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Filippo Ippolito, Roberto Steri,
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Mind the Gap: The Market Price of Financial Flexibility

Filippo Ippolito* Roberto Steri† Claudio Tebaldi‡ Alessandro T. Villa§

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Abstract

The empirical connection between financial leverage and equity risk premia is surprisingly weak. We link limited financial flexibility to levered risk premia with a quantitative model, where firms make dynamic investment, financing, and default decisions. Our model spotlights two variables, *leverage gaps* and *leverage targets*, as drivers of risk premia. Firms partially close the gap toward their target, being optimally over- or under-levered. Equityholders of over-levered firms bear higher costs of debt, as their capital structure is vulnerable to bankruptcy costs. Hence, gaps contribute to the amplification of asset returns. The "lost" leverage risk premium reappears after controlling for targets.

Keywords: firm dynamics, financial flexibility, financial frictions, heterogeneous firms, capital misallocation, cross section of returns, dynamic capital structure, risk premia.

JEL Classification Numbers: G12, G32.

*Barcelona Graduate School of Economics and CEPR, Universitat Pompeu Fabra. E-mail: filippo.ippolito@upf.edu.

†Department of Finance at the University of Luxembourg. E-mail: roberto.steri@uni.lu.

‡Department of Finance at Bocconi University. E-mail: claudio.tebaldi@unibocconi.it.

§Federal Reserve Bank of Chicago. E-mail: alessandro.villa@chi.frb.org.

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1 Introduction

Financial flexibility, or the ability of a business to efficiently adjust its funding, is a key driver of firm dynamics. Scholars and industry experts concur that restrictions on such flexibility shape firm investment and financing choices. As highlighted in Graham (2022)'s survey, chief financial officers (CFOs) in the U.S. view financial flexibility as the primary aspect shaping a firm's debt policy, with roughly 80% of them indicating it as a key driver. While Gamba and Triantis (2008) estimate that financial flexibility holds significant value for companies, its impact on stock market valuations for levered firms remains underexplored.

The main takeaway of this paper is that accounting for limited financial flexibility resurrects the expected strong connection between financial leverage and equity risk premia, which is crucial for understanding firms' financing costs and thus influences investment and capital allocation decisions.[1] Accordingly, financial flexibility offers a simple explanation for the surprisingly weak relationship previously documented in the empirical literature.

We present and calibrate a quantitative model of firm dynamics, in the spirit of Gomes and Schmid (2010), to examine the equilibrium interplay between limited financial flexibility and expected returns. Firms face both idiosyncratic and aggregate risk and make dynamic investment, financing, and default decisions, while balancing the conventional trade-off between debt tax benefits and bankruptcy costs. In this dynamic environment, the key ingredient of our model are firms' debt adjustment costs, whose magnitude determines the degree of financial flexibility in the economy. We convey the economic intuition via a two-period version of the model, while linking our analytical findings to the seminal Proposition 2 of Modigliani and Miller (1958).

First, when financial flexibility is limited, firms generally face excessive costs to attain their leverage target, and optimally choose to only partially close the gap between their current and target leverage. The latter is the optimal leverage that firms would pursue with full financial flexibility. As a result, firms may be either optimally under-levered — when their leverage is higher

[1] From a practical standpoint, a conventional approach to making capital budgeting decisions involves using the net present value (NPV) method, where the firm's cash flows are discounted using the weighted-average cost of capital (WACC). The calculation of the WACC is rooted in Proposition 2 of Modigliani and Miller (1958). Additionally, according to estimates by David, Schmid, and Zeke (2022), around 25% of the dispersion in the marginal product of capital among U.S. firms is accounted for by risk premium dispersion across firms.

than the target, or over-levered — when their leverage exceeds the target. Intuitively, the rate at which firms close their leverage gaps increases with financial flexibility. Second, in equilibrium, every dollar of debt incurs a higher cost for equity holders of over-levered firms than for those of under-levered firms. Thus, optimal leverage is no longer a sufficient statistic for its net cost, as if two firms carrying one dollar of debt are effectively carrying more or less than that one dollar, depending on their equilibrium leverage gaps. This aspect has implications for the conventional mechanism amplifying asset returns via leverage, with large leverage gaps triggering further amplification. The higher cost of holding debt for equity holders of over-levered firms arises because, at their optimal leverage point, the average bankruptcy costs they bear exceed the average tax benefits. When financial flexibility is perfect, firms reach their leverage targets, making gaps irrelevant for equity payouts.[2] Instead of leverage gaps, leverage targets offer an equivalent characterization of the relationship between leverage and returns. Under mild conditions, the "lost" leverage risk premium re-emerges when controlling for targets, with high targets leading to lower risk premia. Firms with high targets are less likely to become over-levered due to productivity shocks, thereby hedging over-leverage risks.

