac{\tilde{V}}{2x_F \sqrt{Vx_OW_O}} - \frac{1}{x_F} \right)
\]
This is positive if $\tilde{V} > 2\tilde{V}'_F$.

2. 
\[
\frac{\partial \tau^*}{\partial x_O} = W_O \left( \frac{\tilde{V}}{2x_F \sqrt{Vx_OW_O}} - \frac{1}{x_F} \right)
\]
This is positive if $\tilde{V} > 2\tilde{V}'_F$.

3. 
\[
\frac{\partial \Delta V}{\partial W_O} = x_O \left( 1 - \frac{\tilde{V}}{\sqrt{Vx_OW_O}} + \frac{\tilde{V}x_FW_F}{(x_FW_F + x_OW_O)^2} \right)
\]
This simplifies to
\[
\frac{\partial \Delta V}{\partial W_O} = x_O \left( 1 - \frac{\tilde{V}}{\tilde{V}'_F} + \frac{\theta \tilde{V}}{\bar{V}} \right)
\]
This is positive if $(\bar{V} - \theta \bar{V}) > \frac{\bar{V} \bar{V}'}{\bar{V}}$.

4. 
\[
\frac{\partial \Delta V}{\partial x_O} = W_O \left( 1 - \frac{\tilde{V}}{\sqrt{Vx_OW_O}} + \frac{\tilde{V}x_FW_F}{(x_FW_F + x_OW_O)^2} \right)
\]
This is positive if $(\bar{V} - \theta \bar{V}) > \frac{\bar{V} \bar{V}'}{\bar{V}'}$.
Lemma A.2. Suppose that the firm reports \( H_F = W_F \). Then, \( V_B^O > V_N^O \), where \( V_N^O \) is the value of the project for the outsider when neither player uses a buffer and \( V_B^O \) is its value with a buffer.

Proof

Firm \( O \) will report its true cost of capital if

\[
V_N^O - V_B^O = (1 - \theta)(\bar{V} - V) - \left( \bar{V} + x_F W_F - 2\sqrt{V x_F W_F} \right) > 0.
\]

Distributing and simplifying (noting that \( (1 - \theta)V = X_O W_O \) from the definition if \( \theta \)), the expression simplifies to:

\[-\theta \bar{V} - V + 2V_O' > 0\]

Solving for \( \theta \), the condition for \( O \) to not use a buffer given that \( O \) does not use a buffer is

\[\theta < \frac{2V_O' - V}{V}\] (A.8)

However, as shown below, A.8 can never hold. To see this start from the equivalent expression

\[\theta \bar{V} + V - 2V_O' < 0\]

First note that \( \theta \bar{V} = \frac{x_F W_F \bar{V}}{V} \). The numerator of this expression can be written as \( \left( \sqrt{x_F W_F \bar{V}} \right)^2 \).

Recall that the expression \( \sqrt{V x_F W_F} \) is the new minimum acceptable project value when firm \( O \) shades and firm \( F \) does not. So, \( \theta \bar{V} = \frac{(V_O')^2}{V} \). We can re-write the inequality as

\[
\frac{(V_O')^2}{V} + V - 2V_O' < 0
\]

\[
\Rightarrow (V_O')^2 + V^2 - 2V_O' V < 0
\] (A.9)

This expression on the left side is of the form \( a^2 + b^2 - 2ab \), which is strictly greater than zero for all values of \( a \) and \( b \). Therefore, A.9 is never true and player \( O \) will always use a buffer if player \( F \) does not. ■
Proof of Proposition 2

Integrating (5) over all incentive compatible gross returns \( \bar{V} \) to \( \bar{V} \) yields

\[
V_F = \frac{x_F \bar{V}}{x_F \bar{V} + x_O \bar{V}} \bigg|_{V''}.
\]

Substituting in \( V' = x_F \bar{V} + x_O \bar{V} \) yields the following:

\[
V_F = \frac{x_F \bar{V}}{x_F \bar{V} + x_O \bar{V}} \left[ \bar{V} - (x_F \bar{V} + x_O \bar{V}) \right].
\]

Simplifying gives the expression for the value of the firm in terms of \( \tau_F \):

\[
V_F = \frac{x_F \bar{V}}{x_F \bar{V} + x_O \bar{V}} - x_F \bar{V}.
\] (A.10)

Similar calculation for the outside trading partner yields

\[
V_O = \frac{x_O \bar{V}}{x_F \bar{V} + x_O \bar{V}} - x_O \bar{V}.
\] (A.11)

Taking first order conditions with respect to \( \tau_F \) and \( \tau_O \)

\[
\frac{\partial V_F}{\partial \tau_F} = \frac{x_F \bar{V} (x_F \bar{V} + x_O \bar{V}) - x_F^2 \bar{V}}{(x_F \bar{V} + x_O \bar{V})^2} - x_F = 0
\]

\[\Rightarrow \bar{V} x_O \bar{V} = (x_F \bar{V} + x_O \bar{V})^2, \tag{A.12}\]

\[
\frac{\partial V_F}{\partial \tau_O} = \frac{x_O \bar{V} (x_F \bar{V} + x_O \bar{V}) - x_O^2 \bar{V}}{(x_F \bar{V} + x_O \bar{V})^2} - x_O = 0
\]

\[\Rightarrow \bar{V} x_F \bar{V} = (x_F \bar{V} + x_O \bar{V})^2. \tag{A.13}\]

