Project Development with Delegated Bargaining: The Role of Elevated Hurdle Rates

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Abstract

During project development, investment costs are endogenously determined through delegated bargaining with counterparties. In surveys, nearly 80% of CFOs report using an elevated hurdle rate, the implications of which we build a model to explore. We show that elevated hurdle rates can convey a bargaining advantage that exceeds the opportunity cost of forgone projects, whether these hurdle rate buffers arise for strategic or non-strategic reasons. Using CFO survey data, we find buffer use is negatively related to the cost of capital and to bargaining power, consistent with our model's predictions, and that realized returns are associated with "beat the hurdle rate benchmark" behavior.

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"'If I set a higher hurdle rate, my people go out and get better deals on contracts they negotiate."

CFO of NYSE listed energy firm.

1. Introduction

Project *development* is distinct from project *evaluation*. By the latter we mean the capital budgeting steps prescribed by textbooks, while the former is broader and involves interactions with trading partners, including the procurement of inputs. In this paper, we explore the special role of discount rates in project development, and in particular, the common practice of requiring that expected returns for projects exceed a hurdle rate that is greater than the risk-appropriate weighted-average cost of capital (WACC). We show that, because of the process through which projects are cultivated, adding a buffer to discount rates often preserves and improves firm value.

Two ideas are central. First, every project that a firm accepts is an acquisition that changes the boundary of the firm. Each one needs to be developed. Therefore, up-front investment costs are not exogenous, contrary to what most textbooks posit. They are the *endogenous* result of a collection of bargaining outcomes between a firm's managers and outsiders who do business with the firm. 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 (which is part of up front investment costs C_0). The price that the land sells for 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.

Second, employees accept their CFO's instructions about hurdle rates as given without questioning or verifying them.[1] This common organizational structure within firms gives rise

[1]Evidence based on CFO interviews from Graham (2022) illustrates that the hurdle rate is considered

to a delegated bargaining situation, in which top executives can alter the firm's observable preferences to outsiders.[2] As such, when a hurdle rate is high, project managers presume that their walkaway value is higher and that the firm has better outside options. This can result in the firm obtaining a greater share of the surplus during negotiations as projects are developed.

Based on these ideas, we pose a theoretical model of delegated bargaining, characterize the optimal hurdle rate buffer in several settings, and test the novel empirical implications that arise from the analysis.

Hurdle rate buffers are extremely common. Our survey evidence shows that 78% of companies set hurdle rates above their cost of capital, and among these firms the average buffer is 6.6%.[3] The surveys also indicate why (Figure 1): 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).[4]

But, in many cases textbook capital budgeting with inflated hurdle rates would lead companies to destroy value ("leave money on the table") as they bypass positive net present value (NPV) projects.[5] In these cases, why wouldn't innovation in contracting, governance, hiring, or organizational structure arise to claw back lost firm value? And why wouldn't the market for corporate control, discipline from earnings reporting, or stock market pressure correct this behavior? A key outcome of our model is showing that inflated hurdle rates

"sacred" at firms, thus providing a clear benchmark to facilitate decisions by mid-level employees.

[2]See Schelling (1956), Crawford and Varian (1979), Sobel (1981), Jones (1989), Fershtman et al. (1991), Burtraw (1993), and Segendorff (1998).

[3]Jagannathan et al. (2016), Gormsen and Huber (2022), and Graham (2022) provide similar estimates.

[4]For reasons to be explained below, we refer to these collectively as "non-strategic" explanations of the hurdle rate buffer.

[5]The magnitudes in our surveys imply that firms impose a negative bias of 5.7% for one-year cash flows and a 45% decrease for perpetual cash flows. Among firms that use a hurdle rate buffer, the average hurdle rate and WACC are 14.73% and 8.15%, respectively. Each dollar of perpetual cash flow is worth $6.79 in present value under the hurdle rate, and $12.27 under the cost of capital. This represents a decrease in value of 45% attributable to the buffer.

persist because they are part of an equilibrium trade-off between the gains to trade resulting from negotiating with an inflated hurdle rate and losses from bypassing moderately positive NPV projects. The result of this trade-off can on net preserve firm value and at times create value.

Importantly, the purpose of this paper is not to propose a "7th explanation" for the use of hurdle rate buffers or to run a horse race among all of the explanations. Rather, we seek to explore the effects that elevated hurdle rates have on project development and why buffers appear to persist over time, whether buffers arise for bargaining power (strategic) reasons or because of traditional (non-strategic) reasons.[6] As such, our rationale for the persistence of buffers co-exists with and complements the reasons already described in the literature.[7] Nonetheless, as we show, our model and empirical evidence provide implications that are not consistent with what other explanations for buffers would predict.

In our model of delegated bargaining, we derive the Nash bargaining solution from first principles. A key result is that parties enjoy a greater share of the surplus when their required rate of return is reported to be higher. This is in the spirit of Rubinstein (1982), but distinct. Rubinstein bargaining uses a higher discount rate to model less patience, so 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

[6] If buffers were value-destroying, we would expect them to have disappeared.

[7] We repeat this point for emphasis: Even if firms do not "strategically" choose a high hurdle rate to aid negotiations, but instead the hurdle rate is high for traditional "non-strategic" reasons, the key point of our paper still goes through: a high hurdle rate aids bargaining. Thus, our message does not compete with nor reject traditional rationales; rather, our argument complements traditional hurdle rate buffer rationales by offering an explanation for how large, long-lasting buffers might continue to exist.

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 when a trading partner uses a buffer as well. This helps explain why hurdle rate buffers are so widely used and persistent.

Using data from six CFO surveys, we establish new stylized facts about hurdle rates and test the model's predictions about buffer use. One interesting new empirical fact is that the distribution of ex post return on investment capital (ROIC, which we estimate using Compustat) aligns with the ex ante hurdle rates that CFOs provide in our surveys. Interestingly, a portion of the mass of the ROIC distribution is shifted from just below the hurdle rate to just above the hurdle rate, consistent with firms working to "meet or beat" the hurdle rate benchmark. These facts corroborate the validity of the hurdle rates that CFOs provide to us via surveys; and more broadly, they indicate that buffered-up hurdle rates are a focal point of corporate action. We additionally show that realized ROIC is typically several percentage points greater than WACC, indicating that hurdle rate buffers play a deeper role than simply offsetting optimistic cash flow projections provided by managers. These findings motivate our theoretical modeling of the effects of elevated hurdle rates

We use the survey data to empirically explore four specific predictions from the model on both the extensive and intensive margins. Our first two empirical tests relate the buffer to the firm's cost of capital and how much bargaining power a firm has. First, we confirm empirically that buffer use and the size of the chosen buffer are 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 larger 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 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 (because managerial time constraints are likely independent of the cost of capital) or a positive relation (because financial constraints are more likely to bind for high cost of capital firms). Thus, our prediction and result are unique in the literature.

Second, we show that buffer use is negatively correlated with plausible measures of a firm's bargaining power relative to trading partners. This is consistent with the model's implication that firms that already have strong bargaining power have less incentive to use buffered-up hurdle rates to further enhance bargaining power. We confirm the expected relation using a measure of the concentration of a firm's customer base (Patatoukas, 2012); confirming this negative relation is new to the literature. In a separate test of this prediction, among firms operating in predominantly B2B industries, for which markups based on Baqaee and Farhi (2020) would seem to be a reasonable proxy for bargaining power, we confirm the negative relation.

A third 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 (PPE) have higher buffer use. This positive relation 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). Under the view that, all else equal, bargaining will play a more important role in acquisitions of significant fixed assets compared to other inputs, the PPE findings are consistent with predictions from our model. But we note that there are other possible explanations for the positive relation we document. For example, to the extent that asset tangibility is related to lumpy investment dynamics (due to adjustment costs or some other friction, e.g., Cooper and Haltiwanger, 2006), we would expect to see the same directional relation. We validate our hypothesis relating to PPE by finding a negative relation between asset redeployability (Kim and Kung, 2017) and the buffer – all else equal, assets with lower redeployability (assets that are more specific-to-use) are more likely to be bargained over, hence increasing the incentive to use a buffer in negotiations.

A final implication of our model is that the buffer is larger for firms with higher volatility of underlying project value (i.e., idiosyncratic risk), consistent with Décaire (2021). We also show that buffer use increases in uncertainty about WACC (Bessembinder and Décaire, 2021). These findings tie our paper to frontier research on corporate discount rates.

The rest of the paper is organized as follows. In the next section, we describe the contributions of our paper in the context of the existing literature. In Section 3, we describe the survey and other data that we use, and establish a number of stylized facts about the hurdle rate buffer. In Section 4, we analyze delegated bargaining theoretically and characterize the empirical implications about IRR buffers that arise from the model. The proofs are contained in the appendix. In Section 5, we develop a set of hypotheses and test the model using data from six CFO surveys. Section 6 concludes.

2. 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 companies and showed that hurdle rates often exceed both the equityholders' 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 commonplace. Unlike our study, though, they did not ask their subjects whether a different WACC was also computed and not used for project development. While the authors did not compute a specific IRR buffer as we do, their findings suggest that the hurdle rates used were indeed inflated.

Since that time, many explanations have been proposed for the use of elevated 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) 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 – and furthermore shows that such commitment that arises when the CFO (headquarters) dictates the elevated 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 reassuring. Further, our more recent surveys confirm that elevated hurdle rates remain important for managers. However, as we describe above, one still wonders why firms would leave value on the table if they could access labor markets and hire or train more managers. Our paper addresses this issue directly, both theoretically and empirically.

Décaire (2021) shows that firms use an IRR buffer when they 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 firms to adjust their hurdle rates. These predictions are also considered in our model. We also show that they are present in the data, confirming these studies as well as predictions from our model; we control for these forces when investigating the other implications of our model.

Relatedly, a recent literature has studied the real effects of managers using imprecise or over-simplified discount rates. Krüger et al. (2015) analyze the practice of using a single firm-wide discount rate (see Graham and Harvey, 2001) and show that companies value high-risk projects using discount rates that are too low and vice versa; this leads to over-investment (under-investment) in relatively risky (safe) projects. They further show that this practice leads to lost value – in the context of acquisitions, when the bidder's beta is lower than the target's beta, announcement returns are significantly lower. Dessaint et al. (2021) study a different mechanism – managers and the market may arrive at different acquisition valuations if managers (over-)rely on CAPM-estimated discount rates. This stems from the well documented observation that the empirical security market line is too "flat" relative to CAPM-implied estimates. They show that managers who rely on the CAPM tend to overvalue low-beta targets and undervalue high-beta targets relative to the market. Together, these papers highlight additional real consequences of the use of imprecise WACC in corporate finance, which we incorporate into our model and empirical analysis.

Our paper is also related to Gormsen and Huber (2022), who document time-varying wedges between discount rates and the cost of capital disclosed in earnings calls. Despite our having much different data sources, the magnitude of the hurdle rate buffers are similar between our paper and theirs. Gormsen and Huber (2022) also show that the hurdle rate wedges are negatively related to investment, providing new evidence on the real effects of inflated discount rates.

A key contribution of our paper relative to the prior work on the buffer is that we show that a 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 return exceeding a high hurdle rate. Even if buffers are used heuristically in this manner, our model suggests that large buffers have the added benefit of impacting the bargaining surplus the project will achieve.

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 reached. 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.

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 of the project surplus the firm receives 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 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). What differentiates our work 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. We thus add 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).

3. 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 3.1, discuss the origins of the buffer in Section 3.2 and relate ex ante hurdle rates to ex post returns in Section 3.2.3. Table A.1 provides variable definitions and Appendix C provides more detail on the CFO Survey.

3.1. CFO Survey Data

Our primary data source comes from six CFO surveys conducted by Duke University. These surveys have been conducted quarterly for 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 information 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)?" Similar 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.[8] For sample inclusion, we require that the CFO supply a value for their WACC and hurdle rate. From there, we compute the hurdle rate buffer as the difference between the hurdle rate and WACC.[9]

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 asked 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 buffer is 6.6%. The size of the buffer is consistent with other research (Jagannathan et al., 2016; Graham, 2022; Gormsen and Huber, 2022).

3.2. Why Do Companies Use 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.

[8]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.

[9]In our terminology, we use the extensive margin to refer to the use of a positive buffer (i.e., an indicator taking one (zero) if the firm's hurdle rate is greater than (equal to) WACC). We use intensive margin to refer to the difference between the hurdle rate and WACC. Much of our analysis of the intensive margin is for the full sample (including firms that have buffer = 0), which is the same sample used for the extensive margin analysis and therefore enhances comparability; the intensive analysis is robust to using a Tobit specification (to account for zero-inflation in our intensive margin variable). Our intensive analysis is also robust to deleting buffer = 0 firms and examining only firms that have a positive buffer (e.g., see Panel B of Table 3). Table A.1 displays variable definitions.

3.2.1. 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).

To explore these possibilities, 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).[10] The 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 groupings, 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 A.2 describes how we group responses across each survey. Panel A of Figure 1 displays the importance of each category across the three surveys. There is reasonable support for each of the five

[10]The three surveys were conducted in 2011q1, 2019q1 and 2022q2.

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 a 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 more important for large firms. This may be because large firms are more likely to have numerous diverse projects, with different idiosyncratic risk, and 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 5.1 discusses specific variables used to measure buffer explanations, as well as the other non-CFO survey variables that we use in our empirical analysis.

3.2.2. 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 through time (Graham, 2022; Sharpe and Suarez, 2021; 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.[11] 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 A.3 displays average hurdle rate, cost of capital, and the intensive and extensive margins of the buffer across NAICS-2 and CFO survey industries.[12]

Panel B shows that the size of the average buffer is relatively stable 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, it 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 hurdle rate and the cost of capital (see also Gormsen and Huber, 2022). We separately examine the properties of the extensive margin of the buffer in Figure A.1. The extensive margin patterns in the appendix figure are very similar to the just-discussed intensive margin results shown in Figure 3.

3.2.3. Ex Ante Hurdle Rates versus Realized Returns

Companies use hurdle rates as a benchmark against which expected returns of projects are compared. To the extent that realized and expected returns align, we would therefore expect hurdle rates to influence the distribution of realized project returns. In particular, as we explain in the next two paragraphs, we expect to observe excess mass in the ROIC distribution directly above the benchmark hurdle rate. We do not observe project-level

[11] For example, the average buffer in Mining/Construction is approximately 6%, and the inter-quartile range is 0% to roughly 9%.

[12] We use company names and the Infogroup dataset to match survey firms to their NAICS codes. Survey industry codes are supplied by the CFO directly and roughly equate to one-digit SIC codes.

returns in our data; however, for public firms in Compustat we can calculate the return on invested capital (ROIC) as a measure of realized returns, which is an aggregation of the firm's return on all its projects.

The spirit of our model, and the data, suggest that hurdle rates are chosen to be greater than the true cost of capital. Thus, in project development, even with a bargaining advantage, managers of marginal projects (those with expected returns close to or just below the hurdle rate) might need to stretch to surpass the elevated hurdle. Managers are incentivized to push a little harder to get these marginal projects over the line. This could occur via the specific mechanism in our paper (bargaining hard over project inputs), though it could also result from another aspect of project development.

A direct empirical consequence of the just described evaluation-development link would be bunching of ROIC just above the hurdle rate; that is, a shift in a portion of the ROIC distribution from just below to just above the hurdle rate. Empirically, we search for this discontinuity in the distribution using a simple application of manipulation testing, often used in the context of regression discontinuity designs (McCrary, 2008; Cattaneo et al., 2018). In our application, we are interested in determining formally whether there is evidence of a discontinuity in the density of ROIC at the hurdle rate. To implement this test, we define the variable $Excess\ ROIC = ROIC - Hurdle$, which measures the firm's ROIC earned in excess of its hurdle rate. We are interested in testing for the existence of a discontinuity in excess ROIC at zero.

Figure 4 displays the density of excess ROIC centered at zero. The light blue and orange bars display observed frequencies of excess ROIC in 0.5 percentage point bins. The frequency of observations just above zero (realized ROIC just greater than the hurdle rate) is much larger than that directly below. For example, about 9% of relevant observations are in the +0.5% bin, whereas about 3.5% are in the −0.5% bin.[13] The shaded area and lines overlaid

[13]As stated in the caption of Figure 4, we linearly interpolate between observed hurdle rates for Compustat firms in our sample. For example, if the hurdle rate is 10% in 2012q2 and 11% in 2012q4, we assume a hurdle rate of 10.5% in 2012q3. Given the stickiness of hurdle rates as shown in Graham (2022), we

on the histograms display the result from the methodology described in Cattaneo et al. (2018) – estimating the density of excess ROIC via local polynomial density estimation. The figures reveals a distinct discontinuity in excess ROIC at zero.[14]

The findings in Figure 4 provide evidence consistent with companies choosing projects to beat their hurdle rates. The bunching just above the hurdle rate is consistent with the spirit of our model. Moreover, if companies are choosing projects based on hurdle rates, rather than the cost of capital, one would not expect to find ROICs bunched just above the WACC. This is exactly what we find in Figure A.3, where we undertake a similar exercise to Figure 4, testing instead for discontinuity in the density of ROIC at firms' costs of capital. We find no statistical or visual evidence of bunching in ROIC directly above WACC, suggesting that firms target their hurdle rates, as opposed to WACC.[15]

One take-away from these figures is explicit confirmation, for the first time in the literature to our knowledge, of the importance of hurdle rates (more so than the cost of capital) in project development, as well as "beat-the-benchmark" bunching just above the hurdle rate.[16] These implications motivate our focus on the hurdle rate in our model, as explored in the next section.