Informed by the model's predictions, we document two novel empirical facts. Although leverage targets and leverage gaps are unobservable, the empirical corporate finance literature frequently relies on reduced-form measures of these variables.[3] First, we find that estimated leverage gaps have a strong positive association with stock returns. Second, upon breaking down leverage gaps into leverage targets and observed leverage, we find that stocks from high-leverage firms command a premium. Leverage targets, instead, exhibit a negative relationship with returns. These empirical patterns are robust across various specifications.[4]

We perform our quantitative analysis through the lens of a discrete-time, infinite-horizon neoclassical investment model where firms make investment, financing, and default decisions to maximize their value in arbitrage-free markets. The model incorporates cross-sectional firm heterogeneity through idiosyncratic productivity shocks. It also factors in aggregate shocks, which concurrently

[2] Since investment is endogenous in our model, the leverage amplification mechanism remains active regardless of asset return differences between mature and young firms, which is the focus of Gomes and Schmid (2010).

[3] Notably, some of these measures (e.g., Flannery and Rangan, 2006) are grounded in partial-adjustment specifications, which describe leverage dynamics that align with those predicted by our model.

[4] They are robust to both book and market value measures of leverage. Moreover, they are robust to additional controls such as investment and profitability, and when alternative reduced-form proxies are used for leverage targets.

impact firm profitability and discount rates, or the stochastic discount factor (SDF) of the economy. Firms face financial constraints due to issuance costs of external equity and the potential for endogenous default on debt when borrowing from competitive lenders. The model structure is similar to Gomes and Schmid (2010), to which we add costs associated with adjusting the firm's debt stock, whose magnitude determines the degree of financial flexibility in the economy. These costs, which can pertain to both issuances and reductions of corporate debt, can stem from various sources, including underwriting and management fees (Fischer, Heinkel, and Zechner, 1989; Strebulaev, 2007), seniority issues that make significant changes in the capital structure expensive (Acharya, Bharath, and Srinivasan, 2007), and liquidation and agency costs associated with debt usage (Myers, 1977; Diamond, 1991). To preserve tractability without committing to a specific mechanism, we adopt a reduced-form flexible specification for the financial flexibility costs. Although including debt adjustment costs in endogenous default models to account for limited financial flexibility is conceptually straightforward, it triggers technical challenges because of the problem's dimensionality.

While informative, the reduced-form proxies of leverage targets and gaps are susceptible to measurement errors and may not precisely map into the corresponding concepts within the model. Therefore, we utilize the model as a laboratory for a cleaner assessment of how financial flexibility influences risk premia. We define leverage targets building on the "gap approach" to the costly adjustments of production factors, commonly employed in the macroeconomic literature.[5] This dynamic leverage target evolves alongside the model's state variables, taking into consideration forward-looking funding requirements.

We calibrate our model using U.S. data, and we simulate artificial panels of firms. The model provides a good fit to the data, as it succeeds in reasonably matching not only the targeted moments used in its calibration but also various untargeted ones. These encompass firm dynamics, such as investment, financing, and profits, as well as aggregate stock market valuations. Through the lens of the calibrated model, we study capital structure dynamics and levered risk premia. We find that firms adjust their capital structure toward their dynamic targets. When leverage gaps are positive, indicating over-levered firms, firms tend to decrease their leverage. Conversely, firms with negative gaps tend to increase their leverage. Financial flexibility has a pronounced quantitative effect. On

[5]See, for example, Sargent (1978), Caballero and Engel (1993), Cooper and Willis (2004), King and Thomas (2006), and Bayer (2009).

average, firms close their gaps at a rate of 22%,[6] consistent with previous studies documenting hysteresis in capital structure (e.g., Hennessy and Whited, 2005; Lemmon, Roberts, and Zender, 2008).

Crucially, the calibrated model replicates the empirical patterns in levered risk premia, as documented using reduced-form proxies. Leverage gaps are strongly positively related to equity returns. The traditional positive leverage premium reemerges when we control for leverage targets, which load negatively on returns. The estimated coefficient of leverage, both in isolation and after controlling for size and book-to-market equity, is still positive, but quantitatively small. Specifically, its magnitude is approximately five times smaller than when the specification includes leverage targets.

Our quantitative analysis provides an array of supplementary results. We simulate a series of counterfactual economies, each exhibiting varying degrees of financial flexibility. Perhaps not surprisingly, an inverse relationship emerges between the degree of inflexibility in the economy and the rate at which firms close their leverage gaps. This relationship is distinctly nonlinear. In the scenario of full flexibility, firms close 100% of their leverage gaps. However, slight increments in inflexibility from the full-flexibility benchmark trigger swift declines in adjustment speeds. At high levels of inflexibility, adjustment speeds hover around 19%, a figure relatively close to the 22% under our baseline calibration. The stock market's price of financial flexibility mirrors these patterns, with the relationship between returns and gaps, and returns and targets, being more pronounced in economies with low flexibility.