It follows that

\[
\bar{V} x_F \bar{V} = \bar{V} x_O \bar{V}.
\] (A.14)

Substituting (A.14) into (A.12) for \( x_O \bar{V} \) gives us

\[
\bar{V} x_F \bar{V} = 4(x_F \bar{V})^2
\]

\[\Rightarrow \tau_F^* = \frac{\bar{V}}{4x_F}. \tag{A.15}\]

By the same method

\[
\bar{V} x_O \bar{V} = 4(x_O \bar{V})^2
\]

\[\Rightarrow \tau_O^* = \frac{\bar{V}}{4x_O}. \tag{A.16}\]
Taking second order conditions for each party yields
\[
\frac{\partial^2 V_F}{\partial \tau_F^2} = -2x_F^2 x_O \bar{V} (x_F \tau_F + x_O \tau_O) < 0
\]
\[
\frac{\partial^2 V_O}{\partial \tau_O^2} = -2x_O^2 x_F \bar{V} (x_F \tau_F + x_O \tau_O) < 0,
\]
so that \(\tau_1^*\) and \(\tau_2^*\) are global maxima.

At the optimal buffered discount rates, the value of of the project
\[
V_F^* = \frac{x_F \tau_F^* \bar{V}}{x_F \tau_F^* + x_O \tau_O^*} - x_F \tau_F^*.
\]

Using (A.14) to substitute in for \(x_O \tau_O^*\), this simplifies to:
\[
V_F^* = \frac{\bar{V}}{2} - x_F \tau_F^*.
\]

Substituting (10) for \(\tau_F\) results in
\[
V_F^* = \frac{\bar{V}}{2} - \frac{x_F \bar{V}}{4x_F} \Rightarrow \bar{V} = \frac{\bar{V}}{4},
\]
which is (11) in the text.

In what follows, we show that there is no profitable deviation for each party, if their trading partner chooses a buffer as defined above. The logic is the same for each, so we present the analysis for firm F.

If firm F does not use a buffer and the outsider does, the value to F is
\[
V_{B,O}^F = \frac{x_F W_F}{x_F W_F + x_O \tau_O} [\bar{V} - V_O'],
\]
and the value to the firm if both use the buffer is
\[
V_{B,O,F}^F = \frac{\bar{V}}{4}
\]

Therefore, F will choose to use a buffer given O does if
\[
V_{B,O,F}^F - V_{B,O}^F = \bar{V} - \frac{x_F W_F}{x_F W_F + x_O \tau_O} [\bar{V} - V_O'] > 0
\]
(A.16)

Below we show that (A.16) is always true. First, note that \(x_F W_F + x_O \tau_O\) is \(V_O'\), the minimum acceptable project when firm O uses a buffer and firm F does not. (A.16) simplifies to
\[
\bar{V} - \frac{x_F W_F}{V_O'} [\bar{V} - V_O'] > 0
\]
\[
\Rightarrow \bar{V} - \left( \frac{\bar{V} x_F W_F}{V_O'} - x_F W_F \right) > 0
\]
(A.17)
The numerator of \( \frac{\bar{V}_{x_F W_F}}{V_o} \) can be written as \( \left( \sqrt{V_{x_F W_F}} \right)^2 \). Recall that the expression \( \sqrt{V_{x_F W_F}} \) is the new minimum acceptable project value when firm \( O \) shades and firm \( F \) does not. So, \( \frac{\bar{V}_{x_F W_F}}{V_o} = \frac{(V_o')^2}{V_o} = V_o' \). Therefore, the expression in (A.17) simplifies to

\[
\frac{\bar{V}}{4} - V_o' + x_F W_F > 0
\]

\( V_o' \) can also be written as \( x_F W_F + x_O \tau_O \) which yields

\[
\frac{\bar{V}}{4} - (x_F W_F + x_O \tau_O) + x_F W_F > 0
\]

\[
\Rightarrow \bar{V} - x_O \tau_O > 0
\]

\[
\Rightarrow \bar{V} > 4x_O \tau_O \quad (A.18)
\]

Next, we show that \( \bar{V} \) can be expressed as a function of \( x_F W_F \) and \( x_O \tau_O \). The minimum acceptable project when firm \( O \) uses a buffer and \( F \) does not is defined as \( x_F W_F + x_O \tau_O \). From (A.5) it follows that

\[
x_F W_F + x_O \tau_O = \sqrt{V_{x_F W_F}}.
\]

Squaring both sides and solving for \( \bar{V} \) yields

\[
(x_F W_F)^2 + 2(x_F W_F)(x_O \tau_O) + (x_O \tau_O)^2 = \bar{V} x_F W_F
\]

\[
\Rightarrow (x_F W_F) + 2(x_O \tau_O) + \frac{(x_O \tau_O)^2}{x_F W_F} = \bar{V}. \quad (A.19)
\]

Substituting (A.19) into (A.18) shows that firm \( F \) will use a buffer given firm \( O \) does if

\[
(x_F W_F) + 2(x_O \tau_O) + \frac{(x_O \tau_O)^2}{x_F W_F} > 4x_O \tau_O
\]

\[
\Rightarrow (x_F W_F) - 2(x_O \tau_O) + \frac{(x_O \tau_O)^2}{x_F W_F} > 0
\]

\[
\Rightarrow (x_F W_F)^2 - 2(x_O \tau_O)(x_F W_F) + (x_O \tau_O)^2 > 0
\]

This expression on the left side is of the form \( a^2 + b^2 - 2ab \), which is strictly greater than zero for all values of \( a \) and \( b \), and therefore the inequality always holds.