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feel that this assumption is reasonable. We confirm the primary findings of our analysis in Figure 4 by alternatively using "stair-step" interpolation, where we keep the hurdle rate constant between consecutive observation until data from a future survey reveals a change in the hurdle. For the same example just given, we would assume that the firm's hurdle rate remained at 10% in 2012q3. Results are very similar.

[14] We follow the data-driven bandwidth selection methodology to estimate the density, and set the order of the local polynomial to 3. Inference using this methodology can be sensitive to researcher-chosen parameters, in particular the order of the local polynomial and the size of the bandwidth for local estimation. In Table A.4, we vary these parameters and show that the implications of Figure 4 are quite robust to parameter choices, though the effects attenuate as the size of the bandwidth increases.

[15] In appendix Figure A.3, we use the same sample of firms as in Figure 4. In nearly all of our analyses, we require the respondent to supply both a hurdle rate and a WACC. However, for Figure 4 we maximize our sample size to include firms that only supply their hurdle rate. For this expanded sample, because CFOs do not always provide a WACC number along with their hurdle rate, in Figure A.3 only we estimate WACC using Compustat data and the CAPM (see Appendix C). We do this to facilitate comparison between the role of the hurdle rate vs. the role of WACC in determining the distribution of ROIC, as depicted in the two figures.

[16] Burgstahler and Dichev (1997) find beat-the-benchmark behavior for earnings per share targets, a highly visible external benchmark. Our finding shows similar behavior for the hurdle rate benchmark, a number which is internal to the firm and not generally known publicly, suggesting strong beat-the-benchmark corporate incentives.

The evidence in this section confirms three empirical features of hurdle rate buffers. First, firms use buffers for a variety of reasons, often 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). Third, the hurdle rate matters for realized returns, which is consistent with hurdle-based project evaluation influencing outcomes in project development (Figure 4). These three points motivate and discipline the model in Section 4 and subsequent empirical analyses in Section 5.

4. The Model

4.1. 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 $W_F = 1 + r^F_{wacc}$. 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 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 refer to an IRR buffer as strategic if a positive buffer is chosen by the CFO to take advantage of the delegated-bargaining organizational structure of the firm (to be described shortly). Alternatively, IRR buffers may exist for non-strategic reasons that may be the result of compensating for a lack of precision in estimating W_F, conservatism, or managerial and financial constraints.

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 acquire one asset from an outside business partner (e.g., land, a building, or equipment). If the delegate fails to secure the necessary asset, the entire project becomes infeasible. In Section 4.2.2, 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 $H_O = W_O = 1 + r^O_{wacc}$ 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. Also, to abstract away from other agency or adverse selection problems, assume that the value of any project that is ultimately accepted is ex post verifiable.

When assets are acquired, delegated Nash bargaining takes place, with a fraction θ of the surplus being allocated to the firm, F, and $(1-\theta)$ going to trading partner, O. Both delegates report their respective hurdle rates to each other, H_F and H_O. For each potential trade, Nash bargaining maximizes

$$\max_{s} \quad (s_F - d_F)^{\alpha}(s_O - d_O)^{\beta}, \tag{1}$$

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 $s = \{\theta(x_F + x_O)R - x_F H_F, (1-\theta)(x_F + x_O)R - x_O H_O\}$, $d = \{0, 0\}$, and $\alpha = \beta = 1$. Then,*

$$\theta = \frac{1}{2} + \frac{x_F H_F - x_O H_O}{2(x_F + x_O)R}. \tag{2}$$

In Lemma 1, the total value (V) equals the return on investment R times the total capital invested ($x_F + x_O$). Firms receive their portion of V minus their opportunity cost. If the two managers walk away, they believe that they can invest their capital in an alternative at their hurdle rate, earning zero NPV. The solution in (2) shows that the split of the surplus depends on each firm's purported hurdle rate - the firm with a higher hurdle rate effectively has more bargaining power. The two parties split the surplus, with a greater proportion going to the party with the higher walkaway value: θ is increasing in H_F and decreasing in H_O.

The use of discount rates in θ 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 perceived value of the outside option is based on the hurdle rate. 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 hurdle rates of each firm, we formulate a more convenient bargaining split that will be used in the rest of the paper, which still yields an outcome with similar properties. We define $\alpha = x_F H_F$ and $\beta = x_O H_O$, and assume that the surplus to be split is the value of the project above and beyond what both firms would require if they made investments at their hurdle rates. Total net surplus is computed as $(x_F + x_O)R - (x_F H_F + x_O H_O)$. As before, walking away means that the firms earn a zero NPV.

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,*

$$\theta = \frac{x_F H_F}{x_F H_F + x_O H_O}. \tag{3}$$

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).[17]

In the following subsections, we present four different versions of the model linking hurdle rates (and hurdle rate buffers) to project outcomes via this bargaining mechanism. We illustrate how this effect holds whether buffers are used by a single firm strategically, by both firms competitively, or by a single firm for reasons unrelated to bargaining, either due to imprecise estimation of the WACC or due to operational or financial constraints. In all versions of the model, the hurdle rate buffer affects bargaining outcomes and firm value.

4.2. Strategic Use of IRR Buffers

Firms 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 non-strategic reasons, such as constraints on managerial time or capital.

4.2.1. Single-firm IRR Buffer

It is instructive to start by assuming that the outside business partner does not use an IRR buffer strategically. Without loss of generality, we set $H_O = W_O$.[18] Nash bargaining

[17] Chowdhury and Sheremeta (2011) generalize Tullock contest functions to consider linear combinations of effort complementarities in duopoly contests. See also D'Aspremont and Jacquemin (1988), Chung (1996), and Alexeev and Leitzel (1996).

[18] A value $H_O > W_O$ that is set exogenously or used for non-strategic reasons does not qualitatively change the results that follow.

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 of the total surplus is given by

$$\theta_N = \frac{x_F W_F}{x_F W_F + x_O W_O}. \tag{4}$$

Firm value is computed as

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

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

$$V_N = \frac{x_F W_F \bar{V}}{x_F W_F + x_O W_O} - x_F W_F. \tag{5}$$

Now consider that a hurdle rate buffer may be used strategically by the firm when the outsider does not. The firm solves

$$\max_{\tau_F \geq W_F} \quad V_B = \int_{\underline{V}'}^{\bar{V}} \theta_B dV, \tag{6}$$

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, $\underline{V}' \equiv x_F \tau_F + x_O W_O$, which is larger than $\underline{V}$. 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 trade-off. Using a higher buffer increases the split of the surplus from θ_N to θ_B, but raises the minimum acceptable project from $\underline{V}$ to $\underline{V}'$: Bargaining power increases, but 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*

$$\tau_F^* = \frac{\sqrt{\bar{V} x_O W_O} - x_O W_O}{x_F}, \tag{7}$$

and the resulting value to the firm is given by

$$V_B^* = \bar{V} + x_O W_O - 2\sqrt{\bar{V} x_O W_O}. \tag{8}$$

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

$$\Delta V = V_B^* - V_N = \frac{x_O W_O \bar{V}}{x_F W_F + x_O W_O} + (x_F W_F + x_O W_O) - 2\sqrt{\bar{V} x_O W_O} > 0. \tag{9}$$

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

We can use (7) 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

$$(1 - \theta_N)\bar{V} > x_F W_F + x_O W_O. \tag{10}$$

The firm is more likely to use the buffer when its starting bargaining power (i.e., their initial split of the surplus, θ_N) is lower, its own cost of capital (W_F) is lower, and when there are more high potential project values ($\bar{V}$). The upper bound of the project values $\bar{V}$ can also be considered a proxy for the uncertainty faced by managers, since the variance of the distribution increases with $\bar{V}$. If (10) is not satisfied, then the CFO reports the hurdle rate as equal to the true WACC.

As a specific example, Figure 5 displays the value implications from the model. We calibrate parameters so the optimal hurdle rate buffer $b^* = 5.11\%$, the unconditional average value in the CFO Survey data. On the right y-axis, we plot the change in value implied by a standard capital budgeting model, where we only consider the value lost from foregoing positive NPV projects. At b^*, the implied "traditional" change in value is about -4.4%. On the left y-axis, we incorporate the value benefit from bargaining and plot the model-implied percentage increase in firm value from using a hurdle rate buffer.[19] This equals $+0.11\%$. While this may seem small, it does imply that firm value is preserved even with a large buffer. The difference in value creation between traditional assumptions and the bargaining model is quantitatively large at 4.5 percentage points.

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 ΔV and $x_O W_O$. This stems from a non-monotonic relationship between the use of the IRR buffer (τ_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 $\bar{V} > 2\underline{V}'$. The same is true for the derivative with respect to x_O. When the surplus gained from a larger share of projects is greater than the value lost from forgoing positive NPV projects, the firm's IRR buffer is increasing in $x_O W_O$. Otherwise, if $\bar{V} < 2\underline{V}'$, the cost of lost positive NPV projects dominates and the buffer is smaller.

[19]The difference between the two axes is the bargaining split. On the left y-axis, θ_B is allowed to change with b, so $V_B = \theta_B \bar{V} - (W_F + b)$ and the bargaining split increases with b. On the right, we hold the surplus split fixed, so $\tilde{V}_B = \theta_N \bar{V} - (W_F + b)$, with θ_N displayed in (4).

4.2.2. Competitive IRR Buffers

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

$$\max_{\tau_F} \quad V_F = \int_{\underline{V}''}^{\bar{V}} \theta dV$$

and

$$\max_{\tau_O} \quad V_O = \int_{\underline{V}''}^{\bar{V}} (1-\theta) dV,$$

conditional on their counterparty acting optimally as well. Now, the lower limit of integration is defined as $\underline{V}'' = x_F \tau_F + x_O \tau_O$, which is the purported minimum project value that can meet both parties' required returns under the buffered IRR hurdle rates.

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

$$\tau_F^* = \frac{\bar{V}}{4x_F} \qquad \tau_O^* = \frac{\bar{V}}{4x_O} \tag{11}$$

and the value for each firm is

$$V_F^* = V_O^* = \frac{\bar{V}}{4}. \tag{12}$$

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

$$Loss = \frac{\bar{V}}{2} - (x_F W_F + x_O W_O). \tag{13}$$

The comparative statics implied by Proposition 2 are straightforward. For each counterparty, the hurdle rate buffer is increasing in the potential value of projects ($\bar{V}$) and decreasing in the scale of each party's investment.

According to Proposition 2, hurdle rate buffers are used by both firms as long as $\bar{V} > 4x_F W_F$ and $\bar{V} > 4x_O W_O$. The condition in (10) provides a sufficient condition for this to hold for firm F. A similar condition can be calculated for firm O as

$$\theta_N \bar{V} > x_F W_F + x_O W_O. \tag{14}$$

While there is an equilibrium 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.

$$\Delta V_F = \bar{V}\left(\frac{1}{2} - \theta_N\right) - x_F(\tau_F - W_F) \tag{15}$$

$$\Delta V_O = \bar{V}\left(\theta_N - \frac{1}{2}\right) - x_O(\tau_O - W_O). \tag{16}$$

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 (15), firm F is net positive with hurdle rate buffers if

$$\frac{\bar{V}}{4} - \theta_N \bar{V} + x_F W_F > 0 \qquad \Leftrightarrow \qquad \frac{\bar{V}}{4\theta_N} - (\bar{V} - \underline{V}) > 0.$$

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

$$\frac{\bar{V}}{4} - (1 - \theta_N)\bar{V} + x_O W_O > 0 \qquad \Leftrightarrow \qquad \frac{\bar{V}}{4(1 - \theta_N)} - (\bar{V} - \underline{V}) > 0.$$

We conclude this section by considering that n parties take part in the investment, and each may act strategically. 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

$$\theta_i = \frac{H_i}{\sum_{j \in N} H_j}, \tag{17}$$

where $N \equiv \{1, \ldots, n\}$. As such, θ_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 (17) there exists a unique symmetric Nash equilibrium in which the optimal buffered hurdle rates are given by*

$$\tau^* = \frac{(n-1)\bar{R}}{n^2} \tag{18}$$

and the value for each counterparty is

$$V^* = \frac{\bar{R}}{n^2}. \tag{19}$$

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 in n.

4.3. 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 the returns to potential projects are uniformly distributed across the support $R \sim U[0, \bar{R}]$. Because buffer use is non-strategic in this section, we assume that the primary firm may use a buffer, but their trading partner does not (i.e., $H_O = W_O$).

4.3.1. 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 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

$$\theta_B = \frac{H_F}{H_F + W_O} \tag{20}$$

and the value of the firm can be calculated as

$$V_B = \frac{W_F \bar{R} + b\bar{R}}{W_F + b + W_O} - (W_F + b). \tag{21}$$

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*

$$V_B > V_N \quad \Leftrightarrow \quad \frac{\bar{R}W_O - (W_F + W_O)^2}{(W_F + W_O)} > b. \tag{22}$$

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 (22) as

$$V_B > V_N \quad \Leftrightarrow \quad (\bar{R} - \underline{R}^N) - \theta_N \bar{R} > b, \tag{23}$$

where $\underline{R}^N$ is the lower bound of feasible projects when no IRR buffer is used. This expression indicates that, because the range of projects $(\bar{R} - \underline{R}^N)$ can be considered a measure of uncertainty, according to (23) 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 (23), if the firm already enjoys sufficient bargaining power without a buffer (θ_N is large), it is less likely that using a buffer adds value. In this case, foregoing positive NPV projects is too costly.

4.3.2. 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

$$V_B = \int_{\underline{R}^H}^{\bar{R}} \theta_H dR,$$

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*

$$H_F = (1 - k)(\bar{R} - W_O) + kW_F. \tag{24}$$

It follows that $H_F > \tau_F^*$ iff

$$k < \frac{\bar{R} - \underline{R}'}{\bar{R} - \underline{R}}, \tag{25}$$

where $\underline{R}'$ and $\underline{R}$ are defined as in Section 4.2.1. Finally,

$$V_B > V_N \quad \Leftrightarrow \quad (\theta_H - \theta_N) > (1 - k)(1 - \frac{W_F + W_O}{\bar{R}}). \tag{26}$$

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, (25) 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 4.2.1, which is suboptimal. However, the use of the IRR buffer due to constraints increases firm value if (26) 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.

5. Model Predictions and Empirical Evidence

In Section 5.1, we present empirical predictions from the models described in Section 4 and explain how we test these predictions in the data. We then analyze the determinants of the buffer and test model predictions in Section 5.2.

5.1. 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 A.1 and summary statistics in Table 1, Panel B.

We start by outlining predictions relating the buffer to four underlying characteristics of firms and projects: the cost of capital, bargaining power, the company's industry, and volatility of project returns. 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., the cost of capital) 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 is based on the model's prediction that buffer use decreases in the firm's cost of capital. In the single firm strategic case, buffer use decreases in the cost of capital on both the extensive and intensive margins. To see the former, note that Equation (10) is less likely to hold as W_F increases. For the intensive margin, if we write $\tau^* = W_F + b$, by definition, for any optimal hurdle rate τ^* the buffer is decreasing as W_F increases. Therefore, as we investigate this empirically, we will control for the industry beta for each firm, which affects the WACC. We get the same prediction on the intensive margin for the non-strategic case where a buffer is given exogenously (Proposition 4).

Hypothesis 1a. *Buffer use is less likely for firms with a higher cost of capital.*

Hypothesis 1b. *Conditional on use, the size of the buffer is smaller for firms with a higher cost of capital.*

Note that Hypothesis 1 distinguishes our theory from other buffer explanations because the predictions differ from what we would expect for 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 empirically 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 1 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 would be 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.

A second hypothesis relates to our model predicting a systematic relation between the buffer and a firm's bargaining power. For the single firm case, we can use (10) to predict that increasing bargaining power decreases use of a buffer. For the intensive margin, according to Proposition 1,

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

and therefore $\frac{\partial b}{\partial W_F} < 0$. If we hold, x_O, x_F, and W_O fixed, then $\frac{\partial W_F}{\partial \theta_N} > 0$. This implies that $\frac{\partial b}{\partial \theta_N} < 0$. So, because θ_N is a measure of ex-ante bargaining power, we expect the buffer to decrease in bargaining power. In the competitive model, according to (13), ΔV is decreasing in θ_N, so on the extensive margin, we expect firms to use buffers less. Also, according to Propositions 4 and 5, in the versions of the model where managers set hurdle rate buffers for non-strategic reasons, higher bargaining power is associated with decreased likelihood that a buffer will create value through a bargaining channel: The left-hand side of (23) is decreasing in θ_N, as is equation (26).