We then turn to the role of financial flexibility for capital structure and risk premia in the cross-section of firm size. Existing studies suggest that large, mature firms operate with higher leverage than small firms, yet do not carry more risk, leading to a complex leverage-return relationship. We find that patterns involving leverage gaps and targets are prevalent across both small and large firms. Larger firms are more sluggish in adjusting their capital structure toward leverage targets than smaller firms and they exhibit steeper return-gap and return-target relationships. Overall, irrespective of a firm's size, financial flexibility provides insight into levered risk premia, which are not solely obfuscated by differences in firms' growth opportunities and asset returns.

[6] Explicitly, shifts in targets and gaps are accompanied by simultaneous adjustments in firms' capital structures, filling 22% of the gap. As targets and gaps are generally subject to fluctuations in each time period (e.g., monthly, annually), this figure remains invariant across different frequencies of observations in large samples.

Finally, we explore whether the properties of the dynamic target, as defined using the "gap approach," are pivotal for our key results. To this end, we consider an alternative definition: a long-term static target, as proposed by DeAngelo, DeAngelo, and Whited (2011). This allows us to assess whether firms target a relatively stable leverage. We find that our results cannot be ascribed to mean reversion toward stable long-term targets, which offer limited insight into the model's capital structure dynamics.

Related Literature. Our work primarily contributes to the following three research areas.

Firm Dynamics and Financial Flexibility. Numerous studies calibrate or estimate dynamic models to explore firm dynamics in the face of frictions in adjusting their capital structure. The closest study to ours is Gamba and Triantis (2008). Their study emphasizes the value losses from financial inflexibility, especially for small firms. Differently from them, we use asset pricing data and focus on the puzzling evidence on levered risk premia. Among these studies, our work primarily relates to those that introduce leverage targets in dynamic economies. Hennessy and Whited (2005) underscore the challenges in defining leverage targets in a dynamic investment and financing model, where there is no target leverage, defined as a single optimal capital structure independent of the current state of the world. DeAngelo, DeAngelo, and Whited (2011) recognize that a meaningful leverage target exists in a similar model. They consider a long-term target, from which firms occasionally move away with debt adjustments that they interpret as transitory. Leverage targets are also routinely used to characterize (S, s)-type refinancing policies in continuous-time models.[7] Our findings complement these studies by characterizing leverage policies by means of a dynamic leverage target, defined using the "gap approach". Most importantly, our focus is on the weak relationship between leverage and risk premia. We adopt a parsimonious approach to financial inflexibility with reduced-form debt adjustment costs, instead of microfounding their sources.

Firm-Level Risk Premia and Corporate Capital Structure. Few studies calibrate dynamic models to link equity risk premia to various facets of capital and debt structure. We align most closely with Gomes and Schmid (2010), who also focus on the weak leverage-return relation. They use a dynamic model where investment and financing decisions are endogenous and successfully predict

[7] A non-exhaustive list of contributions includes Fischer, Heinkel, and Zechner (1989), Goldstein, Ju, and Leland (2001), Strebulaev (2007), Morellec and Zhdanov (2008), Hugonnier, Malamud, and Morellec (2015), Bolton, Wang, and Yang (2021), and Benzoni, Garlappi, Goldstein, and Ying (2022).

a quantitatively weak relationship. Other cross-sectional asset pricing studies do not focus on this "puzzle," but provide predictions related to equity returns and corporate capital structure. Ozdagli (2012) and Obreja (2013) jointly study risk premia on corporate leverage and book-to-market equity. Yamarthy (2020), Friewald, Nagler, and Wagner (2022), and Chaderina, Weiss, and Zechner (2022) explore the risk premia emerging from debt maturity choices. Additionally, numerous papers delve into other asset pricing implications of dynamic leverage models. For instance, Chen (2010), Bhamra, Kuehn, and Strebulaev (2010), and Gomes and Schmid (2021) propose credit risk models to interpret the joint time-series patterns of debt and equity pricing along the business cycle. Bhamra, Fisher, and Kuehn (2011), Kuehn and Schmid (2014), and more recently Palazzo and Yamarthy (2022) and Danis and Gamba (2023), direct their attention toward the pricing of firms' credit instruments. In relation to these studies, we examine cross-sectional equity risk premia rather than aggregate risk premia on credit instruments. In line with this objective, we adopt the partial-equilibrium approach, pioneered by Berk, Green, and Naik (1999) and followed by Gomes and Schmid (2010), Ozdagli (2012), and Obreja (2013), among other cross-sectional asset pricing studies. Accordingly, we calibrate an exogenous pricing kernel to quantitatively match aggregate equity premia.[8] Other studies have developed models that connect default probabilities with equity risk premia and credit spreads, building upon the "distress puzzle" that was empirically documented by Campbell, Hilscher, and Szilagyi (2008). Recent contributions in this area include Friewald, Wagner, and Zechner (2014), and Chen, Hackbarth, and Strebulaev (2022), among others. The "distress premium puzzle" is not the focus of this study. Instead, we explore the leverage amplification mechanism, which is generally not associated with financial distress. In line with this objective, we expand on the groundwork of Gomes and Schmid (2010), who predict that mature and safer firms exhibit higher leverage. Our results suggest that the differences in asset returns between mature and young firms are not enough to mask the positive leverage-return relationship. While the argument put forth by Gomes and Schmid (2010) holds merit, our findings indicate that the conventional leverage amplification mechanism remains relevant. This effect can be effectively captured by considering leverage gaps and leverage targets.