Finally, the projects that are undertaken when no IRR buffers are used yield an aggregate value of \( \bar{V} - (x_F W_F + x_O W_O) \). The aggregate value with competitive IRR buffers is \( \frac{\bar{V}}{2} \). The deadweight loss is computed as the difference. ■
Proof of Proposition 3

The value for party $i$ given the actions of the others is

$$V_i = \int_R^\hat{R} \theta_i dR,$$

where $R = \sum_{j \in N} H_j \equiv \Sigma$. This implies that

$$V_i = \frac{\hat{R}H_i}{\Sigma} - H_i.$$  \hspace{1cm} (A.20)

Taking first-order conditions yields

$$\frac{\partial V_i}{\partial H_i} = \frac{\hat{R} \Sigma - \hat{R}H_i}{\Sigma^2} - 1.$$  \hspace{1cm} (A.21)

Second-order conditions confirm that the objective function is strictly concave. Setting (A.21) equal to zero and re-arranging yields

$$\hat{R} \sum_{j \in J} H_j = \Sigma^2,$$

where $J$ are all others except party $i$. For all pairs of parties $i$ and $j$, $S \equiv \sum_{k \neq i, j}$ is the same. Therefore,

$$\hat{R}(S + H_j) = \Sigma^2 \hspace{1cm} (A.22)$$

$$\hat{R}(S + H_i) = \Sigma^2 \hspace{1cm} (A.23)$$

which implies that $H_i = H_j = H^*$ for all pairs $i, j$. Thus,

$$\hat{R}(n - 1)H^* = n^2(H^*)^2,$$

or

$$H^* = \frac{(n - 1)\hat{R}}{n^2}.$$  \hspace{1cm} (A.24)

Plugging (A.24) into (A.20)

$$V_i = \frac{\hat{R}}{n^2}.$$

\[ \blacksquare \]
Proof of Proposition 4

With a buffer $H_F = W_F + b$, the Nash Bargaining split is

$$\theta_B = \frac{H_F}{H_F + W_O}$$

(A.25)

and the value of the firm can be calculated as

$$V_B = \frac{W_F \bar{R} + b \bar{R}}{W_F + b + W_O} - (W_F + b).$$

(A.26)

Without a buffer, the Nash Bargaining split is

$$\theta_N = \frac{W_F}{W_F + W_O}$$

(A.27)

and the value of the firm can be calculated as

$$V_N = \frac{W_F \bar{R}}{W_F + W_O} - W_F.$$

(A.28)

Therefore, $V_B > V_N$ if

$$V_B > V_N \Rightarrow \frac{W_F \bar{R} + b \bar{R}}{W_F + b + W_O} - (W_F + b) > \frac{W_F \bar{R}}{W_F + W_O} - W_F \Rightarrow \frac{W_F \bar{R} + b \bar{R}}{W_F + b + W_O} > \frac{W_F \bar{R}}{W_F + W_O} + b \Rightarrow \frac{\bar{R}W_O - (W_F + W_O)^2}{(W_F + W_O)} > b$$

(A.29)
Proof of Proposition 5

The hurdle rate, $H_F$, that implements the CFO’s limitation on feasible projects is set such that the following holds with equality:

$$k[\bar{R} - W_F - W_O] = \bar{R} - H_F - W_O$$

Solving for $H_F$ yields

$$H_F = (1 - k)\bar{R} + kW_F - (1 - k)W_O \Rightarrow$$

$$H_F = kW_F + (1 - k)(\bar{R} - W_O).$$

(A.30)

The value of the project under the biased hurdle rate is:

$$V_B = \int_{R_H}^{\bar{R}} \theta_H dR = \theta_H[\bar{R} - (H_F + W_O)] = \frac{H_F}{H_F + W_O} - H_F$$

The value under the biased hurdle rate exceeds the value under the true discount rate if:

$$V_B > V_N \Rightarrow \theta_H[\bar{R} - (H_F + W_O)] > \theta_N[\bar{R} - (W_F + W_O)] \Rightarrow$$

$$\theta_H[\bar{R} - R_H] > \theta_N[\bar{R} - \bar{R}] \Rightarrow$$

$$(\theta_H - \theta_N)\bar{R} > (H_F - W_F) \Rightarrow$$

$$(\theta_H - \theta_N) > (1 - k)(1 - \frac{W_F + W_O}{\bar{R}}).$$

(A.31)

The last inequality follows from the fact that

$$H_F - W_F = (1 - k)[\bar{R} - (W_F + W_O)].$$

The optimal hurdle rate that maximized the firm’s share of the surplus, $\tau^*$, is greater than the biased hurdle rate, $H_F$, if:

$$\tau^* > H_F \Rightarrow$$

$$\sqrt{RW_O - W_O} > (1 - k)\bar{R} + k(W_F + W_O) - W_O \Rightarrow$$

$$R' > (1 - k)\bar{R} + k\bar{R} \Rightarrow$$

$$k[\bar{R} - \bar{R}] > \bar{R} - R' \Rightarrow$$

$$k > \frac{\bar{R} - R'}{\bar{R} - \bar{R}}$$

(A.32)
B. Appendix Figures and Tables

Figure B.1: Time Series and Cross-Sectional Differences in the Extensive Margin of the Buffer