Hypothesis 2a. *Buffer use is less likely when a firm has more bargaining power.*

Hypothesis 2b. *Conditional on use, the size of the buffer is smaller for a firm with higher bargaining power.*

These predictions are not in the traditional buffer literature as there is no immediate analogous prediction related to bargaining power from buffer explanations based on idiosyncratic risk, financial constraints, or managerial constraints. To test Hypothesis 2, we measure bargaining power in two ways. First, 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. Second and separately, we measure markups using the methodologies presented in Baqaee and Farhi (2020) and De Loecker et al. (2020), where higher markups proxy for more bargaining power. In our analysis of markups, which we explain in detail below, we focus on firms whose transactions are predominantly business-to-business (B2B) because the price markup of B2B firms is a clear consequence of bargaining power over customers/suppliers.

Our third hypothesis comes from the basic premise of the model that project value is a function of bargaining over inputs and outputs. We expect that a buffer is less likely to arise or increase value in, for example, industries where inputs are purchased at liquid market prices. Therefore, we predict that buffer use will be positively correlated with industries where a given project's inputs or outputs are large and their value is specific to the project (e.g., land).

Hypothesis 3a. *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 3b. *Conditional on use, the size of the buffer is larger in industries where more PPE is required for projects.*

We note that firms bargain over more than just tangible assets. Our framework readily applies to, e.g., a manufacturing firm purchasing supply chain management software. Hypothesis 3 is an empirical prediction under the view that bargaining plays a more important role when the tangibility of assets is higher.

Our predictions in Hypothesis 3 are new and generally differ from predictions implicit in 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 3, we use two proxies to identify industries in which bargaining is likely to play a role. First, we group firms into industry buckets based on the type of underlying investments (e.g., fixed assets vs human capital). The four groups are: 1) Manufacturing, Construction, Mining, Energy, 2) Finance, 3) Services, Communications, Media, and 4) Healthcare, Pharma, 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.[20]

In addition to this methodology, we also explore this hypothesis with respect to the redeployability of assets (Kim and Kung, 2017). All else equal, we expect that assets with lower redeployability (more specific-to-use) are more likely to be bargained over, which increases the incentive to use a buffer in negotiations.

Our last prediction is that buffer use and size generally increase with the volatility of project returns. According to Propositions 4 and 5, ΔV is increasing in $\bar{R} - \underline{R}^N$. The predictions from the single firm strategic case and the competitive buffer case (Proposition 2) are a little more nuanced. Because the lower bound on acceptable projects is fixed, an increase in $\bar{V}$ leads to both a higher average project value and increased variance. Clearly, τ^* is increasing in $\bar{V}$ in both strategic models. So, we do predict that project volatility is positively correlated with buffer use, keeping in mind the limitations of those versions of the model. Notwithstanding, previous work predicts this as well. Décaire (2021) argues that firms use buffers to compensate for idiosyncratic volatility. Likewise, buffers that are put in place due to financial constraints may be because a firm faces uncertainty.

Hypothesis 4a. *Buffer use is more likely for firms with higher volatility of underlying project values.*

Hypothesis 4b. *Conditional on use, the size of the buffer is larger for firms with volatility*

[20] A regression of firm-level tangibility on NAICS-4 fixed effects gives an R^2 of 0.62, whereas including year fixed effects only increases this to 0.635, thus there is little gained from using a time-varying industry-level measure of tangibility.

of underlying project values.

To measure volatility, we adapt the methodology used in Décaire (2021). Specifically, we compute firm-level idiosyncratic volatility as the residual from a regression of sales to lagged assets on NAICS-4 and quarter fixed effects. We then measure industry volatility as the standard deviation of these residuals within a CFO survey firm's NAICS-4 industry the quarter previous to the survey quarter. This measure captures the dispersion of firm-level idiosyncratic volatility within a CFO survey firm's industry. If managers alter their discount rates in response to volatility, then this measure should correlate positively with the buffer.

5.2. Empirical Analysis of Model Predictions about the Hurdle Rate Buffer

We now provide deeper analyses of the hurdle rate buffer, guided by the empirical evidence from Section 3 and the model predictions made in Section 5.1. In our regression analyses, all continuous variables are standardized to unit variance except for the firm's cost of capital. Table 1, Panel A displays summary statistics for variables related to the buffer, and Panel B displays the same for other variables; Figure A.2 presents pair-wise correlations.

In Table 3, 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 similar, we discuss them together.

Hypothesis 1. *The Firm's Cost of Capital*

As can be seen in Table 3, both the probability of using a buffer and the size of the buffer itself are strongly negatively related to the cost of capital.[21] These negative relations support Hypothesis 1. A one percentage point 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

[21] These negative relations are very robust, and exists in every specification in the paper.

reduction in size of the buffer.[22]

This negative correlation between cost of capital and buffer use 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.

Based on estimates from Table 3, 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 about 87% to 60%. Panel B displays a binned scatter plot of the size of a firm's (intensive margin) buffer and its cost of capital. A strong negative relation between the two variables is apparent. We note that the relations shown in the figure are net of both size and industry fixed effects (the underlying regressions control for both). While the model makes 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, as the buffer gets forced down to zero.[23] Figure A.4 estimates the relation between the buffer and WACC for high, medium and low

[22] If we condition on firms that set their hurdle rate above WACC, the effect of a one pp increase in the cost of capital leads to about a 0.18 pp drop in the buffer, as in columns 5-8 of Table 3, Panel B.

[23] 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.

WACC firms and shows that the negative relation exists within each subset, even among firms with a high cost of capital (15% or greater).

Control Variables in Table 3. 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 would affect hurdle rate buffers in our data, if CFOs include a fudge factor in their discount rates to offset this uncertainty. 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).[24] Table 3 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 4). 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 larger buffers.

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

[24] 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.[25] 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 choose a larger buffer at least in part to offset over-optimism in other aspects of project development. 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.

The Buffer, the Cost of Capital, and Beta. Table 3 shows that that the use and size of the buffer are strongly negatively related to the cost of capital. This is a key prediction of our model – all else equal, two firms with different costs of capital will have different incentives to use a buffer. Implicit in this prediction is the assumption that two firms can face the same distribution of project returns, but have different costs of capital. This assumption is consistent with a CAPM determined cost of capital as long as not all project volatility is systematic. Nonetheless, it is important empirically to ensure our results are not driven by systematic differences in the risk of projects.

With this in mind, we conduct additional tests of the relation between the buffer and WACC, controlling for firms' estimated betas. To do this, we rely on the publicly traded firms that appear in the CFO survey; for which we can directly estimate their CAPM betas (see Table 4).[26] The analysis shows that the negative buffer-WACC relationship continues to hold, as before. The table also provides further reassurance that our survey data are sound – survey-provided discount rates are positively related to the firm's beta (consistent with Jagannathan et al., 2016).

Hypothesis 2. *Bargaining Power in Negotiations*

[25] The question asks CFOs to rate their level of optimism on a 0-100 scale, with 0 being the least optimistic. The mean firm-level (US) optimism is 68.7 (63.1), with a standard deviation of about 18 (16).

[26] The mean (median) CAPM beta for our public firms is 1.19 (1.22).

Our second main hypothesis predicts a systematic negative relation between the size and use of the 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 analyze the firm's *own* level of bargaining power, and separately that of its trading partners.

Customer Concentration. As a first step, we directly quantify the relative bargaining power of a given company by measuring it relative to the market position of its customers. We proxy for the bargaining power of a seller/supplier based on the level of concentration of 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. Specifically, we calculate a Herfindahl–Hirschman Index (HHI) of each firm's sales to its corporate customers (Patatoukas, 2012). To match to our survey data, we take quarter × NAICS-3 averages of this measure and match to each firm in the survey by its industry.[27]

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 revenue.

In Table 5, we relate this measure to survey firms' buffers. Columns 1-3 analyze the extensive margin; columns 4-6 analyze the intensive margin. We find no relation between customer concentration and the extensive margin of the buffer. In terms of the intensive margin, columns 4-6 show that a one-standard deviation increase in customer concentration leads to about a 0.3 pp increase in the buffer, consistent with the model's prediction. For context, our results predict that moving from the 10th to 90th percentile of customer

[27] The industry level for most of the variables in our analysis is NAICS-4; however, our bargaining power measures are at the NAICS-3 level. We do this to align with the industry level that Baqaee and Farhi (2020) focus on in their analysis, and because we estimate the output elasticities used in Table A.5 Panel C at the NAICS-3 level. Table A.1 provides detail on the exact construction.

concentration would increase the size of the buffer by about 0.9 pp.[28]

Markups. Next, we proxy for the firm's own bargaining power by using markups. We note that markups in B2B transactions are a consequence of bargaining between trading partners (either customers or suppliers) and thus are close in spirit to the model. The model predicts a negative relation between the buffer and bargaining power as proxied by B2B markups.[29]

At consumer-facing firms (in contrast to B2B), price markups are over consumers, and may be more determined by competition in the firm's local market (and less reflective of the model's bargaining power over other firms). Therefore, we would not necessarily expect the model's predicted negative relation between markups and buffers to hold in that setting. In our main analysis of the relation between the buffer and markups, we therefore study a subsample of firms in B2B industries to better isolate the prediction in Hypothesis 2. Following Gofman et al. (2020), we classify industries as consumer-facing if they are in GICS sectors "Consumer Discretionary" or "Consumer Staples." In the CFO survey data, 13.5% of observations are in consumer-facing industries, which we delete from the B2B subsample analysis.

Our primary markup measure is the "accounting" markup developed in Baqaee and Farhi (2020) and we supplement this analysis using the methodology in De Loecker et al. (2020). 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.[30]

[28] We use industry-level measures because the CFO survey sample is comprised of many private firms, so we cannot estimate their customer concentration directly. To justify this approach, we do two tests. First, we regress Compustat firm-level customer concentration on its industry-by-time average counterpart, yielding an R^2 of 0.41, suggesting customer concentration has an important industry component. Second, using the CFO survey firms in Compustat (15.1% of our sample), we do similar analysis to Table 5, substituting the industry customer concentration for the firm's customer concentration; coefficients are directionally the same with similar magnitudes, though the statistical significance is not as uniformly strong, perhaps due to lower power in the smaller sample. Results are available in Table A.6.

[29] Markups are commonly used as an empirical proxy for market power, on which our model makes no prediction. The price markup for B2B firms is an adequate, if noisy, proxy of bargaining power. Nevertheless, we cannot perfectly separate these two forces (bargaining and market power).

[30] A regression of firm-level markup on its industry-by-time counterpart yields an R^2 of 0.46, suggesting that price markups have an important industry component.

Table 6 displays the markup-buffer analysis related to Hypothesis 2. The table shows that a one standard deviation increase in markups reduces the likelihood of using a buffer by 2 pp and decreases the size of the buffer by about 0.5 pp. These results predict that moving from the 10th to the 90th percentile markup would reduce the size of the buffer by 1.1 pp.[31] In Table A.5, Panel C, we perform similar analyses where we estimate markups via the methodology in De Loecker et al. (2020), still focusing on firms in B2B industries. The results are similar.

As discussed above, the model makes no prediction about the relation between the markup and the buffer for firms in consumer-facing industries. But for completeness, in Table A.5 Panel A, we repeat the analysis of Table 6 using the full CFO Survey sample. While results are similar, the coefficients on markup are slightly lower (towards zero) by including consumer-facing firms. In Table A.5 Panel B, we explore this further and interact the markup variable with a consumer-facing indicator to test if markups affect buffers differently in consumer-centered industries. The table displays group-specific slopes and shows for non-consumer-facing (i.e., B2B, as in our main analysis), the signs for extensive and intensive margins are negative, as expected.

Hypothesis 3. *Industry Differences and Asset Tangibility*

We document the use and size of the buffer across general industry classifications, to test the basic premise of the model. Table 7 Panel A shows that firms in manufacturing, construction, mining and energy industries are 7.3 percentage points more likely to use a buffer, and also use significantly larger buffers (0.79 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, consistent with the spirit of the model.

We complement this analysis by examining the relation between the buffer and industry

[31] Table A.6 shows that coefficients are of similar magnitude when we do similar analysis using firm-level markups for CFO Survey firms that appear in Compustat.

tangibility in Table 7 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 asset tangibility (measured at the industry level) increases the probability of using a buffer by approximately 3.5 pp and increases the size of the buffer by 0.3-0.4 pp.

While many tangible assets are naturally specific-to-use, with prices more likely to be influenced by the relative bargaining power of trading partners, other forces can play a role in the documented positive relation. With this in mind, we refine our analysis to also explore *asset redeployability*, as in Kim and Kung (2017), which captures the usability of assets within and across industries – high redeployability implies an active secondary market and hence more competitive prices (and less room for a bargaining advantage). We thus expect firms that purchase and use assets with *lower* redeployability have a buffer, as these assets are more specific to utilize.

We match the industry-level measure from Kim and Kung (2017) based on 2-digit NAICS codes; Table A.7 displays the analyses. We find a negative relation on both margins, with the intensive margin being more robustly significant – firms that rely on assets with lower redeployability have larger buffers, all else equal (the negative coefficient estimate for redeployability makes sense, given the variable's strong negative correlation with tangibility in our data, as expected). Though not shown in the table, the statistical significance of the relation between redeployability and the buffer is weaker at finer industry codes (e.g. NAICS-3), possibly due to measurement error from using finer classifications.

Hypothesis 4. *Volatility of Underlying Project Values*

As explained in Section 5.1, 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 3 to discuss the role of this project risk (proxied by sales volatility), and we also control for this variable in many specifications. While our model predicts a positive 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 ≈ 0.4 pp increase in the size of the buffer (Panel B), consistent with the model and Décaire (2021). Further, the positive estimated coefficient for beta volatility is also consistent with a positive relation between idiosyncratic project (or cash flow) volatility and the buffer, given the positive relation between beta and idiosyncratic cash flow volatility documented in Babenko et al. (2016).

6. Conclusion

Project development differs from standard textbook capital budgeting guidance. We explore these differences based on two observations about real-world capital allocation. First, input costs are not exogenous as commonly assumed, but rather are the result of negotiation between a firm and its trading partners. Second, headquarters tells mid-level managers the hurdle rate they must use for project evaluation, which the managers accept without question. As is well known, and confirmed by our survey data over the past dozen years, CFOs typically inflate the hurdle rate with a buffer of 5 or 6 percentage points above the cost of capital. We also provide direct empirical evidence that hurdle rates are a focal point of corporate investment decisions and that companies exhibit "beat the benchmark" behavior relative to the hurdle rate.

We build a model to explore the implications of these realistic features of project development. The model highlights a trade-off that occurs from using an inflated hurdle rate: passing up projects with moderately positive net present value versus earning a higher share in negotiations from the smaller set of projects. We explore these issues in several settings, including where firms set inflated hurdle rates (i) for non-bargaining reasons, (ii) strategically to gain bargaining power, and (iii) where firms and their trading partners both use hurdle rates for bargaining. In the model, the inflated hurdle rates reflect firms' relative bargaining power, their relative investment in the project, and the value of the underlying projects.

In equilibrium, using an inflated hurdle rate can preserve or even create value, thus offering an explanation for the wide-spread and long-standing use of inflated hurdle rates. Importantly, the implications of our model hold whether companies strategically choose inflated hurdle rates to aid negotiation or whether hurdle rates are inflated for other "non-strategic" reasons posited by the literature. Moreover, even when a counterparty is using an inflated hurdle rate for strategic reasons, a firm will find it optimal to use a hurdle rate buffer.

We test four predictions of the model using data that span 2011 to 2022 provided by the expert practitioners who make project development decisions. Our empirical findings generally support the model's predictions. We find that hurdle rate buffers are negatively correlated with the cost of capital and negatively correlated with the firm's ex ante relative bargaining power. These two predictions are novel and opposite from what one would expect based on existing hurdle rate buffer models. We also show that hurdle rate buffers are more likely when firms (or industries) rely on fixed assets and find evidence of a positive relation between volatility of sales and the hurdle rate buffer as predicted. Our empirical exploration of these latter two predictions based on CFO survey data is new, though the predictions themselves align with other explanations of the hurdle rate buffer.