Discrete-Time Models with Endogenous Default. From a methodological perspective, we conduct

[8] However, note that in the two-period illustration of our economic mechanism in Section 3.2, we derive our results for every pricing kernel, regardless of investors' preferences, similarly to Modigliani and Miller (1958).

our quantitative analysis using a discrete-time model with endogenous investment, financing, and default, for which we employ a global numerical solution. As discussed, for example, in Chen and Frank (2022), the solution of these models presents computational complexity. This complexity arises because the default condition of the firm depends on the equity value, which, in turn, is influenced by debt prices. These debt prices are internalized by each firm's decision-making process. Some successful quantitative analyses have been conducted using models of this nature, such as Hennessy and Whited (2005), Gomes and Schmid (2010), Obreja (2013), Kuehn and Schmid (2014), Gomes and Schmid (2021), and Danis and Gamba (2018). However, incorporating financial inflexibility prevents the redefinition of the state space, a commonly used technique in the literature to reduce dimensionality (see Section 3.4). To tackle this challenge, we employ projection methods and rely on a non-parametric structure for interpolation.

2 Empirical Patterns in Levered Returns

This section presents three empirical facts that motivate our quantitative analysis. First, we replicate the well-known puzzle that leverage and equity returns are very weakly related after controlling for standard return predictors, namely size and book-to-market. Second, we show that standard measures of leverage gaps from the corporate finance literature are strongly positively related to stock returns. Third, we document that when leverage gaps are replaced by their two components, target leverage and leverage, the textbook positive relation between leverage and returns is restored, while the coefficient of target leverage is negative.

2.1 Data and Sample

Accounting variables are from the CRSP/COMPUSTAT merged annual database over the period 1965-2020. Our sample includes all companies listed on AMEX, NYSE, and NASDAQ. We exclude financial firms (SIC codes 6000-6999), utility companies (SIC codes 4900-4999), and firms that are not incorporated in the United States. All variables used in the analysis are defined in Appendix A.

We match accounting variables to monthly stock prices and returns from the Center of Research in Security Prices (CRSP). We drop observations for which the trading status is halted or suspended and we include delisting returns in the time series of returns. To avoid look-ahead biases, we follow Fama and French (1992) and conservatively require a minimum gap of six months between fiscal year-ends and realized returns. To do so, for each firm, we match data from the latest fiscal year ending in calendar year $t-1$ to returns on common shares from July of calendar year t to June of calendar year $t+1$.

2.2 Empirical Proxies of Leverage Targets and Gaps

Our analysis involves reduced-form measures of leverage targets and gaps, which need to be estimated. We follow on the empirical model of Flannery and Rangan (2006), which is widely used in the corporate finance literature to produce proxies of leverage targets.[9] We implement rolling estimates of leverage targets $LT_{i,t}$ for firm i in year t to avoid look-ahead biases when including them in our asset pricing tests. Years from 1965 to 1979 are used as a "burn-in" period to obtain sensible initial estimates. We then continue on a rolling basis using accounting information available until year t. To be included in the analysis, firms are required to have at least five consecutive years of observations.

In Flannery and Rangan (2006)'s model, firms partially adjust their leverage $L_{i,t}$ over time toward the target level $LT_{i,t}$ with a "speed of adjustment" λ, i.e.,

$$L_{i,t} - L_{i,t-1} = \lambda(LT_{i,t} - L_{i,t-1}) + \epsilon_{i,t}, \tag{1}$$

where leverage targets $LT_{i,t} = \beta X_{i,t-1}$ are linear functions of firm-level characteristics $X_{i,t-1}$, and vary both over time and across firms. Using this linear approximation, one obtains the following estimable regression equation:

$$L_{i,t} = (\lambda\beta)X_{i,t-1} + (1-\lambda)L_{i,t-1} + \epsilon_{i,t}. \tag{2}$$

The control variables that Flannery and Rangan (2006) include in $X_{i,t-1}$ are profitability, the market-to-book value of assets, depreciation, total assets, a measure of tangibility, R&D expenses,

[9]The validation of alternative reduced-form proxies of leverage targets is outside the scope of our model-based analysis. In a review article, Flannery and Hankins (2013) assess different estimation procedures for leverage targets in dynamic panels. The evidence on their performance is mixed, but we choose Flannery and Rangan (2006)'s approach primarily for its computational efficiency in large datasets.

an indicator variable for missing values of R&D expenses, industry-median leverage, and a firm fixed effect. We first estimate (2) to obtain the coefficients $\lambda\beta$ on $X_{i,t-1}$ and $(1-\lambda)$ on $L_{i,t-1}$. We then recover λ and β and estimate $LT_{i,t}$. Finally, we compute leverage gaps as the difference between observed and leverage targets, i.e., as $L_{i,t-1} - LT_{i,t}$.