This figure displays the proportion of firms that use a positive buffer (i.e., their hurdle rate exceeds their cost of capital) across several observable characteristics of the CFO survey sample.
Figure B.2: Cross-Correlations of Main Variables

This figure shows the correlations among the main variables. Dark blue indicates strong positive correlations, and dark red indicates strong negative correlations. Detailed variable definitions are available in Table B.1.
This figure displays how the relationship between the cost of capital and the buffer varies across the size of the cost of capital. We first estimate a regression of the buffer (extensive and intensive margins) on an interaction between WACC and a categorical variable which groups survey firms by the size of their WACC (along with the non-interactive variables):

\[ B_{i,t} = \delta_1 + \beta_1 WACC_{i,t} + \sum_{k=2}^{4} \beta_k WACC_{i,t} \times WACC \text{ Group}_k + \delta_k WACC \text{ Group}_k + X_{i,t} \gamma'_{i,t} + \epsilon_{i,t} \]

The four groups are (1) \(\leq 5\%\), (2) (5\%, 10\%], (3) (10\%, 15\%] and (4) > 15\%. We then display effect of WACC on the buffer for each group. I.e., for firms with WACC \(\leq 5\%\), the figure displays the baseline effect from the regression (\(\beta_1\)); the other three groups display the group-specific slope coefficient (\(\beta_1 + \beta_k\mid k \in \{2, 3, 4\}\)). In each plot, we display the overall effect for comparison (labeled “All”), which is estimated from a similar regression without interactions. Controls in this regression are industry sales volatility and industry beta volatility; fixed effects are survey quarter and size. Standard errors are clustered by survey industry \times survey quarter.
Figure B.4: Markups of Compustat Firms Throughout Time Using Alternative Measure of Markups

This figure displays how the markups of Compustat firms have evolved through time using an alternative measure of markups to Figure 7. We estimate markups using the production function estimation approach as described in De Loecker et al. (2020), Appendix C.2.3 of Baqaee and Farhi (2020) (both papers are based on the methodology in Olley and Pakes (1996)). See Table B.1 for a detailed description. Panel A displays average markups for Compustat firms by year. Panel B splits the sample by above/below median markup in 2002 and plots average percentage changes in markup (relative to 2002) by year for each group. Panel C updates the ranking of markups each year (as in De Loecker et al., 2020). We require that firms have a non-missing markup in 2002 for inclusion in both panels.
Table B.1: Empirical Variable Definitions

This table gives definitions, details on construction and sources for each empirical variable used in the paper. Appendix C contains further details on the survey data and other data sources.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hurdle Rate</td>
<td>The minimum rate of return required to pursue a project</td>
<td>CFO Survey</td>
</tr>
<tr>
<td>Cost of Capital/WACC</td>
<td>The firm’s weighted average cost of capital</td>
<td>CFO Survey</td>
</tr>
<tr>
<td>Buffer (Intensive Margin)</td>
<td>The difference between hurdle and WACC, i.e. the intensive margin of the buffer</td>
<td>CFO Survey</td>
</tr>
<tr>
<td>Buffer (Extensive Margin)</td>
<td>Indicator variable taking a value of one if the firm’s hurdle rate exceeds their cost of capital, i.e. the extensive margin of the buffer</td>
<td>CFO Survey</td>
</tr>
<tr>
<td>Survey Industry</td>
<td>Industry of firm, as supplied by CFO on the survey, roughly equivalent to 1-digit SIC codes. The 10 categories are Retail/Wholesale trade, Mining/Construction, Manufacturing, Transportation/Energy, Communications/Media, Technology, Finance, Services/Consulting, Healthcare/Pharma and Other.</td>
<td>CFO Survey</td>
</tr>
<tr>
<td>Has Credit Rating</td>
<td>Indicator variable equal to one if the firm states they have a credit rating (and zero for all other firms)</td>
<td>CFO Survey</td>
</tr>
<tr>
<td>Large Firm</td>
<td>Indicator variable equal to one if the firm’s sales revenue is weakly greater than $1 billion</td>
<td>CFO Survey</td>
</tr>
<tr>
<td>Public Firm</td>
<td>Indicator variable equal to one if the firm is publicly traded</td>
<td>CFO Survey</td>
</tr>
<tr>
<td>Firm-Level (US) Optimism</td>
<td>Answer to the question: “Rate your optimism about your firm (the US economy) on a scale from 0-100, with 0 being the least optimistic and 100 being the most optimistic.”</td>
<td>CFO Survey</td>
</tr>
<tr>
<td>Return on Invested Capital</td>
<td>We measure ROIC as ( \frac{EBIT_t}{ICAP_{T-1}} \times (1 - \text{tax}_t) ). We take trailing four-quarter sums of ( EBIT(1 - \text{tax}) ), and divide by the invested capital from the end of the previous fiscal year to derive our final measure.</td>
<td>Compustat Quarterly</td>
</tr>
<tr>
<td>Industry Sales Volatility</td>
<td>Standard deviation of sales divided by lagged assets within a quarter and four-digit NAICS industry</td>
<td>Compustat</td>
</tr>
<tr>
<td>Industry Beta Volatility</td>
<td>Standard deviation of the CAPM beta within a quarter and 4-digit NAICS industry</td>
<td>Compustat and CRSP</td>
</tr>
<tr>
<td>Industry Tangibility</td>
<td>We calculate firm-level tangibility as the ratio of property, plant and equipment to total fixed assets (PPENT/AT). As there is very little time variation in tangibility (a regression of firm tangibility on NAICS-4 fixed effects produces an ( R^2 ) of 0.62, adding year fixed effects produces an ( R^2 ) of 0.635), we take simple NAICS-4 averages of firm-level tangibility for our industry measure.</td>
<td>Compustat</td>
</tr>
<tr>
<td>Industry Markup</td>
<td>We follow the “accounting markup” from Baqae and Farhi (2020) (BF). At the firm-level, we measure profits as operating income after depreciation (OIBPD-DP). The firm-level markup is ( \mu_i ) comes from the following relation: ( \text{profits}_i = \frac{(1 - \mu_i)}{\text{sales}_i} ). To net out the effects of year-specific shocks, we take four-year trailing averages of ( \mu_i ) within-firm. Following BF, we take NAICS-3 by year averages of ( \mu_i ) as our industry measure. See Appendix C.2.1 of BF for details.</td>
<td>Compustat</td>
</tr>
</tbody>
</table>
**Industry Markup (Alternative)**