Future research should explore other realistic features of project development to determine whether and how these features affect project choice and valuation. Consider, for example, several real-world features documented in Graham (2022). First, hurdle rates are typically sticky through time, not moving much as market conditions change. Our paper has explored how the hurdle rate buffer affects project development; future research can examine the effects of hurdle rate stickiness. Second, the budgeting process is discrete, lumpy and rigid. Décaire and Sosyura (2022) explore the impact of budgeting rigidity, showing that as the year-end approaches, companies that have underspent to date on advertising expenses typically go on a year-end spending spree that leads to inefficient investment. Third, the horizon over which companies can realistically plan and forecast cash flows has shrunk in recent years and project life has accordingly gotten shorter. Dessaint et al. (2022) confirm this result using textual analysis of financial filings. Relatedly, managers often require that a project pay off within two or three years, similarly affecting project development via a short-term focus. In addition to a short planning horizon, Graham (2022) shows that internal forecasts for important corporate planning variables are remarkably inaccurate. Finally, corporate managers are typically miscalibrated (underestimate both the upside and downside likelihoods) and also use simple decision rules.

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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 (i.e., use a hurdle rate buffer). 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?" Possible answers vary by survey, so we group them into five distinct reasons. Table A.2 displays these groupings and provides further detail on how the question was asked on each survey. "Rationing" refers to cases when managers prioritize projects, for example due to limited capital resources. "Fudge Factor" refers to cases when managers add a (positive) buffer to their discount rate to account for, e.g., idiosyncratic risk of specific projects (Brealey and Myers, 1996; Décaire, 2021). Panel A displays the percentage of CFOs that fall within each category, Panels B and C displays the results split by survey year and size (revenue above/below $1 billion).

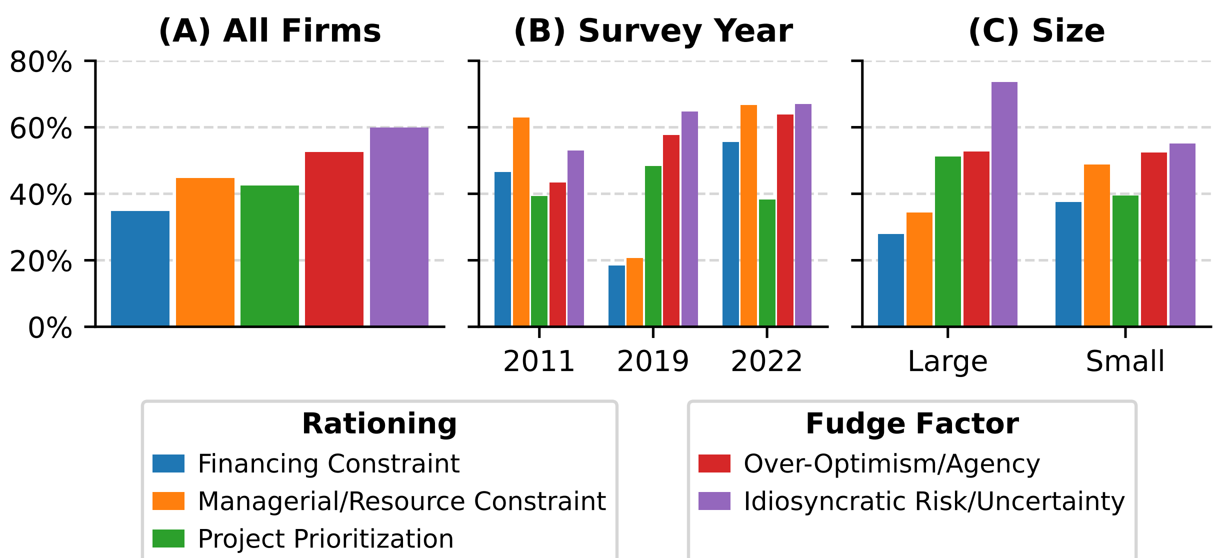


Figure 2: Sample Demographics

This figure displays demographic information for all CFOs that provide both a hurdle rate and cost of capital (WACC) in the Duke CFO Survey.

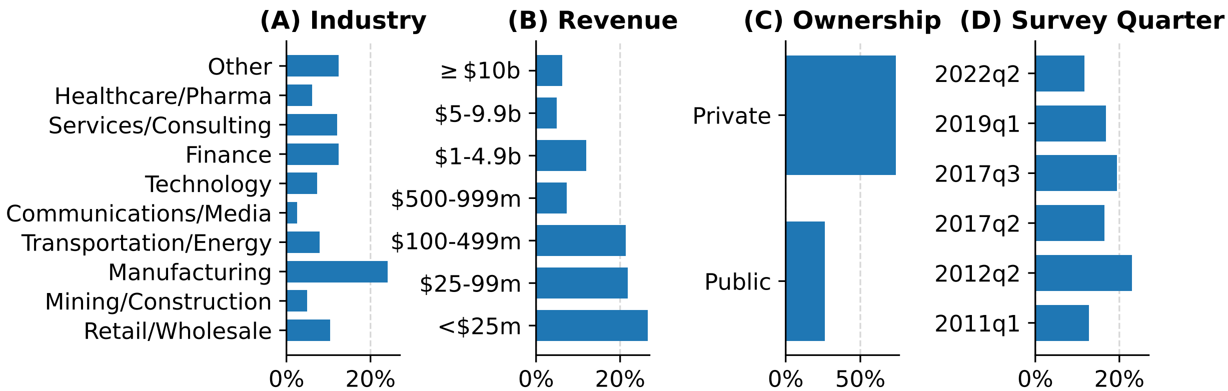


Figure 3: Time Series and Cross-Sectional Variation in Hurdle Rates and the Cost of Capital

This figure displays the within-group average and interquartile range (IQR) of CFO survey company 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 25th and 75th percentiles within-group are roughly 0% and 9%, respectively.

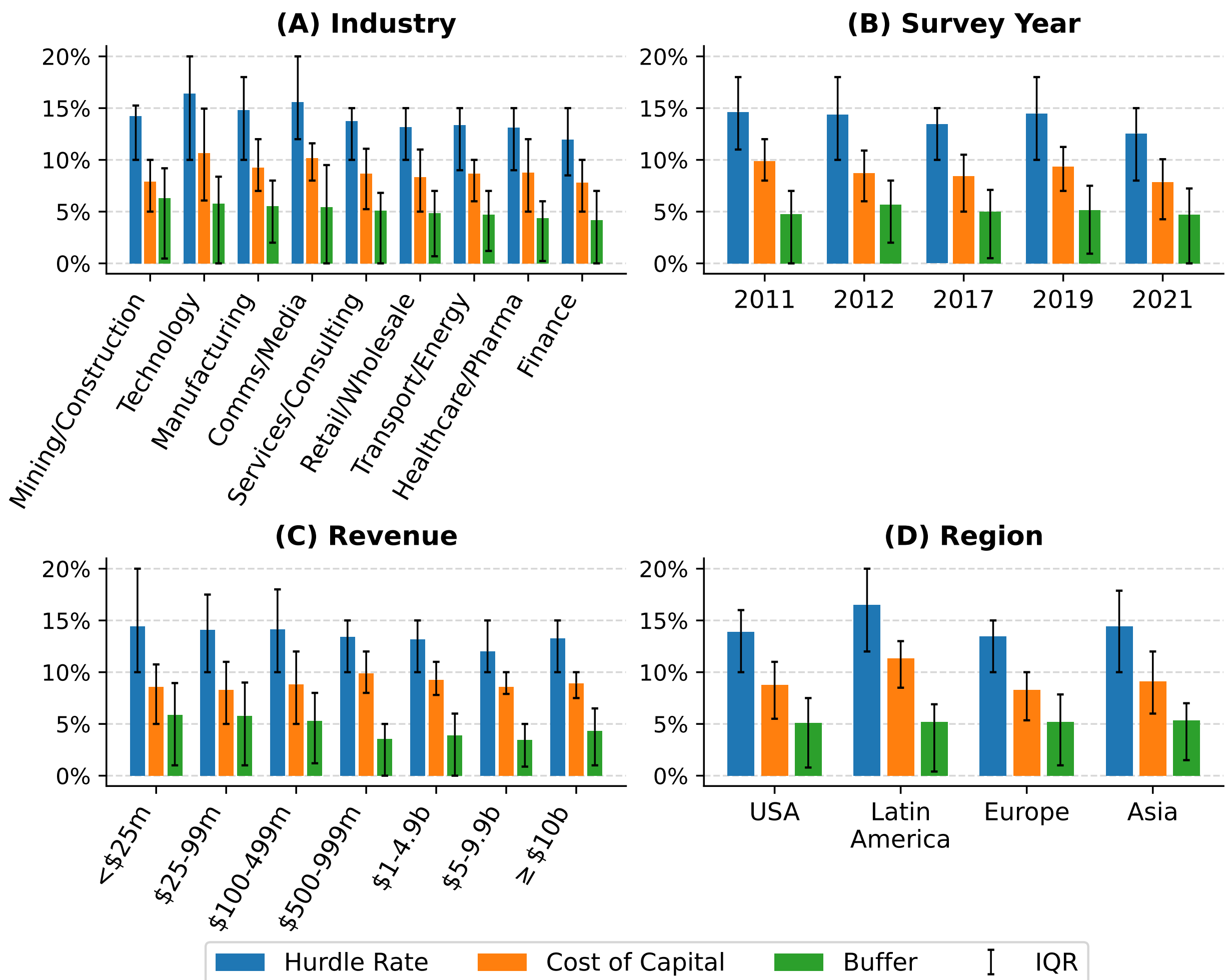


Figure 4: Density Manipulation in Excess ROIC at the Hurdle Rate

This figure displays the results of testing for density manipulation of return on invested capital (ROIC) around the hurdle rate, following the methodology described in Cattaneo et al. (2018). The sample is CFO survey firms that also appear in Compustat quarterly, for which we observe a hurdle rate. We first linearly interpolate firms' hurdle rates between two consecutive appearances in Compustat. For example, if a firm's hurdle rate in 2012q2 were 10%, and in 2012q4 it were 11%, we would assume that the value of the hurdle rate in 2012q3 were 10.5%. Given stickiness in hurdle rates (as in, e.g., Graham, 2022), this assumption seems reasonable. ROIC is defined as $ROIC_{i,t} = EBIT_{i,t}(1 - tax_{i,t})/ICAPT_{i,t-1}$, 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. Next, we define our variable of interest, "Excess ROIC," as a firm's ROIC above its hurdle rate, i.e. for firm i in quarter t,

$$Excess\ ROIC_{i,t} = ROIC_{i,t} - Hurdle_{i,t}$$

We focus on observations of Excess ROIC with an absolute value less than 25%. The sample is 470 observations. We are interested in testing for density manipulation of Excess ROIC at 0. The blue and orange bars display observed frequencies of Excess ROIC in 0.5% bins ranging from -10% to $+10\%$ (though the densities estimated use the full range of observations). The blue and orange lines (and shaded areas) display the estimated local-polynomial densities as described in Cattaneo et al. (2018). To estimate the densities, we set the order of the local polynomial (and the order of the bias-corrected density estimator) equal to 3. The bandwidths for the local polynomial estimator are chosen via the "data-driven" methodology described in Section 2.5 of Cattaneo et al. (2018), and are $\{h_-, h_+\} = \{7.449\%, 6.199\%\}$. The shaded areas display 90% confidence intervals. Table A.4 displays robustness where we vary the size of the bandwidth and the order of the polynomials. The figure displays a discontinuity of the ROIC density at the hurdle rate, with some mass of the ROIC density shifting from just below to just above the hurdle rate.

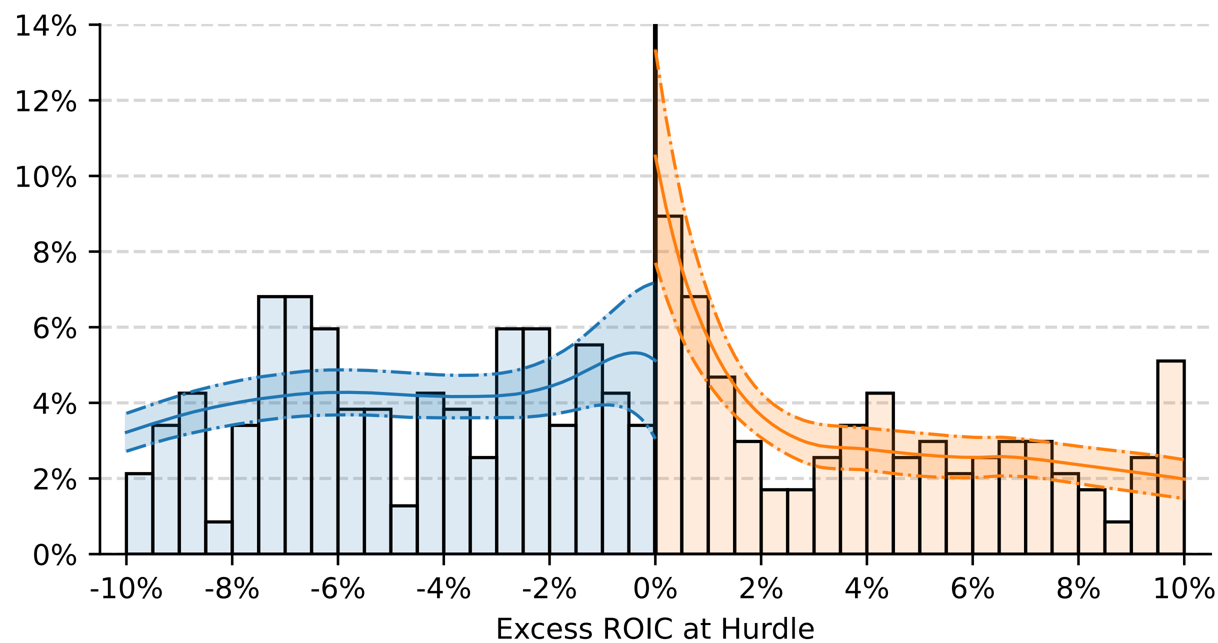


Figure 5: Implications for Firm Value from the Delegated Bargaining Model

This figure plots the model-implied change in firm value from using a hurdle rate buffer and the change in firm value from using a buffer as implied by a standard capital budgeting model. Using Proposition 1, we calibrate our model such that $r_F^{WACC} = 8.77\%$ and $r_O^{WACC} = 13.88\%$, the mean and 90th percentile WACC in the CFO Survey data. We choose remaining parameters such that the optimal hurdle rate buffer $b^* = 5.11\%$, which is the average buffer in our sample (in the graph, we set $x_F = x_O = 1$ so that firms have equal asset sizes, which gives $\underline{V} = 2.228$; and we set $\bar{V} = 4.556$, about $2 \times \underline{V}$). Under these parameters, the percentage increase in firm value from the no-buffer case to the optimal buffered hurdle rate, $V_B^*/V_N - 1 \approx 0.11\%$, and is displayed in blue relative to the left y-axis. Displayed on the right y-axis is the percentage change in value if we were to ignore the benefits from bargaining (and only consider the value lost from forgoing positive NPV projects), which is roughly -4.4%. Thus, the difference in value implications once we consider the effects of bargaining is about 4.5 percentage points.

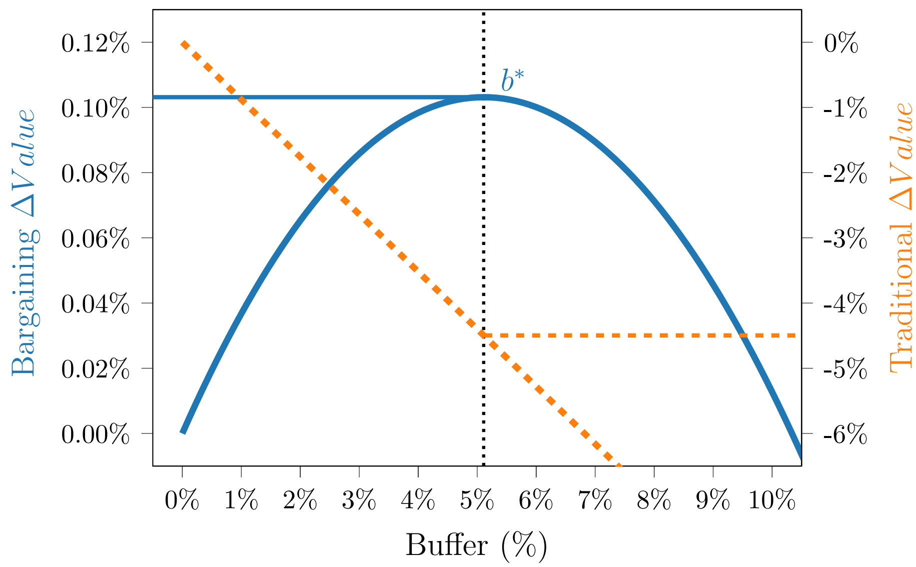


Figure 6: The Relation Between the Cost of Capital and Hurdle Rate Buffers

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 (estimated using column 6 of Table 3, Panel A). 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%, $\Pr[Hurdle > WACC] \approx 87\%$, and this probability decreases with WACC. The gray shaded areas are 95% confidence intervals. Panel B displays a binned scatter plot with 100 bins of a firm's (intensive margin) buffer and the cost of capital (estimated using column 4 of Table 3, Panel B), again showing a negative relation with WACC.