2.3 Empirical Facts

For the sake of brevity, Table 1 summarizes our key empirical facts. Table 1 reports estimates from cross-sectional regressions of stock returns on leverage variables, size and book-to-market. Reported coefficients are time-series averages of the estimates from monthly cross-sectional regressions. T-statistics are based on Newey-West standard errors with lag-length of 4. In Appendix D, we report a series of robustness checks and sensitivity analyses, which we summarize in Subsection 2.4. The empirical analysis of levered returns involves several variables, such as controls for dispersion in asset returns, size and book-to-market equity, and multiple leverage variables. Cross-sectional regressions, as an empirical procedure, facilitate the simultaneous inclusion of multiple predictors and control variables in the analysis. In contrast, portfolio sorts become impractical when handling more than a few characteristics concurrently. This is due to the limited number of stocks available to populate a sufficient number of diversified portfolios each month.

Fact #1: Leverage is Weakly Related to Average Returns. The two leftmost columns show that leverage has a positive and significant coefficient, which turns out to be insignificant once we control for size and book-to-market equity. In addition, the value-weighted portfolio sorts in Appendix Table A1 show that the result is column (1) is not robust to the weighting scheme, as the spread between decile leverage portfolios is economically small and not statistically significant at the 10 percent level. These results illustrate the well-known "leverage puzzle" that emerges in the empirical literature and that Gomes and Schmid (2010) highlight. In fact, several studies have explored the relationship between leverage and equity returns. Contributions in this area include Bhandari (1988), Fama and French (1992), Penman, Richardson, and Tuna (1992), George and Hwang (2010), Caskey, Hughes, and Liu (2012), and Doshi, Jacobs, Kumar, and Rabinovitch (2019). In particular, Caskey, Hughes, and Liu (2012), like our study, refer to overlevered and underlevered firms based solely on variations in marginal tax benefits, as measured by the "kink" proxy of Graham (2000).

Fact #2: Leverage Gaps are Positively Related to Average Returns. Columns (3) to (5) of Table 1 relate returns to leverage gaps.[10] The coefficient in column (3) is positive and significant at the 1 percent level. When observed leverage and the leverage gap are included in the same specification (column 4), the coefficient on the gap stays positive and significant at the 1 percent level. The coefficient on leverage remains positive, but it is substantially smaller than its counterpart in column (1) and statistically significant at the 10 percent level. One size and book-to-market are included as controls in column (5), the coefficient on the gap remains large, positive and significant. Instead, the coefficient on leverage is close to zero and, as in column (2), it is not statistically significant.

Fact #3: Controlling for Leverage Targets, Leverage is Positively Related to Average Returns. Columns (6) and (7) of Table 1 include both leverage and leverage targets. The estimates in column (5) show that when both leverage variables are in the same regression, the traditional positive relation between leverage and returns is restored, while leverage targets are negatively related to returns. Both variables are statistically significant at the 1 percent level. The specification in column (7), in which size and book-to-market are included as controls, confirms this pattern. As leverage gaps are the difference between leverage and leverage targets, the coefficients on the target in columns (6) and (7) have the same magnitude but the opposite sign of the ones on leverage gaps in columns (4) and (5).

2.4 Robustness and Sensitivity Analyses

In Appendix D, we implement a series of robustness checks and sensitivity analyses. Table A2 shows that the results in Table 1 continue to qualitatively hold if leverage is measured at book values or net of cash, as this occasionally affects results in the literature.[11] Table A3 includes investment and profitability factors as additional controls for heterogeneous asset returns, as the q-factor model of Hou, Xue, and Zhang (2015) and the five-factor model of Fama and French (2016) suggest. Although some coefficients are smaller in magnitude, they retain the same signs in Table 1 and they are statistically significant. Finally, Table A4 explores alternative reduced-form measures

[10] This pattern is confirmed by the portfolio sorts in Appendix Table A1.

[11] See, for example, George and Hwang (2010) and Ozdagli (2012). The analysis of market versus book measures of leverage for the mapping between data and structural models is beyond the scope of this paper. For a detailed discussion on this topic, see Bretscher, Feldhütter, Kane, and Schmid (2020).