We follow the estimation procedure PF1 from De Loecker et al. (2020), with the alterations described in Appendix C.2.3 of BF. We estimate output elasticities at the NAICS-3 level using Compustat data from 1990-2021, then calculate firm-level markups and take trailing four-year averages to net out year-specific shocks. Finally, we take NAICS-3 by year averages of markups as our industry measure.

| Industry Customer Concentration | Average of firms’ corporate customer sales HHI within a year and NAICS-3 industry. For firm $i$ and customer firm(s) $j$, $HHI_{sales}^{i} = \sum_{j} \left( \frac{sales_{i,j}}{sales_{i}} \right)^2$. To measure $HHI$, we use the Compustat Segments Customers file (which itself is created using SEC filings), focusing on corporate customers. See, e.g. Patatoukas (2012), for more details. | Compustat & FRED | Compustat and SEC filings |
Table B.2: Reason Aggregation for Figure 1

This table displays how we produce Figure 1. The possible responses that CFOs can give for the reason(s) hurdle is above WACC vary from survey to survey. We categorize possible reasons into five qualitative groupings.

<table>
<thead>
<tr>
<th>Panel</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Panel A: 2011</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Financing Constraint</strong></td>
<td>1. Shortage of funding</td>
</tr>
<tr>
<td></td>
<td>1. Shortage of employees</td>
</tr>
<tr>
<td><strong>Managerial/Resource Constraint</strong></td>
<td>2. Shortage of management time and expertise</td>
</tr>
<tr>
<td></td>
<td>3. Shortage of production capacity</td>
</tr>
<tr>
<td><strong>Project Prioritization</strong></td>
<td>1. We do not pursue some positive net present value projects because we think others will earn even higher returns</td>
</tr>
<tr>
<td><strong>Over-Optimism/Agency</strong></td>
<td>1. Some projects only appear to be attractive due to optimistic projections but may not be successful</td>
</tr>
<tr>
<td></td>
<td>2. Project might reduce earnings per share</td>
</tr>
<tr>
<td><strong>Idiosyncratic Risk/Uncertainty</strong></td>
<td>1. There is too much uncertainty about some projects</td>
</tr>
<tr>
<td></td>
<td>2. The risk of the project is too high</td>
</tr>
<tr>
<td><strong>Panel B: 2019</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Financing Constraint</strong></td>
<td>1. Because we face funding constraints</td>
</tr>
<tr>
<td><strong>Managerial/Resource Constraint</strong></td>
<td>1. Because we have scarcity of managerial time/expertise</td>
</tr>
<tr>
<td><strong>Project Prioritization</strong></td>
<td>1. So that we choose only the best available projects</td>
</tr>
<tr>
<td><strong>Over-Optimism/Agency</strong></td>
<td>1. So that we choose projects that are profitable</td>
</tr>
<tr>
<td></td>
<td>2. To provide a buffer in case the project underperforms</td>
</tr>
<tr>
<td><strong>Idiosyncratic Risk/Uncertainty</strong></td>
<td>1. To account for riskiness of the projects being evaluated</td>
</tr>
<tr>
<td></td>
<td>2. To account for costs not captured by WACC</td>
</tr>
<tr>
<td></td>
<td>3. To provide a margin of error in calculations and assumptions</td>
</tr>
<tr>
<td><strong>Panel C: 2022</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Financing Constraint</strong></td>
<td>1. Our firm cannot fund all profitable projects</td>
</tr>
<tr>
<td><strong>Managerial/Resource Constraint</strong></td>
<td>1. Scarcity of non-management labor</td>
</tr>
<tr>
<td></td>
<td>2. Scarcity of management times</td>
</tr>
<tr>
<td><strong>Project Prioritization</strong></td>
<td>1. To limit the total number of projects we take on</td>
</tr>
<tr>
<td></td>
<td>2. Saves resources in order to preserve the option to invest in future projects that might earn higher return</td>
</tr>
<tr>
<td><strong>Over-Optimism/Agency</strong></td>
<td>1. Helps offset possible over-optimism in project evaluation</td>
</tr>
<tr>
<td></td>
<td>2. Builds in a buffer, to reduce the odds we will have to cancel a project that we have already started should a negative surprise occur</td>
</tr>
<tr>
<td><strong>Idiosyncratic Risk/Uncertainty</strong></td>
<td>1. Provides a margin of error in calculations and assumptions</td>
</tr>
<tr>
<td></td>
<td>2. Accounts for project-specific risks not reflected in WACC</td>
</tr>
</tbody>
</table>
Table B.3: Hurdle Rates, Costs of Capital and Buffers by Industry