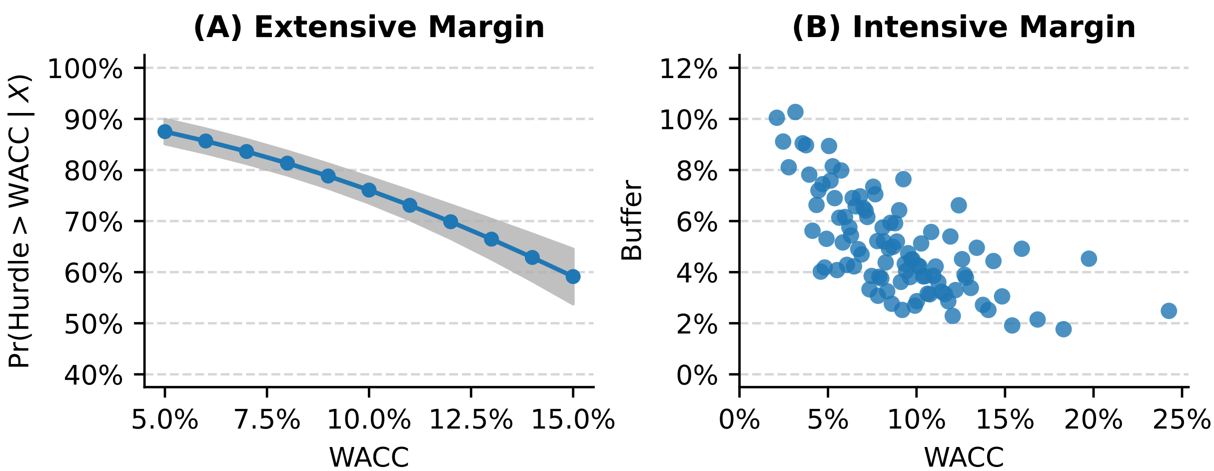


Table 1: Summary Statistics

This table displays the number of observations, averages, standard deviations, and quartiles of key empirical variables. Panel A displays statistics for variables related the hurdle rate and the cost of capital. Panel B displays summary statistics for the industry-level variables we explore in Section 5. Summary statistics for markup variables are displayed only for firms in non-consumer-facing industries. Detailed variable definitions are available in Table A.1.

	N	Mean	Std Dev	25%	50%	75%
Panel A: CFO Survey Variables						
Hurdle Rate	1,232	13.879	5.977	10	12.750	16
Cost of Capital	1,232	8.769	4.211	5.500	8.800	11
Buffer (Extensive Margin)	1,232	0.777				
Buffer (Intensive margin)	1,232	5.111	5.376	0.787	4	7.500
Buffer | Buffer > 0	957	6.579	5.248	3	5	9.500
Panel B: Industry-Level Variables						
Beta Volatility	1,232	0.686	0.234	0.535	0.687	0.834
Sales Volatility	1,232	0.116	0.050	0.088	0.117	0.148
Customer Concentration	1,232	0.292	0.198	0.113	0.316	0.426
Markup	1,066	1.091	0.186	1.015	1.058	1.108
Markup (Alternative)	1,066	1.093	0.102	1.055	1.105	1.154
Asset Tangibility	1,232	0.231	0.159	0.120	0.194	0.297
Asset Redeployability	1,232	0.440	0.128	0.346	0.476	0.516

Table 2: Empirical Predictions of Model Propositions

This table summarizes the direction of the predicted relation between buffer use on the intensive margin (Int.) and extensive margin (Ext.) and four firm characteristics: cost of capital, bargaining power, asset tangibility and volatility of project returns. The predicted sign of a given relation is based on Propositions 1-5 in our model. The columns of the table align with Hypotheses 1, 2, 3, and 4 respectively, as presented in Section 5.1.

Hypothesis Buffer Use	1 Cost of Capital		2 Barg. Power		3 Asset Tang.		4 Vol. of Projects	
	Int.	Ext.	Int.	Ext.	Int.	Ext.	Int.	Ext.
Strategic 1-firm	−	−	−	−	+	+	+	+
Strategic 2-firm	−	−		−	+	+	+	$+^*$
Exog. buffer - uncertainty	−	−	−	−	+	+	+	+
Exog. buffer - constraints	+/−	+/−	−	−	+	+	+	+

*: If ΔV is positive, then it must be that $\theta < \frac{1}{2}$.

Table 3: Determinants of the Extensive and Intensive Margins of the Hurdle Rate 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 Beta Volatility, Sales Volatility, Firm-Level Optimism and US Economy Optimism are standardized to mean zero, unit variance. All variables are defined in detail in Table A.1. In columns 4 and 7 of Panel A and columns 4 and 8 of Panel B, the number of observations drops because we do not have optimism forecasts from every respondent. Standard errors are clustered at 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

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Linear Probability Model				Logit		
Cost of Capital	-0.027***	-0.028***	-0.029***	-0.029***	-0.025***	-0.026***	-0.028***
	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)	(0.003)	(0.004)
Beta Volatility		0.031***	0.031***	0.013		0.031***	0.015
		(0.011)	(0.011)	(0.011)		(0.011)	(0.011)
Sales Volatility		0.010	0.009	0.015		0.010	0.015
		(0.015)	(0.015)	(0.016)		(0.016)	(0.016)
Large Firm		-0.077**				-0.085**	-0.067
		(0.036)				(0.039)	(0.044)
Public Firm		0.079*				0.065*	0.045
		(0.044)				(0.038)	(0.038)
Has Credit Rating		-0.012				-0.016	-0.061**
		(0.029)				(0.030)	(0.029)
Firm-Level Optimism				0.033*			0.033*
				(0.018)			(0.018)
US Economy Optimism				-0.001			-0.015
				(0.018)			(0.018)
Observations	1,232	1,232	1,232	947	1,232	1,232	947
R-squared	0.075	0.086	0.122	0.129	0.068	0.080	0.105
Survey Quarter FE			Yes	Yes			
Size FE			Yes	Yes			
Ownership FE			Yes	Yes			
Credit Rating FE			Yes	Yes			

Table 3: Continued

Panel B: Intensive Margin of Buffer

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	All CFOs				Buffer > 0			
Cost of Capital	-0.307***	-0.311***	-0.314***	-0.319***	-0.194***	-0.181***	-0.180***	-0.166**
	(0.045)	(0.045)	(0.045)	(0.058)	(0.054)	(0.055)	(0.057)	(0.069)
Beta Volatility		0.432***	0.431***	0.325*		0.295*	0.289*	0.307
		(0.148)	(0.145)	(0.175)		(0.165)	(0.166)	(0.196)
Sales Volatility		0.395**	0.375**	0.561***		0.438***	0.420***	0.580***
		(0.163)	(0.167)	(0.173)		(0.151)	(0.155)	(0.171)
Large Firm		-1.246***				-1.033**		
		(0.391)				(0.448)		
Public Firm		-0.040				-0.610		
		(0.462)				(0.521)		
Has Credit Rating		-0.142				-0.077		
		(0.292)				(0.373)		
Firm-Level Optimism				0.520**				0.436*
				(0.210)				(0.235)
US Economy Optimism				-0.371				-0.476
				(0.267)				(0.313)
Observations	1,232	1,232	1,232	947	957	957	957	750
R-squared	0.058	0.083	0.099	0.120	0.021	0.048	0.064	0.083
Survey Quarter FE			Yes	Yes			Yes	Yes
Size FE			Yes	Yes			Yes	Yes
Ownership FE			Yes	Yes			Yes	Yes
Credit Rating FE			Yes	Yes			Yes	Yes

Table 4: The Buffer, the Cost of Capital and Beta for Publicly Listed Companies.

This table explores how the firm's cost of capital affects the use and size of the buffer for publicly traded firms that appear in the CFO survey. In each specification, we control for the firm's estimated CAPM beta, in order to hold constant how the firm's underlying cash flow risk simultaneously affects the buffer and the cost of capital (via its effect on beta). Firm Beta is the firm's estimated CAPM beta; Beta Volatility and Sales Volatility are the industry level measures as shown in Table A.1; all three variables are standardized to mean zero, unit variance. Standard errors are clustered at survey industry × survey quarter and displayed in parentheses below the coefficient. ***, ** , * denote significance at 1%, 5%, 10%.

	(1)	(2)	(3)	(4)	(5)	(6)
	Extensive Margin			Intensive Margin		
Cost of Capital	-0.032***	-0.032***	-0.034***	-0.432**	-0.439**	-0.532***
	(0.010)	(0.010)	(0.009)	(0.202)	(0.197)	(0.191)
Firm Beta	0.078***	0.077***	0.067**	1.001***	0.967***	1.252***
	(0.027)	(0.027)	(0.027)	(0.342)	(0.331)	(0.330)
Beta Volatility		0.012	0.005		0.422	0.334
		(0.020)	(0.019)		(0.278)	(0.274)
Sales Volatility		0.030	0.037		0.599**	0.499*
		(0.030)	(0.032)		(0.256)	(0.286)
Observations	186	186	186	186	186	186
R-squared	0.057	0.064	0.133	0.085	0.113	0.188
Survey Quarter FE			Yes			Yes
Size FE			Yes			Yes
Ownership FE			Yes			Yes
Credit Rating FE			Yes			Yes

Table 5: The Buffer and Customer Concentration

This table explores how the bargaining power of a firm's customers affects the buffer. If a company's customers are concentrated, all else equal the company has less bargaining power; and vice versa. Our measure of customer bargaining power is customer concentration: the HHI of a firm's sales to corporate customers (Patatoukas, 2012). We aggregate to 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 Customer Concentration, Beta Volatility and Sales Volatility are standardized to mean zero, unit variance. All variables are defined in detail in Table A.1. Standard errors are clustered at survey industry × survey quarter and displayed in parentheses below the coefficient. ***, ** , * denote significance at 1%, 5%, 10%.

	(1)	(2)	(3)	(4)	(5)	(6)
	Extensive Margin			Intensive Margin		
Customer Concentration	0.008	0.004	0.004	0.416***	0.295***	0.296**
	(0.013)	(0.010)	(0.012)	(0.140)	(0.082)	(0.107)
Cost of Capital	-0.027***	-0.027***	-0.029***	-0.313***	-0.320***	-0.317***
	(0.003)	(0.003)	(0.003)	(0.045)	(0.049)	(0.043)
Sales Volatility		0.007	0.008		0.369**	0.315*
		(0.010)	(0.010)		(0.133)	(0.143)
Beta Volatility		0.030**	0.030**		0.435**	0.399**
		(0.011)	(0.012)		(0.154)	(0.163)
Observations	1,232	1,232	1,232	1,232	1,232	1,232
R-squared	0.075	0.080	0.122	0.064	0.075	0.102
Survey Quarter FE			Yes			Yes
Size FE			Yes			Yes
Ownership FE			Yes			Yes
Credit Rating FE			Yes			Yes

Table 6: The Buffer and Price Markups in B2B Industries

This table explores how a firm's level bargaining power affects the buffer. The proxy for a firm's bargaining power in this table is the price markup of firms operating in non-consumer-facing industries, i.e., firms whose operations are predominantly (business-to-business) B2B. Higher price markups on a firm's customers would be a direct consequence of bargaining power, all else equal. Our measure of price markup is the "accounting" markup from Baqaee and Farhi (2020), which we aggregate to NAICS-3 by year level and match to our CFO survey data by their industries. Because our model makes no prediction on the relation between the buffer and markup for consumer-facing firms, we remove consumer-facing industries from the analysis. Specifically, we follow Gofman et al. (2020) and define an industry as consumer-facing if it falls in GICS sector "Consumer Discretionary" or "Consumer Staples" (GICS codes 25 and 30, respectively); 166 of our 1232 observations are firms operating in consumer-facing industries. In Appendix Table A.5 Panel A, we analyze the relation between the buffer and price markups for the full sample. Columns 1-3 focus on the extensive margin; columns 4-6 focus on the intensive margin. The variables Markup, Beta Volatility and Sales Volatility are standardized to mean zero, unit variance. All variables are defined in detail in Table A.1. Standard errors are clustered at the survey industry × survey quarter and displayed in parentheses below the coefficient. ***, ** , * denote significance at 1%, 5%, 10%.

	(1)	(2)	(3)	(4)	(5)	(6)
	Extensive Margin			Intensive Margin		
Markup	-0.031***	-0.024**	-0.026*	-0.698***	-0.527***	-0.559***
	(0.011)	(0.011)	(0.013)	(0.148)	(0.162)	(0.163)
Cost of Capital	-0.027***	-0.028***	-0.028***	-0.326***	-0.328***	-0.324***
	(0.003)	(0.003)	(0.003)	(0.047)	(0.047)	(0.047)
Sales Volatility		0.003	0.004		0.284*	0.222
		(0.015)	(0.015)		(0.145)	(0.153)
Beta Volatility		0.027**	0.028**		0.426**	0.408**
		(0.013)	(0.013)		(0.167)	(0.165)
Observations	1,066	1,066	1,066	1,066	1,066	1,066
R-squared	0.083	0.087	0.120	0.079	0.086	0.113
Survey Quarter FE			Yes			Yes
Size FE			Yes			Yes
Ownership FE			Yes			Yes
Credit Rating FE			Yes			Yes

Table 7: Differences in the Buffer: By Broad Industry Category and Asset Tangibility

This table explores how the buffer varies across broad industry categories and across industry tangibility. In Panel A, we regress the buffer 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 Asset Tangibility, Beta Volatility and Sales Volatility are standardized to mean zero, unit variance. All variables are defined in detail in Table A.1. Standard errors are clustered at survey industry × survey quarter and displayed in parentheses below the coefficient. ***, ** , * denote significance at 1%, 5%, 10%.

Panel A: Broad Industry Categories

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Extensive Margin				Intensive Margin			
Manufacturing, Construction Mining, Energy	0.073***				0.793***			
	(0.023)				(0.271)			
Finance		-0.058*				-1.149**		
		(0.034)				(0.454)		
Services, Comms, Media			-0.031				-0.025	
			(0.037)				(0.568)	
Healthcare, Pharma, Tech				-0.027				0.117
				(0.036)				(0.621)
Cost of Capital	-0.029***	-0.029***	-0.028***	-0.028***	-0.316***	-0.322***	-0.314***	-0.315***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.044)	(0.045)	(0.045)	(0.046)
Beta Volatility	0.030***	0.029**	0.031***	0.031***	0.421***	0.399***	0.432***	0.431***
	(0.011)	(0.011)	(0.011)	(0.011)	(0.145)	(0.143)	(0.145)	(0.145)
Sales Volatility	0.012	0.005	0.010	0.010	0.404**	0.301*	0.376**	0.370**
	(0.014)	(0.014)	(0.015)	(0.015)	(0.163)	(0.162)	(0.163)	(0.171)
Observations	1,232	1,232	1,232	1,232	1,232	1,232	1,232	1,232
R-squared	0.128	0.123	0.122	0.122	0.104	0.103	0.099	0.099
Survey Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Size FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ownership FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Credit Rating FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 7: Continued

Panel B: Asset Tangibility

	(1)	(2)	(3)	(4)	(5)	(6)
	Extensive Margin			Intensive Margin		
Tangibility	0.032**	0.035**	0.037***	0.287*	0.389***	0.460***
	(0.014)	(0.014)	(0.014)	(0.145)	(0.145)	(0.148)
Cost of Capital	-0.027***	-0.027***	-0.029***	-0.308***	-0.294***	-0.315***
	(0.003)	(0.003)	(0.003)	(0.044)	(0.042)	(0.044)
Sales Volatility			0.015			0.450***
			(0.015)			(0.165)
Beta Volatility			0.029**			0.406***
			(0.011)			(0.140)
Observations	1,232	1,232	1,232	1,232	1,232	1,232
R-squared	0.080	0.088	0.129	0.061	0.085	0.106
Size FE		Yes	Yes		Yes	Yes
Survey Quarter FE			Yes			Yes
Ownership FE			Yes			Yes
Credit Rating FE			Yes			Yes

A. Appendix Figures and Tables

Figure A.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.