Table 1
EMPIRICAL FACTS ON LEVERAGE AND RETURNS

The table reports coefficient estimates of Fama-MacBeth cross-sectional regression of monthly stock returns on leverage variables and controls. The sample includes all Compustat firms traded on NYSE, AMEX and NASDAQ between 1965 and 2020 and covered by the Center of Research in Security Prices (CRSP). Leverage targets and leverage gaps are the results of the rolling estimation procedure described in Section 2. Years from 1965 to 1979 are used as a "burn in" period. Annual accounting variables are matched to monthly returns from July 1980 to December 2020 following the standard procedure of Fama and French (1992). t-statistics are in parentheses. R^2 and NObs denote the cross-sectional R-squared and the number of observations respectively. All variables are described in Appendix A. The symbols (***), (**) and (*) denote statistical significance at the 1, 5, and 10 percent levels, respectively.

	Dependent Variable: Monthly Stock Return						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Leverage	0.91***	0.24		0.62*	0.18	1.74***	0.97***
	(2.60)	(0.81)		(1.95)	(0.63)	(4.39)	(2.92)
Lev. Gap			1.70***	1.12***	0.79***		
			(4.63)	(3.59)	(2.81)		
Lev. Target						-1.12***	-0.79***
						(-3.59)	(-2.81)
Size		-0.21***			-0.18***		-0.18***
		(-4.98)			(-4.84)		(-4.84)
Be/Me		0.16***			0.10*		0.10*
		(2.65)			(1.76)		(1.77)
R^2	0.01	0.02	0.01	0.01	0.02	0.01	0.02
N. Obs.	1,268,024	1,221,746	910,904	910,904	880,452	910,904	880,452

of leverage targets. In fact, existing studies have pointed out numerous challenges associated with partial-adjustment models for leverage targets, such as Lemmon, Roberts, and Zender (2008) and Chang and Dasgupta (2009).For example, while Lemmon, Roberts, and Zender (2008) argue that capital structure is persistent and driven by an invariant firm-specific determinant, DeAngelo and Roll (2015) find marked differences across leverage cross-sections a few years apart. The results are in line with the baseline ones.

3 The Model

In this section, we lay out a dynamic model, which serves as a basis for the quantitative analysis in Section 4. In the model, firms are ex-post heterogeneous as they are exposed to idiosyncratic productivity shocks. We also introduce aggregate shocks, which affect firms' profitability and discount rates, to better study the role of differences in leverage targets across firms. Every period, firms make endogenous financing and investment decisions. Moreover, firms are financially constrained as external equity is costly and firms can endogenously default on their debt. Finally, firms have limited financial flexibility as they bear costs of adjusting their capital structure. Section 3.1 describes the infinite-horizon setup. Section 3.2 illustrates the economic mechanism at work in a two-period version of the model and suggests an interpretation of the empirical patterns in Section 2 through the lens of the model. Section 3.3 discusses the definition of a dynamic leverage target. Section 3.4 specifies the functional forms used in the quantitative analysis and describes the numerical solution method.

3.1 Setup

Technology and Investment. Time is discrete. We consider the problem of a value-maximizing firm i in a perfectly competitive environment. In each period t, the after-tax operating profits $\Pi_{i,t}$ are given by

$$\Pi_{i,t} = (1-\tau) f(A_t, Z_{i,t}, K_{i,t}), \tag{3}$$

where $\tau \in (0,1)$ is the corporate tax rate, $K_{i,t}$ is firm i's capital stock, $f(A_t, Z_{i,t}, K_{i,t})$ is a production function, A_t is an exogenous aggregate shock, and $Z_{i,t}$ is a firm-specific shock. The variables A_t and $Z_{i,t}$ can be interpreted as shocks to demand, input prices, or productivity. We assume that $f(\cdot)$ is strictly increasing, strictly concave, and differentiable in capital $K_{i,t}$. A_t and $Z_{i,t}$ have bounded support $\mathcal{A} = [\underline{A}, \overline{A}]$ and $\mathcal{Z} = [\underline{Z}, \overline{Z}]$, respectively. The law of motion of A_t is described by a Markovian transition function $Q_A(A_t, A_{t+1})$. Similarly, $Z_{i,t}$ is Markovian with transition function $Q_Z(Z_{i,t}, Z_{i,t+1})$.

At the beginning of each period, firms can scale operations by choosing investment $I_{i,t}$ in physical capital. Next period's capital stock $K_{i,t+1}$ satisfies the standard law of motion for capital accumulation

$$K_{i,t+1} = (1-\delta) K_{i,t} + I_{i,t}, \tag{4}$$

where $\delta \in (0,1)$ is the depreciation rate of capital.

Financing. Investment and distributions to shareholders can be financed with either the internal funds generated by operating profits or new issues. The latter can take the form of new debt (net of repayments) or external equity.

We denote the firm's debt stock as $B_{i,t}$. Outstanding debt pays a coupon $c_{i,t}$ per unit of time. As we detail below, the coupon is set in competitive credit markets to compensate expected bankruptcy costs in case of default, in which lenders recover an amount $R_{i,t}$. Firms are allowed to refinance their debt stock by issuing a net amount $\Delta B_{i,t} = B_{i,t+1} - B_{i,t}$.