This table displays industry-level averages of hurdle rates, costs of capital and the intensive and extensive margins of the buffer. Panel A displays for NAICS-2 industries, Panel B displays for survey industries (i.e., the industry the CFO stated on the survey), which align with one-digit SIC codes.

### Panel A: NAICS-2 Averages

<table>
<thead>
<tr>
<th>NAICS-2 Code</th>
<th>Description</th>
<th>% of Sample</th>
<th>Hurdle Rate</th>
<th>WACC</th>
<th>Buffer</th>
<th>Uses Buffer</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>Agri, Forestry, Fish</td>
<td>0.32</td>
<td>11.875</td>
<td>9.250</td>
<td>2.625</td>
<td>0.750</td>
</tr>
<tr>
<td>21</td>
<td>Mining, Oil/Gas</td>
<td>2.08</td>
<td>17.500</td>
<td>9.923</td>
<td>7.577</td>
<td>0.923</td>
</tr>
<tr>
<td>22</td>
<td>Utilities</td>
<td>0.96</td>
<td>8.892</td>
<td>7.075</td>
<td>1.817</td>
<td>0.667</td>
</tr>
<tr>
<td>23</td>
<td>Construction</td>
<td>5.19</td>
<td>13.420</td>
<td>8.248</td>
<td>5.172</td>
<td>0.723</td>
</tr>
<tr>
<td>31-33</td>
<td>Manufacturing</td>
<td>21.57</td>
<td>14.472</td>
<td>9.133</td>
<td>5.338</td>
<td>0.793</td>
</tr>
<tr>
<td>41-42</td>
<td>Wholesale Trade</td>
<td>7.35</td>
<td>13.277</td>
<td>8.462</td>
<td>4.814</td>
<td>0.750</td>
</tr>
<tr>
<td>44-45</td>
<td>Retail Trade</td>
<td>5.03</td>
<td>14.374</td>
<td>8.910</td>
<td>5.465</td>
<td>0.778</td>
</tr>
<tr>
<td>48-49</td>
<td>Transportation/Warehouse</td>
<td>2.00</td>
<td>13.160</td>
<td>8.796</td>
<td>4.364</td>
<td>0.800</td>
</tr>
<tr>
<td>51</td>
<td>Information</td>
<td>4.31</td>
<td>15.398</td>
<td>9.645</td>
<td>5.753</td>
<td>0.778</td>
</tr>
<tr>
<td>52</td>
<td>Finance/Insurance</td>
<td>9.35</td>
<td>11.640</td>
<td>7.704</td>
<td>3.936</td>
<td>0.726</td>
</tr>
<tr>
<td>53</td>
<td>Real Estate</td>
<td>3.83</td>
<td>12.964</td>
<td>8.383</td>
<td>4.580</td>
<td>0.729</td>
</tr>
<tr>
<td>54</td>
<td>Professional/Scientific Services</td>
<td>9.50</td>
<td>15.708</td>
<td>9.936</td>
<td>5.771</td>
<td>0.756</td>
</tr>
<tr>
<td>55</td>
<td>Management of Companies</td>
<td>0.72</td>
<td>10.267</td>
<td>6.839</td>
<td>3.428</td>
<td>0.556</td>
</tr>
<tr>
<td>56</td>
<td>Admin/Waste Management</td>
<td>2.72</td>
<td>15.294</td>
<td>8.751</td>
<td>6.543</td>
<td>0.824</td>
</tr>
<tr>
<td>61</td>
<td>Educational Services</td>
<td>1.36</td>
<td>8.444</td>
<td>6.368</td>
<td>2.076</td>
<td>0.529</td>
</tr>
<tr>
<td>62</td>
<td>Healthcare</td>
<td>3.91</td>
<td>11.849</td>
<td>7.658</td>
<td>4.191</td>
<td>0.837</td>
</tr>
<tr>
<td>71</td>
<td>Arts/Entertainment</td>
<td>0.56</td>
<td>10.329</td>
<td>8.757</td>
<td>1.571</td>
<td>0.571</td>
</tr>
<tr>
<td>72</td>
<td>Accommodation/Food</td>
<td>1.44</td>
<td>16.744</td>
<td>9.386</td>
<td>7.358</td>
<td>0.833</td>
</tr>
<tr>
<td>81,91-92</td>
<td>Other Services/Public Admin</td>
<td>2.80</td>
<td>11.529</td>
<td>6.446</td>
<td>5.083</td>
<td>0.800</td>
</tr>
<tr>
<td>Unknown</td>
<td>Unknown</td>
<td>15.02</td>
<td>13.600</td>
<td>8.813</td>
<td>4.787</td>
<td>0.750</td>
</tr>
</tbody>
</table>