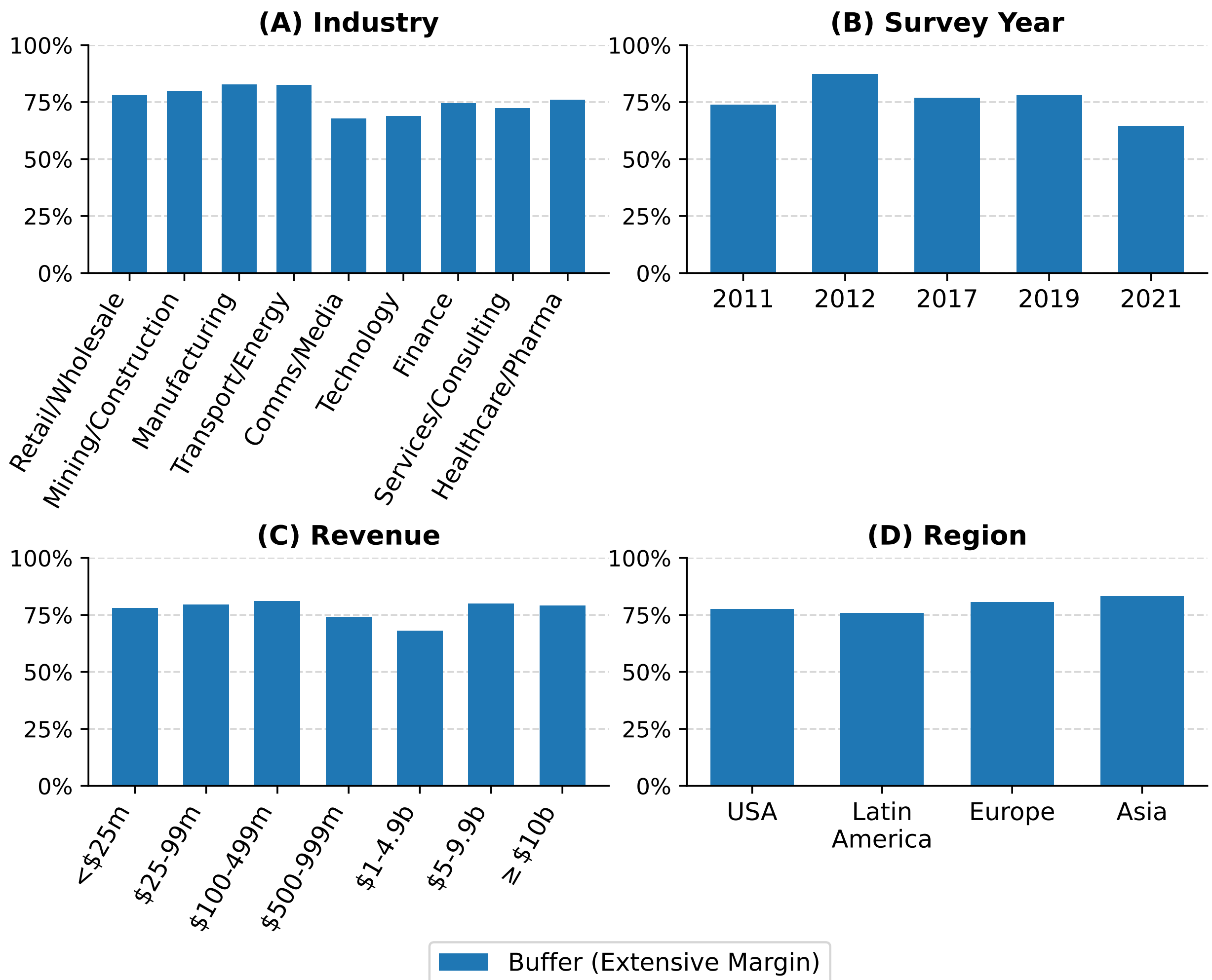


Figure A.2: Cross-Correlations of Main Variables

This figure shows the pair-wise 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 A.1.

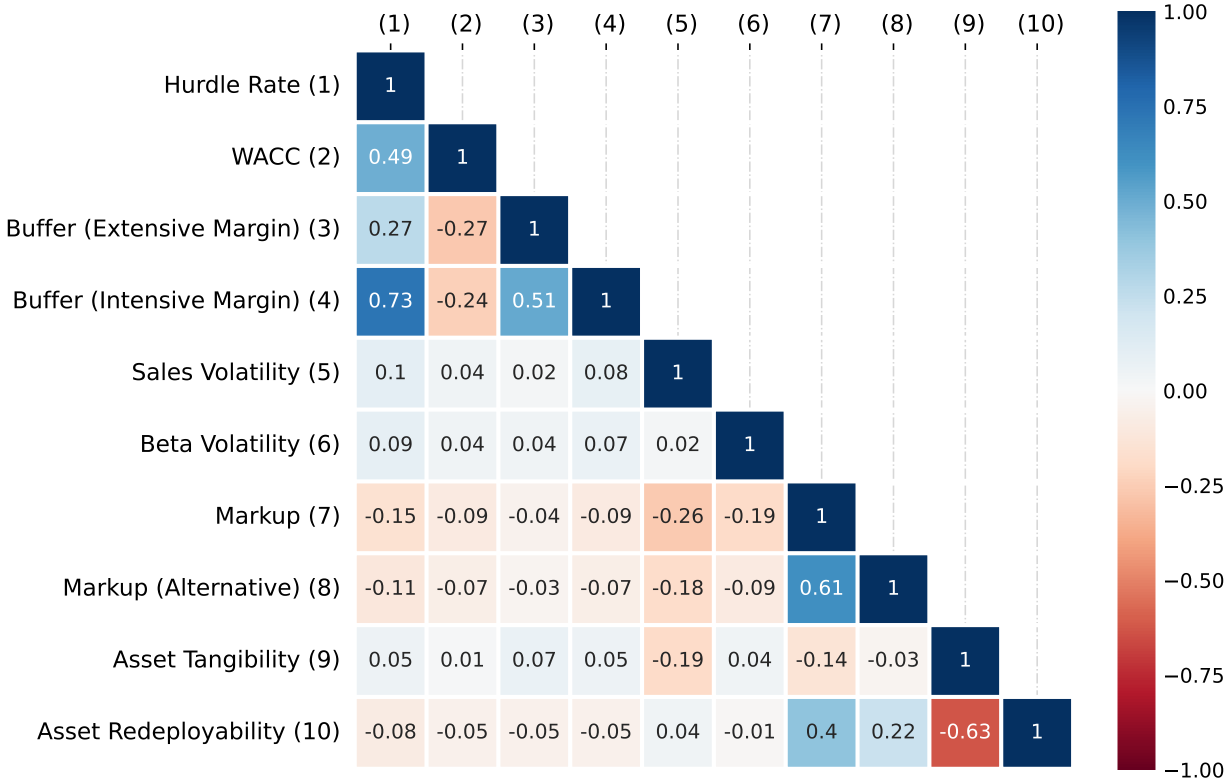


Figure A.3: Density Manipulation in Excess ROIC relative to WACC

This figure displays robustness for Figure 4. In particular, we test for density manipulation of ROIC around the cost of capital, as opposed to the hurdle rate. The sample is the same as in Figure 4. We define $Excess\ ROIC_{i,t}^{WACC} = ROIC_{i,t} - WACC_{i,t}$ as excess ROIC relative to the firm's cost of capital (as opposed to the hurdle rate as in Figure 4). We implement the same test and look for excess bunching in ROIC directly above the firm's WACC; we do not find a discontinuity in the density at WACC (the test returns a t-statistic of -1.013).

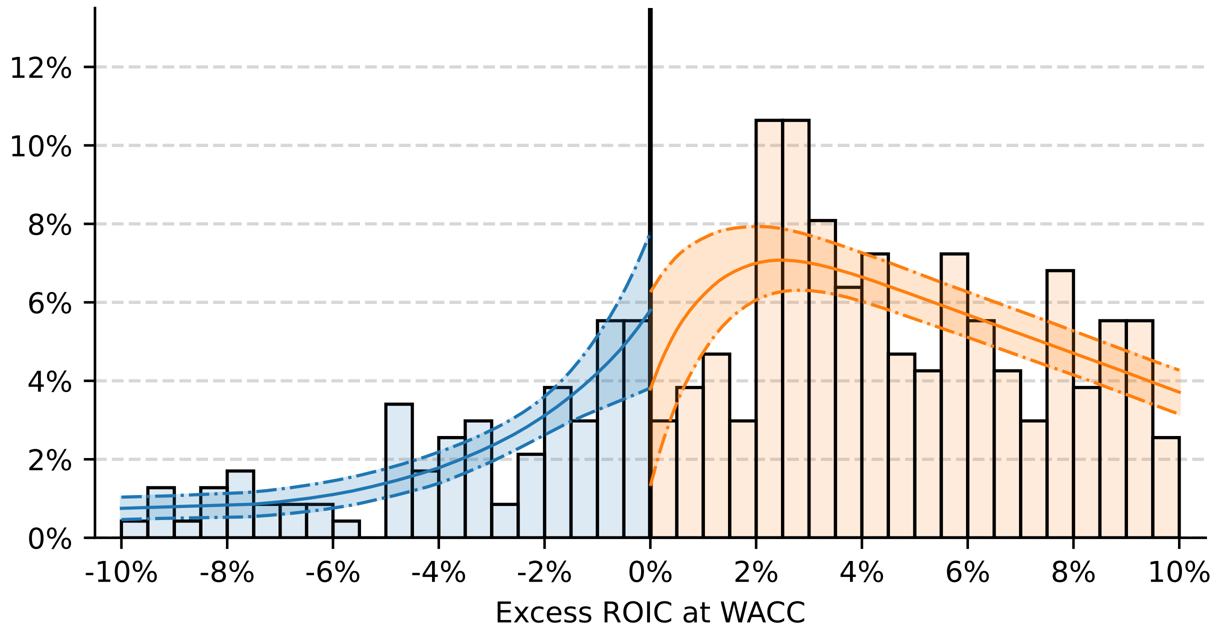


Figure A.4: Negative Relation Between Buffer and Cost of Capital Across Different WACC/Risk Groups

This figure displays how the relation between the cost of capital and the buffer varies across different levels 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 that groups survey firms by the level of their WACC (along with the non-interactive variables):

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

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. For example, for firms with WACC $\leq 5\%$, the figure displays the baseline effect from the regression (β_1); the other three groups display the group-specific slope coefficient ($\beta_1 + \beta_{k|k\in\{2,3,4\}}$). 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 sales volatility and beta volatility; fixed effects are survey-quarter and size. Standard errors are clustered by survey industry $\times$ survey quarter. The results reveal a significant negative relation between the hurdle rate buffer and WACC for each subgroup.

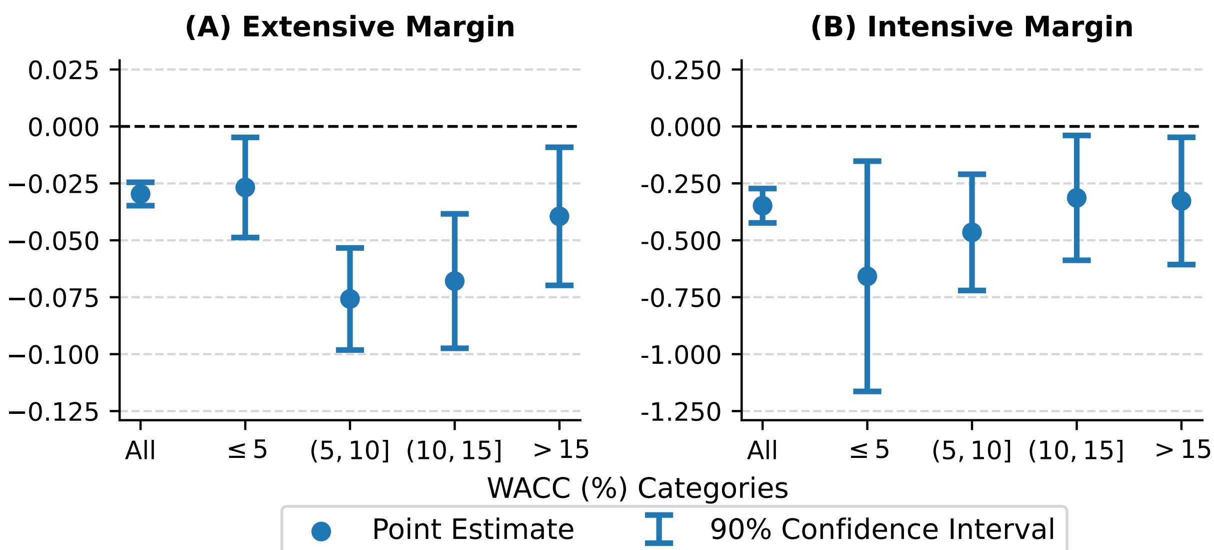


Table A.1: Empirical Variable Definitions

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

Variable	Description	Source
Hurdle Rate	The minimum rate of return required to pursue a project	CFO Survey
Cost of Capital/WACC	The firm's weighted average cost of capital	CFO Survey
Buffer (Extensive Margin)	Indicator variable taking a value of one if the firm's hurdle rate exceeds its cost of capital; i.e., the extensive margin of the buffer	CFO Survey
Buffer (Intensive Margin)	The difference between hurdle and WACC, i.e. the intensive margin of the buffer	CFO Survey
Buffer | Buffer > 0	The intensive margin of the buffer for firms that use a positive buffer. This differs from the definition above as it excludes Buffer $= 0$ observations	CFO Survey
Survey Industry	Industry of firm, as supplied by respondent to the CFO survey, roughly equivalent to 1-digit SIC. The 10 categories are Retail/Wholesale Trade, Mining/Construction, Manufacturing, Transportation/Energy, Communications/Media, Technology, Finance, Servces/Consulting, Healthcare/Pharma, Other.	CFO Survey
Has Credit Rating	Indicator variable equal to one if the firm states it has a credit rating (and zero for all other firms)	CFO Survey
Size	Categorical variable tracking firm size by revenue. Categories are $< \$25m$, $\$25-99m$, $\$100-499m$, $\$500-900m$, $\$1-4.9b$, $\$5-9.9b$ and $\geq \$10b$. Often included as a fixed effect in analysis	CFO Survey
Large Firm	Indicator variable equal to one if the firm's sales revenue is weakly greater than \$1 billion	CFO Survey
Public Firm	Indicator variable equal to one if the firm is publicly traded	CFO Survey
Firm-Level (US) Optimism	Answer to the question: "Rate your optimism about your firm (or in a separate question, the US economy) on a scale from 0-100, with 0 being the least optimistic and 100 being the most optimistic."	CFO Survey
Return on Invested Capital	ROIC is $EBIT_t \times (1 - tax_t)/ICAPT_{t-1}$ where $ICAPT$ is Invested Capital. Invested Capital is the sum of long-term debt (total) and common equity (total). We take trailing four-quarter sums of $EBIT(1 - tax)$, and divide by the invested capital from the end of the previous fiscal year to derive our final measure.	Compustat

Sales Volatility	We adapt methodology in Décaire (2021) to estimate a measure of industry idiosyncratic sales volatility. We estimate $sales/(lagged\ assets)_{i,j,t,q} = \alpha_j + \alpha_t + \alpha_q + \varepsilon_{i,j,t,q}$ for firm i, industry j, calendar quarter t and $q \in \{1,2,3,4\}$. We take residuals $\varepsilon_{i,j,t,q}$ as a quarterly firm-level measure of idiosyncratic risk. To net out short-run, firm-specific shocks, we take trailing 2-year averages of firm idiosyncratic risk as our final firm-level measure. The final measure is the standard deviation of the firm-level measure for firms in a given NAICS-4 industry and calendar quarter.	Compustat
Beta Volatility	Standard deviation of the CAPM beta within a quarter and 4-digit NAICS industry	Compustat & CRSP
Customer Concentration	Average of firms' corporate customer sales HHI within a year and NAICS-3 industry. For firm i and customer firm(s) j, $HHI_i^{sales} = \sum_j \left(\frac{sales_{i,j}}{sales_i}\right)^2$. 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 & SEC filings
Markup	We follow the "accounting markup" from Baqaee and Farhi (2020) (BF). At the firm-level, we measure profits as operating income after depreciation (OIBPD-DP). The firm-level markup is μ_i comes from the following relation: $\text{profits}_i = \left(1 - \mu_i^{-1}\right) \text{sales}_i$. To net out the effects of year-specific shocks, we take four-year trailing averages of μ_i within-firm. Following BF, we take NAICS-3 by year averages of μ_i as our industry measure. See Appendix C.2.1 of BF details, and Baqaee and Farhi (2019) for details on replication.	Compustat
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. See Baqaee and Farhi (2019) for details on replication.	Compustat & FRED
Consumer-Facing	Indicator variable taking a value of one if a firm is in GICS sectors 25 or 30 ("Consumer Discretionary" or "Consumer Staples")	GICS
Asset Tangibility	We calculate firm-level tangibility as the ratio of property, plant and equipment to total fixed assets (PPENT/AT). Because 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.	Compustat
Asset Redeployability	See Kim and Kung (2017). Asset redeployability (at the asset level) is the proportion of industries that use a given asset. Industry-level asset redeployability is the value-weighted average of redeployability based on how important assets are to an industry. We use the publicly available data from Kim and Kung (2017) and match to our survey firms at the NAICS-2 level.	Kim and Kung (2017), BEA

Table A.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) that they set their hurdle above WACC vary by survey. We categorize possible reasons into five qualitative groupings.