Similar to Croce, Kung, Nguyen, and Schmid (2012) and Belo, Lin, and Yang (2014), firms incur costs $\Lambda^B(\Delta B_{i,t}) \geq 0$ of adjusting their debt stock. In our quantitative analysis, we choose a flexible parameterization for $\Lambda^B(\Delta B_{i,t})$ to allow for asymmetries and possibly large marginal costs for small adjustments. Having a flexible reduced-form functional form allows us to keep the model tractable without committing to a specific microfoundation. In fact, debt adjustment costs can arise from several quantitatively relevant sources, including underwriting and management spreads (e.g., Fischer, Heinkel, and Zechner, 1989; Strebulaev, 2007), seniority issues that prevent firms from making large changes in the capital structure (e.g., Acharya, Bharath, and Srinivasan, 2007), costs associated with the liquidation of short-term debt (Diamond, 1991), and agency costs associated with long-term debt (e.g., debt overhang and underinvestment as in Myers, 1977).

Firms can also raise external finance through seasoned equity offerings (SEOs). Let $E_{i,t}$ denote the equity issuances. Following the extensive existing literature, we consider equity issuance costs $\Lambda^E(E_{i,t}) \geq 0$. We interpret negative values for $E_{i,t}$ as equity payouts.

Investment financing decisions must satisfy the firm's budget constraint, which takes the form of the following accounting identity between uses and sources of funds:

$$\Pi_{i,t} + \Delta B_{i,t} + E_{i,t} + \tau\delta K_{i,t} + \tau c_{i,t} = I_{i,t} + c_{i,t}B_{i,t} + \Lambda^B(\Delta B_{i,t}), \tag{5}$$

where the terms $\tau\delta K_{i,t}$ and $\tau c_{i,t}$ reflect the tax deductibility of depreciation and interest expenses, respectively. Net distributions to shareholders, $D_{i,t}$, are then defined as equity payout net of issuance costs, i.e.,

$$D_{i,t} = -E_{i,t} - \Lambda^E(E_{i,t}). \tag{6}$$

Valuation. We assume the absence of arbitrage opportunities in financial markets, which implies the existence of a stochastic discount factor $M_t > 0$ (e.g., Harrison and Kreps, 1979). Define $V_{i,t}$ as the equity value of the firm. We assume that shareholders strategically default on their debt obligations if $V_{i,t} < 0$. Thus, interest payments $c_{i,t}$ are determined endogenously as follows:

$$B_{i,t+1} = \mathbb{E}_t \left[M_{t+1} \{ (1 + c_{i,t+1}) \, B_{i,t+1} \chi_{\{V_{i,t+1} \geq 0\}} + R_{i,t+1} \chi_{\{V_{i,t+1} < 0\}} \} \right], \tag{7}$$

where $\chi_{\{\cdot\}}$ is an indicator function that takes: value 1 when the event $\{\cdot\}$ happens; value 0 when the event $\{\cdot\}$ does not happen.

In our baseline infinite-horizon economy, the firms' maximization problems admit a recursive formulation. Specifically, each firm i at each date t is characterized by the state vector $S_{i,t} \equiv \{K_{i,t}, B_{i,t}, c_{i,t}, Z_{i,t}, A_t\}$ and a corresponding equity value given by the function $V_{i,t} = V(S_{i,t})$. In this context, equity holders choose (i) investment $I_{i,t}$, (ii) debt issuance $\Delta B_{i,t}$, and (iii) make default decisions such that the function $V(S_{i,t})$ satisfies the functional equation

$$V(S_{i,t}) = \max \left\{ 0, \max_{I_{i,t}, \Delta B_{i,t}} \; D_{i,t} + \mathbb{E}_t[M_{t+1} \cdot V(S_{i,t+1})] \right\}, \tag{8}$$

subject to: (i) the law of motion for capital (4), (ii) the firm's budget constraint (5), and (iii) the debt's pricing equation (7). Note that leverage, leverage gaps, and leverage targets are ultimately determined by the model's state variables $S_{i,t}$. However, when we analyze our quantitative results and compare them to the data, we avoid depending on this direct mapping to derive a more insightful characterization and empirical predictions. As elaborated on in Section 3.3, this approach aligns well with established practices in the literature on levered risk premia, and it is also commonly seen in other contexts, like when corporate investment is linked to Tobin's Q (e.g., Hayashi, 1982).

3.2 Economic Mechanism in a Two-Period Version of the Model

To investigate the underlying economic mechanism, we consider a two-period version of the model, with dates denoted as $t = 1, 2$. This streamlined setting offers convenient analytical solutions to effectively characterize both leverage dynamics and levered returns. The key results extend the first and second propositions of Modigliani and Miller (1958) to a tradeoff economy with limited financial flexibility. To serve our purpose of illustration, we make the following assumptions.