### Panel B: Survey Industry Averages

<table>
<thead>
<tr>
<th>Industry</th>
<th>% of Sample</th>
<th>Hurdle Rate</th>
<th>WACC</th>
<th>Buffer</th>
<th>Uses Buffer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mining/Construction</td>
<td>4.95</td>
<td>13.882</td>
<td>7.769</td>
<td>6.114</td>
<td>0.774</td>
</tr>
<tr>
<td>Technology</td>
<td>7.19</td>
<td>16.394</td>
<td>10.638</td>
<td>5.756</td>
<td>0.689</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>24.04</td>
<td>14.671</td>
<td>9.218</td>
<td>5.454</td>
<td>0.817</td>
</tr>
<tr>
<td>Communications/Media</td>
<td>2.56</td>
<td>15.219</td>
<td>9.972</td>
<td>5.247</td>
<td>0.656</td>
</tr>
<tr>
<td>Services/Consulting</td>
<td>12.06</td>
<td>13.600</td>
<td>8.601</td>
<td>4.999</td>
<td>0.709</td>
</tr>
<tr>
<td>Retail/Wholesale</td>
<td>10.46</td>
<td>12.985</td>
<td>8.246</td>
<td>4.740</td>
<td>0.763</td>
</tr>
<tr>
<td>Transportation/Energy</td>
<td>7.83</td>
<td>13.249</td>
<td>8.601</td>
<td>4.648</td>
<td>0.816</td>
</tr>
<tr>
<td>Healthcare/Pharma</td>
<td>5.99</td>
<td>13.128</td>
<td>8.763</td>
<td>4.365</td>
<td>0.760</td>
</tr>
<tr>
<td>Finance</td>
<td>12.30</td>
<td>11.917</td>
<td>7.775</td>
<td>4.141</td>
<td>0.740</td>
</tr>
<tr>
<td>Other</td>
<td>12.62</td>
<td>13.217</td>
<td>8.196</td>
<td>5.021</td>
<td>0.772</td>
</tr>
</tbody>
</table>
Table B.4: Buffer and Industry Markups: Firm-Level Markup and Alternative Measures of Markups

This table further provides further detail on how bargaining power affects the buffer. Panel A repeats the analysis of Table 6, focusing on the CFO survey firms that appear in Compustat. We use the firm-level markup as our measure of bargaining power in these regressions, as opposed to the industry markup in Table 6. Panel B repeats the analysis of Table 6 using an alternative measure of Industry Markups. We estimate output elasticities via the production function estimation approach described in De Loecker et al. (2020), Baqaee and Farhi (2020) and Olley and Pakes (1996). See Table B.1 for details on how we construct this measure. All variables apart from Cost of Capital are standardized to unit variance. Standard errors are clustered at the survey industry × survey quarter and displayed in parentheses below the coefficient. ***, **, * denote significance at 1%, 5%, 10%.

**Panel A**: CFO Survey Compustat Firms and Firm-Level Markups

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Extensive Margin</td>
<td>Intensive Margin</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Firm Markup</td>
<td>-0.052*</td>
<td>-0.043</td>
<td>-0.027</td>
<td>-0.814**</td>
<td>-0.595</td>
<td>-0.680*</td>
</tr>
<tr>
<td></td>
<td>(0.028)</td>
<td>(0.032)</td>
<td>(0.036)</td>
<td>(0.364)</td>
<td>(0.389)</td>
<td>(0.392)</td>
</tr>
<tr>
<td>Cost of Capital</td>
<td>-0.029***</td>
<td>-0.029***</td>
<td>-0.030**</td>
<td>-0.414*</td>
<td>-0.403*</td>
<td>-0.468***</td>
</tr>
<tr>
<td></td>
<td>(0.011)</td>
<td>(0.011)</td>
<td>(0.012)</td>
<td>(0.216)</td>
<td>(0.216)</td>
<td>(0.129)</td>
</tr>
<tr>
<td>Industry Sales Volatility</td>
<td>0.020</td>
<td>0.037</td>
<td>0.370</td>
<td>0.230</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.029)</td>
<td>(0.032)</td>
<td>(0.260)</td>
<td>(0.349)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Industry Beta Volatility</td>
<td>0.012</td>
<td>0.009</td>
<td>0.418</td>
<td>0.358</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.022)</td>
<td>(0.033)</td>
<td>(0.302)</td>
<td>(0.359)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Observations</td>
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<td>186</td>
<td>186</td>
<td>186</td>
<td>186</td>
<td>186</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.041</td>
<td>0.043</td>
<td>0.117</td>
<td>0.072</td>
<td>0.085</td>
<td>0.139</td>
</tr>
<tr>
<td>Survey Quarter FE</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Size FE</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ownership FE</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Credit Rating FE</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Cluster: Industry × Quarter</td>
<td></td>
<td></td>
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</table>
Table B.4: Continued