Panel A: 2011	
Financing Constraint	1. Shortage of funding
Managerial/Resource Constraint	1. Shortage of employees 2. Shortage of management time and expertise 3. Shortage of production capacity
Project Prioritization	1. We do not pursue some positive net present value projects because we think others will earn even higher returns
Over-Optimism/Agency	1. Some projects only appear to be attractive due to optimistic projections but may not be successful 2. Project might reduce earnings per share
Idiosyncratic Risk/Uncertainty	1. There is too much uncertainty about some projects 2. The risk of the project is too high

Panel B: 2019	
Financing Constraint	1. Because we face funding constraints
Managerial/Resource Constraint	1. Because we have scarcity of managerial time/expertise
Project Prioritization	1. So that we choose only the best available projects
Over-Optimism/Agency	1. So that we choose projects that are profitable 2. To provide a buffer in case the project underperforms
Idiosyncratic Risk/Uncertainty	1. To account for riskiness of the projects being evaluated 2. To account for costs not captured by WACC 3. To provide a margin of error in calculations and assumptions

Panel C: 2022	
Financing Constraint	1. Our firm cannot fund all profitable projects
Managerial/Resource Constraint	1. Scarcity of non-management labor 2. Scarcity of management times
Project Prioritization	1. To limit the total number of projects we take on 2. Saves resources in order to preserve the option to invest in future projects that might earn higher return
Over-Optimism/Agency	1. Helps offset possible over-optimism in project evaluation 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
Idiosyncratic Risk/Uncertainty	1. Provides a margin of error in calculations and assumptions 2. Accounts for project-specific risks not reflected in WACC

Table A.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 sorts by NAICS-2 industries, Panel B sorts by survey industries (i.e., the industry the CFO stated on the survey), which approximately align with one-digit SIC codes. The final column of both panels displays the average buffer conditional on using a positive buffer. See Table A.1 for detailed definitions.

Panel A: NAICS-2 Averages

Code	Description	Percent of Sample	Hurdle	WACC	Buffer: Intensive Margin	Buffer: Extensive Margin	Buffer | Buffer > 0
11	Agri, Forestry, Fish	0.32	11.875	9.250	2.625	0.750	3.500
21	Mining, Oil/Gas	2.03	18.020	10.140	7.880	0.960	8.208
22	Utilities	0.97	8.892	7.075	1.817	0.667	2.725
23	Construction	5.19	13.575	8.322	5.253	0.734	7.153
31-33	Manufacturing	21.59	14.616	9.197	5.418	0.805	6.735
41-42	Wholesale Trade	7.22	13.553	8.576	4.977	0.775	6.419
44-45	Retail Trade	5.11	14.374	8.910	5.465	0.778	7.026
48-49	Transportation/Warehouse	1.95	13.562	9.017	4.546	0.833	5.455
51	Information	4.38	15.398	9.645	5.753	0.778	7.397
52	Finance/Insurance	9.42	11.693	7.723	3.970	0.733	5.418
53	Real Estate	3.9	12.964	8.383	4.580	0.729	6.281
54	Professional/Scientific Services	9.66	15.708	9.936	5.771	0.756	7.631
55	Management of Companies	0.73	10.267	6.839	3.428	0.556	6.170
56	Admin/Waste Management	2.76	15.294	8.751	6.543	0.824	7.945
61	Educational Services	1.38	8.444	6.368	2.076	0.529	3.922
62	Healthcare	3.98	11.849	7.658	4.191	0.837	5.009
71	Arts/Entertainment	0.49	11.383	9.550	1.833	0.667	2.750
72	Accommodation/Food	1.46	16.744	9.386	7.358	0.833	8.830
81,91-92	Other Services, Public Admin	2.68	11.955	6.564	5.391	0.848	6.354
Unknown	Unknown	14.77	13.848	8.903	4.945	0.775	6.383

Panel B: Survey Industry Averages

Industry	Percent of Sample	Hurdle	WACC	Buffer: Intensive Margin	Buffer: Extensive Margin	Buffer | Buffer > 0
Mining/Construction	4.87	14.212	7.894	6.317	0.800	7.897
Technology	7.31	16.394	10.638	5.756	0.689	8.356
Manufacturing	24.11	14.803	9.276	5.527	0.828	6.673
Communications/Media	2.52	15.581	10.165	5.416	0.677	7.995
Services/Consulting	12.01	13.764	8.664	5.100	0.723	7.055
Retail/Wholesale	10.39	13.170	8.320	4.851	0.781	6.209
Transportation/Energy	7.87	13.349	8.654	4.696	0.825	5.694
Healthcare/Pharma	6.09	13.128	8.763	4.365	0.760	5.744
Finance	12.42	11.958	7.790	4.168	0.745	5.594
Other	12.42	13.459	8.274	5.185	0.797	6.503

Table A.4: Excess ROIC Density Manipulation Test Robustness

This table displays robustness the results of the density manipulation test described in Figure 4. We alter both order of the local polynomial estimator, as well as the bandwidth for the local estimation. For each polynomial order p, the bias-corrected density estimator is set to be $q = p + 1$, which is the default setting. In each column, we display the difference in the estimated density immediately above and immediately below the cutoff. In the notation of Cattaneo et al. (2018), we display $\hat{f}_{+,p}(h) - \hat{f}_{-,p}(h)$, where $\hat{f}_{\pm,p}(h)$ is derived via local polynomial density estimation. Below the estimated difference in density, we display standard errors. Column 1 displays the results when the bandwidths for estimation are chosen via the data-driven methodology in Section 2.5 of Cattaneo et al. (2018). In column 1, the chosen bandwidths $\{h_-, h_+\}$ are displayed below the standard error. In columns 2-5, we fix the bandwidth to be equal on both sides. ***, ** , * denote significance at 1%, 5%, 10%.

		(1)	(2)	(3)	(4)	(5)
			Bandwidth			
		Data-Driven	2.5	5	7.5	10
Polynomial Order	1	0.057***	0.083***	0.030*	0.004	0.002
		(0.021)	(0.027)	(0.017)	(0.012)	(0.010)
		$\{4.422, 3.432\}$				
	2	0.051**	0.108**	0.097***	0.036*	0.012
		(0.023)	(0.048)	(0.028)	(0.021)	(0.017)
		$\{7.926, 6.038\}$				
	3	0.125***	0.136*	0.118***	0.113***	0.046*
		(0.034)	(0.077)	(0.041)	(0.030)	(0.025)
		$\{7.449, 6.199\}$				

Table A.5: Additional Analysis of the Relation Between The Buffer and Price Markups

This table provides additional analysis of the relation between hurdle rate buffers and price markups. In Panel A, we repeat the analysis of Table 6 for the full sample, i.e., we group non-consumer-facing and consumer-facing together and estimate the relationship between buffers and price markups. Like Table 6, the markup is the "accounting" markup from Baqaee and Farhi (2020). In Panel B, in order to separate out predominantly B2B and predominantly consumer-facing firms, we display the estimated slope coefficient on the markup for firms in non-consumer-facing and consumer-facing industries separately. In columns 2 and 6, we include the controls Beta Volatility and Sales Volatility. In columns 3 and 7, we also include survey quarter, size, ownership and credit rating fixed effects. In columns 4 and 8, we interact all right-hand side variables with the consumer-facing dummy. Lastly, Panel C 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). In Panels A and C, all variables apart from the cost of capital are standardized to unit variance. All variables are defined in detail in Table A.1. In each panel, 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: The Buffer and Markups for All CFO Survey Firms

	(1)	(2)	(3)	(4)	(5)	(6)
	Extensive Margin			Intensive Margin		
Markup	-0.025**	-0.019	-0.021	-0.623***	-0.466***	-0.505***
	(0.011)	(0.012)	(0.014)	(0.139)	(0.154)	(0.164)
Cost of Capital	-0.028***	-0.028***	-0.029***	-0.320***	-0.324***	-0.322***
	(0.003)	(0.003)	(0.003)	(0.045)	(0.045)	(0.045)
Sales Volatility		0.003	0.003		0.303**	0.236
		(0.015)	(0.014)		(0.151)	(0.162)
Beta Volatility		0.027**	0.027**		0.378**	0.336**
		(0.012)	(0.012)		(0.149)	(0.144)
Observations	1,232	1,232	1,232	1,232	1,232	1,232
R-squared	0.078	0.082	0.124	0.071	0.079	0.107
Survey Quarter FE			Yes			Yes
Size FE			Yes			Yes
Ownership FE			Yes			Yes
Credit Rating FE			Yes			Yes

Table A.5: Continued

Panel B: The Buffer and Markups for Non-Consumer- and Consumer-Facing Industries

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Extensive Margin				Intensive Margin			
Slope Coefficient on Markup								
Firms in Non-Consumer-Facing Industries	-0.031***	-0.024**	-0.027*	-0.026*	-0.696***	-0.526***	-0.569***	-0.559***
	(0.012)	(0.012)	(0.014)	(0.014)	(0.148)	(0.162)	(0.173)	(0.164)
Firms in Consumer-Facing Industries	0.056	0.061	0.052	0.040	0.484	0.590	0.577	0.526
	(0.037)	(0.038)	(0.037)	(0.038)	(0.409)	(0.431)	(0.428)	(0.479)
Observations	1,232	1,232	1,232	1,232	1,232	1,232	1,232	1,232
Controls		Yes	Yes	Yes		Yes	Yes	Yes
Fixed Effects			Yes	Yes			Yes	Yes
Fully Interacted				Yes				Yes

Panel C: Alternative Measure of Markups

	(1)	(2)	(3)	(4)	(5)	(6)
	Extensive Margin			Intensive Margin		
Markup (Alternative)	-0.029**	-0.024**	-0.018	-0.556***	-0.440***	-0.420***
	(0.011)	(0.011)	(0.012)	(0.158)	(0.164)	(0.163)
Cost of Capital	-0.027***	-0.027***	-0.028***	-0.321***	-0.326***	-0.320***
	(0.003)	(0.003)	(0.003)	(0.046)	(0.047)	(0.037)
Beta Volatility		0.029**	0.031**		0.484***	0.476***
		(0.012)	(0.013)		(0.170)	(0.165)
Sales Volatility		0.007	0.009		0.368**	0.316**
		(0.016)	(0.012)		(0.145)	(0.159)
Observations	1,066	1,066	1,066	1,066	1,066	1,066
R-squared	0.082	0.087	0.118	0.073	0.085	0.109
Survey Quarter FE			Yes			Yes
Size FE			Yes			Yes
Ownership FE			Yes			Yes
Credit Rating FE			Yes			Yes

Table A.6: The Buffer and Firm-Level Bargaining Power Measures

This table provides further analysis on how bargaining power affects the buffer. We corroborate our findings in Tables 5 and 6 by focusing on the CFO Survey firms that appear in Compustat, for which we can observe firm-level customer concentration and price markups. We focus on CFO survey firms that are also present in Compustat. For consistency across the specifications in the table, we further focus on firms in non-consumer-facing industries (see Table 6). In columns 1-4, we focus on the degree of concentration in a firm's corporate customers as our measure of bargaining power (see Table 5). Columns 1-2 focus on the extensive margin of the buffer and columns 3-4 focus on the intensive margin. Similarly, columns 5-8 focus on the price markup for predominantly B2B firms (see Table 6). All variables apart from Cost of Capital are standardized to unit variance. Standard errors are clustered at survey industry × survey quarter and displayed in parentheses below the coefficient. ***, ** , * denote significance at 1%, 5%, 10%.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Customer Concentration				Markup			
Buffer Margin:	Extensive		Intensive		Extensive		Intensive	
Customer Concentration	0.055*	0.050	0.187	0.250				
(Firm-Level)	(0.033)	(0.034)	(0.391)	(0.394)				
Markup					-0.057**	-0.034	-0.859**	-0.742**
(Firm-Level)					(0.028)	(0.042)	(0.378)	(0.292)
Cost of Capital	-0.025**	-0.028***	-0.351	-0.437**	-0.028***	-0.029***	-0.411*	-0.480**
	(0.011)	(0.009)	(0.212)	(0.216)	(0.010)	(0.009)	(0.218)	(0.220)
Beta Volatility		0.017		0.531		0.020		0.451
		(0.022)		(0.331)		(0.020)		(0.316)
Sales Volatility		0.036		0.484*		0.027		0.254
		(0.030)		(0.265)		(0.031)		(0.255)
Observations	178	178	178	178	178	178	178	178
R-squared	0.040	0.141	0.044	0.136	0.040	0.133	0.074	0.151
Survey Quarter FE		Yes		Yes		Yes		Yes
Size FE		Yes		Yes		Yes		Yes
Ownership FE		Yes		Yes		Yes		Yes
Credit Rating FE		Yes		Yes		Yes		Yes

Table A.7: The Buffer and Asset Redeployability (Kim and Kung, 2017)

This table explores how the redeployability of a firm's assets affects the use and size of the buffer. Prices of assets with low redeployability are more likely to be bargained over, hence we predict a negative relationship between the buffer and redeployability, all else equal. Our measure of asset redeployability is the industry-level (BEA) measure from Kim and Kung (2017). We use the BEA-NAICS crosswalk provided with their publicly available data to match the measure to our survey firms at the NAICS-2 level. The mean (standard deviation) asset redeployability for industries in the CFO survey is 0.44 (0.13), which closely matches the broader BEA-level data in Kim and Kung (2017): 0.41 (0.12). Asset Redeployability, Beta Volatility and Sales Volatility are standardized to mean zero, 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%.

	(1)	(2)	(3)	(4)	(5)	(6)
	Extensive Margin			Intensive Margin		
Asset Redeployability	-0.026*	-0.026	-0.030*	-0.319**	-0.323**	-0.421**
	(0.016)	(0.016)	(0.015)	(0.148)	(0.143)	(0.159)
Cost of Capital	-0.027***	-0.028***	-0.029***	-0.311***	-0.321***	-0.317***
	(0.003)	(0.003)	(0.003)	(0.044)	(0.045)	(0.044)
Beta Volatility		0.030***	0.030**		0.459***	0.420***
		(0.011)	(0.011)		(0.148)	(0.142)
Sales Volatility		0.008	0.009		0.436***	0.378**
		(0.015)	(0.014)		(0.150)	(0.159)
Observations	1,232	1,232	1,232	1,232	1,232	1,232
R-squared	0.078	0.084	0.127	0.062	0.076	0.105
Survey Quarter FE			Yes			Yes
Size FE			Yes			Yes
Ownership FE			Yes			Yes
Credit Rating FE			Yes			Yes

B. Proofs

Proof of Lemmas 1 and 2

1. If $s = \{\theta(x_F + x_O)R - x_F H_F, (1-\theta)(x_F + x_O)R - x_O H_O\}$, $d = \{0, 0\}$, and $\alpha = \beta = 1$, then (1) becomes

$$\max_{\theta} \quad \Big(\theta(x_F + x_O)R - x_F H_F\Big)\Big((1-\theta)(x_F + x_O)R - x_O H_O\Big). \tag{B.1}$$

Expansion yields

$$\theta(1-\theta)[(x_F + x_O)R]^2 - \theta(x_F + x_O)Rx_O H_O - (1-\theta)(x_F + x_O)Rx_F H_F + x_F H_F x_O H_O.$$

Taking first-order conditions,

$$(1-2\theta)[(x_F + x_O)R]^2 + (x_F + x_O)Rx_F H_F - (x_F + x_O)Rx_O H_O = 0.$$

Solving for the Nash split yields

$$\theta = \frac{1}{2} + \frac{x_F H_F - x_O H_O}{2(x_F + x_O)R}.$$

2. If $s = \{\theta[(x_F + x_O)R - (x_F H_F + x_O H_O)], (1-\theta)[(x_F + x_O)R - (x_F H_F + x_O H_O)]\}$, $d = \{0, 0\}$, $\alpha = x_F H_F$, and $\beta = x_O H_O$, then (1) becomes

$$\max_{\theta} \quad \Big(\theta[(x_F + x_O)R - (x_F H_F + x_O H_O)]\Big)^{x_F H_F}\Big((1-\theta)[(x_F + x_O)R - (x_F H_F + x_O H_O)]\Big)^{x_O H_O}. \tag{B.2}$$

Taking first-order conditions,

$$\frac{1}{(\theta-1)\theta}\Big[\left(\theta\left((R - H_F)\,x_F + (R - H_O)\,x_O\right)\right)^{H_F x_F} \left((\theta-1)\left((H_F - R)\,x_F + (H_O - R)\,x_O\right)\right)^{H_O x_O}\left(H_F(\theta-1)x_F + H_O\theta x_O\right)\Big] = 0 \tag{B.3}$$

Solving for the Nash split yields

$$\theta = \frac{x_F H_F}{x_F H_F + x_O H_O}.$$

■

Proof of Proposition 1

Integrating (6) over all incentive compatible gross returns ($\underline{V}'$ to $\bar{V}$) yields

$$V_B = \frac{x_F\tau}{x_F\tau + x_O W_O} V\Big|_{\underline{V}'}^{\bar{V}} .$$

Substituting in $\underline{V}' = x_F\tau + x_O W_O$ yields the following:

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

Simplifying gives the expression for the value of the firm in terms of τ:

$$V_B = \frac{x_F\tau\bar{V}}{x_F\tau + x_O W_O} - x_F\tau . \tag{B.4}$$

Taking the derivative of (B.4) with respect to τ yields the optimal hurdle rate

$$\begin{aligned}\frac{\partial V_B}{\partial \tau} &= \frac{x_F\bar{V}(x_F\tau + x_O W_O) - x_F^2\tau\bar{V}}{(x_F\tau + x_O W_O)^2} - x_F = 0\\ \Rightarrow \quad & \bar{V}x_O W_O = (x_F\tau + x_O W_O)^2\\ \Rightarrow \quad & x_F\tau = \sqrt{\bar{V}x_O W_O} - x_O W_O .\end{aligned} \tag{B.5}$$

The optimal τ is therefore given by

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

which is (7) in the text. It follows that $\tau^* > W_F$ if (10) holds. Otherwise, $\tau^* = W_F$.