**Panel B: Alternative Measure of Industry Markups**

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Extensive Margin</td>
<td>Intensive Margin</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Industry Markup (Alternative)</td>
<td>-0.022**</td>
<td>-0.018*</td>
<td>-0.011</td>
<td>-0.447***</td>
<td>-0.351**</td>
<td>-0.328**</td>
</tr>
<tr>
<td></td>
<td>(0.011)</td>
<td>(0.010)</td>
<td>(0.012)</td>
<td>(0.162)</td>
<td>(0.168)</td>
<td>(0.151)</td>
</tr>
<tr>
<td>Cost of Capital</td>
<td>-0.027***</td>
<td>-0.028***</td>
<td>-0.029***</td>
<td>-0.315***</td>
<td>-0.321***</td>
<td>-0.316***</td>
</tr>
<tr>
<td></td>
<td>(0.003)</td>
<td>(0.003)</td>
<td>(0.003)</td>
<td>(0.044)</td>
<td>(0.045)</td>
<td>(0.035)</td>
</tr>
<tr>
<td>Industry Sales Volatility</td>
<td>0.001</td>
<td>0.003</td>
<td>0.342**</td>
<td>0.291*</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>(0.016)</td>
<td>(0.012)</td>
<td></td>
<td>(0.141)</td>
<td></td>
<td>(0.150)</td>
</tr>
<tr>
<td>Industry Beta Volatility</td>
<td>0.029**</td>
<td>0.030***</td>
<td>0.436***</td>
<td>0.404***</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.011)</td>
<td>(0.011)</td>
<td>(0.153)</td>
<td>(0.148)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Observations</td>
<td>1,232</td>
<td>1,232</td>
<td>1,232</td>
<td>1,232</td>
<td>1,232</td>
<td>1,232</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.077</td>
<td>0.082</td>
<td>0.122</td>
<td>0.065</td>
<td>0.075</td>
<td>0.102</td>
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<tr>
<td>Survey Quarter FE</td>
<td>Yes</td>
<td></td>
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<tr>
<td>Size FE</td>
<td>Yes</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Ownership FE</td>
<td>Yes</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Credit Rating FE</td>
<td>Yes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Survey Quarter FE, Size FE, Ownership FE, Credit Rating FE: Yes

Cluster: Industry × Quarter
C. Data Appendix

The CFO survey has asked respondents about their hurdle rate and cost of capital jointly six different times: 2011q1, 2012q2, 2017q2, 2017q3, 2019q1 and 2022q2. The last survey was conducted jointly with the Federal Reserve Banks of Richmond and Atlanta. On each edition of the survey, the wording of the hurdle rate question specifically asked CFOs for the expected rate of return an investment project must exceed in order to be adopted. Thus, we are confident that the respondents provide us with their investment hurdle rate. We similarly asked CFOs to supply their weighted average cost of capital (WACC), as opposed to their cost of equity or cost of debt. As an example, Figure C.1 displays how we asked CFOs for their hurdle rate and WACC in the 2012q2 survey. How the questions appeared in other surveys can be found at https://cfosurvey.fuqua.duke.edu/ for surveys conducted previous to 2022q2 and https://www.richmondfed.org/cfosurvey/ for the 2022q2 survey.

Figure C.1: Hurdle Rate and WACC Questions in 2012q2 CFO Survey

<table>
<thead>
<tr>
<th>10a. What do you estimate is your firm’s overall weighted average cost of capital (WACC)? (e.g., 11.2%)</th>
<th>10b. What is your firm’s ‘hurdle rate’ (the rate of return that an investment must beat in order to be adopted)?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>%</td>
</tr>
</tbody>
</table>

A major concern with survey data is that respondents do not understand the survey questions, or do not respond accurately (Graham, 2022). While we cannot fully address these concerns, we can analyze the accuracy of the CFO survey firms that also have archival data in Compustat (about 15% of the sample). Following analysis in Gormsen and Huber (2020) that relates firms’ survey costs of capital to estimated costs of capital, Figure C.2 Panel A displays a binned scatter plot of the WACC as reported on the survey and the WACC we estimate using data from CRSP and Compustat. The slope coefficient from this regression is 0.61 and highly significant. While exploring the relationship between perceived and estimated costs of capital is not the point of our paper, we are reassured by the tightness of this relationship. Secondly, Figure C.2 Panel B compares the survey-reported revenue categories of these same firms to the equivalent category calculated using Compustat. The proportions line up nearly one-to-one.

A second major concern with survey data is representativeness. Table IAI in the Internet Appendix of Graham (2022) shows that, even though the CFO survey contains a large proportion of private firms, the distributions of employment counts conditional on firm size are quite similar in the CFO survey and Compustat. Thus, we do not detect anamolies that would suggest problems using our public firm data to draw inference about public firms in the US or our overall sample is appropriate for studying the U.S. corporate sector more generally.

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19 We estimate WACC in the simplest way possible. The cost of equity is derived using the CAPM. The cost of debt is total interest expense to total debt (i.e., the average cost of debt).

Figure C.2: Closeness of Data Reported on CFO Survey to Archival Data

This figure analyzes the closeness of survey-reported data and archival data using CFO survey firms that appear in Compustat. We match data from Compustat to the survey firms by survey year and calendar year in Compustat. Panel A displays a binned scatterplot from a regression of reported WACC on estimated WACC. The cost of equity is estimated using the CAPM, cost of debt is total interest expense to total debt. Panel B displays the percentage of these Compustat firms that fall into the stated revenue category on survey (blue bars) vs. the same categories calculated using archival revenue data (orange bars).