Plugging (7) into (B.4) for τ gives us the value of the project at the optimal IRR hurdle rate

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

which simplifies to

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

This is (8) in the text. The change in value, ΔV, from using a buffered hurdle rate is calculated as the difference between V_N from (5) and V_B from (8)

$$\begin{aligned}\Delta V &= \bar{V} + x_O W_O - 2\sqrt{\bar{V}x_O W_O} - \frac{x_F W_F\bar{V}}{x_F W_F + x_O W_O} + x_F W_F\\ \Rightarrow &= (1 - \frac{x_F W_F}{x_F W_F + x_O W_O})\bar{V} + x_F W_F + x_O W_O - 2\sqrt{\bar{V}x_O W_O}.\end{aligned} \tag{B.6}$$

It is straightforward to show that $\Delta V > 0$. We can re-write (B.6) as

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

or

$$\Delta V = (\underline{V}')^2 + \underline{V}^2 - 2\underline{V}'\underline{V}. \tag{B.7}$$

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, B.7 is always positive.

Finally, the comparative statics are proven by straightforward differentiation.

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

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

$$\begin{aligned} 1 - \frac{\underline{V}_F'}{\bar{V}} - \frac{x_F W_F}{\underline{V}} &> 0 \\ \Rightarrow \bar{V} - \underline{V}_F' - \frac{\bar{V} x_F W_F}{\underline{V}} &> 0 \\ \Rightarrow \bar{V}\underline{V} - \underline{V}_F'\underline{V} - \bar{V} x_F W_F &> 0 \\ \Rightarrow \bar{V}\underline{V} - \bar{V} x_F W_F &> \underline{V}_F'\underline{V} \\ \Rightarrow \bar{V}(\underline{V} - x_F W_F) &> \underline{V}_F'\underline{V} \\ \Rightarrow \bar{V}(x_O W_O) &> \underline{V}_F'\underline{V} \\ \Rightarrow (\underline{V}_F')^2 &> \underline{V}_F'\underline{V}\,. \end{aligned}$$

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

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 $\bar{V} x_O W_O = (\underline{V}_F')^2$ and $(x_F W_F + x_O W_O)^2 = \underline{V}^2$. Subbing in leads to

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

Since $\underline{V}_F' > \underline{V}$, 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 B.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* $\bar{V} > 2\underline{V}'_F$.
2. $\frac{\partial \Delta V}{\partial W_O}$ *and* $\frac{\partial \Delta V}{\partial x_O}$ *are positive if* $(\underline{V} + \theta\bar{V}) > \frac{\underline{V}\bar{V}}{\underline{V}'_F}$.

Proof

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

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

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

4.
$$\frac{\partial \Delta V}{\partial x_O} = W_O\left(1 - \frac{\bar{V}}{\sqrt{\bar{V}x_OW_O}} + \frac{\bar{V}x_FW_F}{(x_FW_F + x_OW_O)^2}\right)$$
This is positive if $(\underline{V} - \theta\bar{V}) > \frac{\underline{V}\bar{V}}{\underline{V}'_F}$. ■

Lemma B.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

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

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

$$-\theta\bar{V} - \underline{V} + 2\underline{V}_O' > 0$$

Solving for θ, the condition for O to not use a buffer given that O does not use a buffer is

$$\theta < \frac{2\underline{V}_O' - \underline{V}}{\bar{V}} \tag{B.8}$$

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

$$\theta\bar{V} + \underline{V} - 2\underline{V}_O' < 0$$

First note that $\theta\bar{V} = \frac{x_F W_F \bar{V}}{\underline{V}}$. The numerator of this expression can be written as $\left(\sqrt{x_F W_F \bar{V}}\right)^2$. Recall that the expression $\sqrt{\bar{V} x_F W_F}$ is the new minimum acceptable project value when firm O shades and firm F does not. So, $\theta\bar{V} = \frac{(\underline{V}_O')^2}{\underline{V}}$. We can re-write the inequality as

$$\frac{(\underline{V}_O')^2}{\underline{V}} + \underline{V} - 2\underline{V}_O' < 0$$

$$\Rightarrow (\underline{V}_O')^2 + \underline{V}^2 - 2\underline{V}_O'\underline{V} < 0 \tag{B.9}$$

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, B.9 is never true and player O will always use a buffer if player F does not. ■

Proof of Proposition 2

Integrating (6) over all incentive compatible gross returns ($\underline{V}''$ to $\bar{V}$) yields

$$V_F = \frac{x_F \tau_F}{x_F \tau_F + x_O \tau_O} V \Big|_{\underline{V}''}^{\bar{V}} .$$

Substituting in $\underline{V}'' = x_F \tau_F + x_O \tau_O$ yields the following:

$$V_F = \frac{x_F \tau_F}{x_F \tau_F + x_O \tau_O} [\bar{V} - (x_F \tau_F + x_O \tau_O)] .$$

Simplifying gives the expression for the value of the firm in terms of τ_F:

$$V_F = \frac{x_F \tau_F \bar{V}}{x_F \tau_F + x_O \tau_O} - x_F \tau_F . \tag{B.10}$$

Similar calculation for the outside trading partner yields

$$V_O = \frac{x_O \tau_O \bar{V}}{x_F \tau_F + x_O \tau_O} - x_O \tau_O . \tag{B.11}$$

Taking first order conditions with respect to τ_F and τ_O

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

$$\Rightarrow \quad \bar{V} x_O \tau_O = (x_F \tau_F + x_O \tau_O)^2 , \tag{B.12}$$

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

$$\Rightarrow \quad \bar{V} x_F \tau_F = (x_F \tau_F + x_O \tau_O)^2 . \tag{B.13}$$

It follows that

$$\bar{V} x_F \tau_F = \bar{V} x_O \tau_O . \tag{B.14}$$

Substituting (B.14) into (B.12) for $x_O \tau_O$ gives us

$$\bar{V} x_F \tau_F = 4(x_F \tau_F)^2$$

$$\Rightarrow \tau_F^* = \frac{\bar{V}}{4 x_F} .$$

By the same method

$$\bar{V} x_O \tau_O = 4(x_O \tau_O)^2$$

$$\Rightarrow \tau_O^* = \frac{\bar{V}}{4 x_O} .$$

Taking second order conditions for each party yields

$$\frac{\partial^2 V_F}{\partial {\tau_F}^2} = \frac{-2x_F^2 x_O \tau_O \bar{V}(x_F\tau_F + x_O\tau_O)}{(x_F\tau_F + x_O\tau_O)^4} < 0$$
$$\frac{\partial^2 V_O}{\partial {\tau_O}^2} = \frac{-2x_O^2 x_F \tau_F \bar{V}(x_F\tau_F + x_O\tau_O)}{(x_F\tau_F + x_O\tau_O)^4} < 0,$$

so that τ_F^* and τ_O^* 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 (B.14) to substitute in for $x_O\tau_O^*$, this simplifies to:

$$V_F^* = \frac{\bar{V}}{2} - x_F\tau_F^* .$$

Substituting (11) for τ_F results in

$$V_F^* = \frac{\bar{V}}{2} - x_F\frac{\bar{V}}{4x_F}$$
$$\Rightarrow = \frac{\bar{V}}{4} , \tag{B.15}$$

which is (12) 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

$$V_{B^O}^F = \frac{x_F W_F}{x_F W_F + x_O\tau_O}[\bar{V} - \underline{V}_O'] ,$$

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

$$V_{B^{O,F}}^F - V_{B^O}^F = \frac{\bar{V}}{4} - \frac{x_F W_F}{x_F W_F + x_O\tau_O}[\bar{V} - \underline{V}_O'] > 0 \tag{B.16}$$

Below we show that (B.16) is always true. First, note that $x_F W_F + x_O\tau_O$ is $\underline{V}_O'$, the minimum acceptable project when firm O uses a buffer and firm F does not. (B.16) simplifies to

$$\frac{\bar{V}}{4} - \frac{x_F W_F}{\underline{V}_O'}[\bar{V} - \underline{V}_O'] > 0$$
$$\Rightarrow \frac{\bar{V}}{4} - \left(\frac{\bar{V}x_F W_F}{\underline{V}_O'} - x_F W_F\right) > 0 \tag{B.17}$$

The numerator of $\frac{\bar{V}x_F W_F}{V'_O}$ can be written as $\left(\sqrt{\bar{V}x_F W_F}\right)^2$. Recall that the expression $\sqrt{\bar{V}x_F W_F}$ 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 (B.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

$$\begin{aligned} &\frac{\bar{V}}{4} - (x_F W_F + x_O \tau_O) + x_F W_F > 0 \\ &\Rightarrow \frac{\bar{V}}{4} - x_O \tau_O > 0 \\ &\Rightarrow \bar{V} > 4 x_O \tau_O \end{aligned} \tag{B.18}$$

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 (B.5) it follows that

$$x_F W_F + x_O \tau_O = \sqrt{\bar{V}x_F W_F}\,.$$

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

$$\begin{aligned} &(x_F W_F)^2 + 2(x_F W_F)(x_O \tau_O) + (x_O \tau_O)^2 = \bar{V}x_F W_F \\ &\Rightarrow (x_F W_F) + 2(x_O \tau_O) + \frac{(x_O \tau_O)^2}{x_F W_F} = \bar{V}\,. \end{aligned} \tag{B.19}$$

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

$$\begin{aligned} &(x_F W_F) + 2(x_O \tau_O) + \frac{(x_O \tau_O)^2}{x_F W_F} > 4 x_O \tau_O \\ &\Rightarrow (x_F W_F) - 2(x_O \tau_O) + \frac{(x_O \tau_O)^2}{x_F W_F} > 0 \\ &\Rightarrow (x_F W_F)^2 - 2(x_O \tau_O)(x_F W_F) + (x_O \tau_O)^2 > 0 \end{aligned}$$

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

$$V_i = \int_{\underline{R}}^{\bar{R}} \theta_i dR,$$

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

$$V_i = \frac{\bar{R} H_i}{\Sigma} - H_i. \tag{B.20}$$

Taking first-order conditions yields

$$\frac{\partial V_i}{\partial H_i} = \frac{\bar{R}\Sigma - \bar{R} H_i}{\Sigma^2} - 1. \tag{B.21}$$

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

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

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,

$$\bar{R}(S + H_j) = \Sigma^2 \tag{B.22}$$

$$\bar{R}(S + H_i) = \Sigma^2, \tag{B.23}$$

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

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

or

$$H^* = \frac{(n-1)\bar{R}}{n^2}. \tag{B.24}$$

Plugging (B.24) into (B.20)

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

■

Proof of Proposition 4

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

$$\theta_B = \frac{H_F}{H_F + W_O} \tag{B.25}$$

and the value of the firm can be calculated as

$$V_B = \frac{W_F \bar{R} + b\bar{R}}{W_F + b + W_O} - (W_F + b). \tag{B.26}$$

Without a buffer, the Nash Bargaining split is

$$\theta_N = \frac{W_F}{W_F + W_O} \tag{B.27}$$

and the value of the firm can be calculated as

$$V_N = \frac{W_F \bar{R}}{W_F + W_O} - W_F. \tag{B.28}$$

Therefore, $V_B > V_N$ if

$$\begin{aligned} V_B &> V_N \Rightarrow \\ \frac{W_F \bar{R} + b\bar{R}}{W_F + b + W_O} - (W_F + b) &> \frac{W_F \bar{R}}{W_F + W_O} - W_F \Rightarrow \\ \frac{W_F \bar{R} + b\bar{R}}{W_F + b + W_O} &> \frac{W_F \bar{R}}{W_F + W_O} + b \Rightarrow \\ \frac{\bar{R} W_O - (W_F + W_O)^2}{(W_F + W_O)} &> b \end{aligned} \tag{B.29}$$

■

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

$$\begin{aligned} H_F &= (1-k)\bar{R} + kW_F - (1-k)W_O \Rightarrow \\ H_F &= kW_F + (1-k)(\bar{R} - W_O). \end{aligned} \tag{B.30}$$

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

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

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

$$\begin{aligned} V_B &> V_N \Rightarrow \\ \theta_H[\bar{R} - (H_F + W_O)] &> \theta_N[\bar{R} - (W_F + W_O)] \Rightarrow \\ \theta_H[\bar{R} - \underline{R}_H] &> \theta_N[\bar{R} - \underline{R}] \Rightarrow \\ (\theta_H - \theta_N)\bar{R} &> (H_F - W_F) \Rightarrow \\ (\theta_H - \theta_N) &> (1-k)(1 - \frac{W_F + W_O}{\bar{R}}). \end{aligned} \tag{B.31}$$

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, τ^*, is greater than the biased hurdle rate, H_F, if:

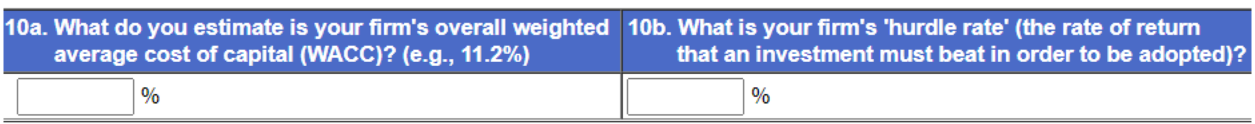
$$\begin{aligned} \tau^* &> H_F \Rightarrow \\ \sqrt{\bar{R}W_O} - W_O &> (1-k)\bar{R} + k(W_F + W_O) - W_O \Rightarrow \\ \underline{R}' &> (1-k)\bar{R} + k\underline{R} \Rightarrow \\ k[\bar{R} - \underline{R}] &> \bar{R} - \underline{R}' \Rightarrow \\ k &> \frac{\bar{R} - \underline{R}'}{\bar{R} - \underline{R}} \end{aligned} \tag{B.32}$$

■

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 survey, the wording of the hurdle rate question specifically asked CFOs for their investment hurdle rates (the expected rate of return an investment project must exceed in order to be adopted). We similarly asked CFOs to supply their weighted average cost of capital (WACC), as opposed to their cost of equity or debt. As an example, Figure C.1 displays how we asked CFOs for their hurdle rate and WACC in the 2012q2 survey. The questions for the other surveys can be found at https://cfosurvey.fuqua.duke.edu/ for surveys conducted prior to 2022q2 and https://www.richmondfed.org/cfosurvey/ for the 2022q2 survey.

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



10a. What do you estimate is your firm's overall weighted average cost of capital (WACC)? (e.g., 11.2%)	10b. What is your firm's 'hurdle rate' (the rate of return that an investment must beat in order to be adopted)?
%	%

A potential 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 forecasts for 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.[32] The slope coefficient from this regression is 0.61 and highly significant, and the R^2 is 0.44. While exploring the relation between perceived and estimated costs of capital is not the point of our paper, we are reassured by the tightness of the relation. 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. Finally, recall the analysis of Figure 4, which indicates that ex post realized returns align with survey-provided hurdle rates, again providing assurance that our survey data are reliable.

A second concern with survey data is representativeness. Table IAI in the Internet Appendix of Graham (2022)[33] 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 anomalies that would suggest problems using our data to draw inference relative to well-known samples such as Compustat.

[32]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).

[33]See here: https://onlinelibrary.wiley.com/doi/10.1111/jofi.13161

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 Comustat. Panel A displays a binned scatter plot 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 the survey (blue bars) *vs.* the same categories calculated using archival revenue data (orange bars).