Assumptions. First, each firm i defaults at $t = 2$ with an exogenous probability $1 - \rho_i$, where $\rho_i \in (0,1)$ is a constant probability of solvency. Second, the recovery value R_2 (in case of default at $t = 2$) increases at a constant rate $\xi_K > 0$ with residual capital at $t = 2$ and decreases at a linear rate $\xi_B > 0$ with debt; i.e., $\frac{\partial R_2}{\partial K_2} = \xi_K$ and $\frac{\partial R_2}{\partial B_2} = -\xi_B B_2$. Thus, bankruptcy costs increase more than proportionally with the firms' stock of debt. These two assumptions, which our full model relaxes, enable us to sidestep the analytical computation of the default region while keeping intact the dependency of expected default costs on debt. Third, the cost of equity issuance $E_{i,t}$ is equal to zero. Thus, we focus on a pure tradeoff economy, in which firms are not financially constrained for their investment expenses, but issue debt to trade off their tax benefits and bankruptcy costs. Finally, the firm's costs of adjusting its debt stock are quadratic; i.e., $\Lambda^B(B_2 - B_1) \equiv \frac{\lambda_B}{2}(B_2 - B_1)^2$. Accordingly, large debt adjustments are disproportionately more costly than small adjustments. Relaxing the assumption of cost symmetry still allows for closed-form solutions, though these offer limited additional insights.

Notation. For explanation purposes, it is convenient to adapt the notation as follows. From now on, we refer to firm i more simply as "the firm," and drop the subscript i. We define bankruptcy costs BC_2, tax shields TS_2, and debt repayments (principal plus interest) DR_2 at $t = 2$ as

$$BC_2 \equiv \begin{cases} 0, & \mathcal{D}_2 = 0 \\ R_2^A K_2 - R_2, & \mathcal{D}_2 = 1 \end{cases}, \; TS_2 \equiv \begin{cases} \tau c_2 B_2, & \mathcal{D}_2 = 0 \\ 0, & \mathcal{D}_2 = 1 \end{cases}, \; DR_2 \equiv \begin{cases} (1 + c_2)B_2, & \mathcal{D}_2 = 0 \\ R_2, & \mathcal{D}_2 = 1 \end{cases}, \tag{9}$$

where $\mathcal{D}_2$ is an indicator variable for solvency ($\mathcal{D}_2 = 0$) or default ($\mathcal{D}_2 = 1$) at $t = 2$, and $R_2^A \equiv 1 + r_2^A = 1 + (1 - \tau)\left(f(A_2, Z_2, K_2)/K_2 - \delta\right)$. Given these definitions, the firm pays the following dividend at $t = 2$

$$D_2 = R_2^A K_2 - R_2^D B_2, \tag{10}$$

where $R_2^D \equiv \frac{DR_2 - TS_2 + BC_2}{B_2}$ is the effective ex-post gross return on debt the firm needs to pay in each state.[12] Note that these definitions render the shareholders' recovery value, which is the realization random variable D_2 in the case of default, equal to zero. Moreover, define the rate of payment

[12] Observe that the final dividend D_2 at $t = 2$ from (10) coincides with the one in (5) and (6) when investment and capital structure adjustments are set to zero, consistent with $t = 2$ being the terminal period.

to debt holders r_2^D as a random variable such that: (i) $r_2^D = c_2$ in the case of solvency and (ii) $r_2^D = R_2/B_2 - 1$ in the case of default. Under this definition, the debt pricing equation (7) can be conveniently rewritten as

$$\mathbb{E}_1[M_2(1 + r_2^D)] = 1. \tag{11}$$

The dividend at $t = 1$ is instead given by (5) and is equal to

$$D_1 = R_1^A K_1 - I_1 + B_2 - (1 + (1-\tau))c_1 B_1 - \frac{\lambda_B}{2}(B_2 - B_1)^2,$$

where $R_1^A \equiv 1 + (1-\tau)\left(\frac{\Pi(K_1,A_1,Z_1)}{K_1} - \delta\right)$.

Therefore, the firm chooses capital K_2 and debt B_2, given initial conditions (K_1, A_1, Z_1, B_1, c_1), to maximize the equity value V_1, that is:

$$V_1 = \max_{K_2, B_2} D_1 + \mathbb{E}_1[M_2 \cdot D_2].$$

Optimality Conditions. The first-order condition with respect to K_2 can be written as

$$1 = \mathbb{E}_1\left[M_2\left(1 + (1-\tau)\left(f_K(A_2, Z_2, K_2) - \delta + \frac{1-\rho}{\rho}\frac{\partial R_2}{\partial K_2}\right)\right)\right]. \tag{12}$$

This condition has an intuitive interpretation. The firm finds the optimal investment at the point where the marginal cost of giving up one unit of capital at time 1 equates to the marginal benefit from the future after-tax marginal productivity of capital net of depreciation, and from a lower future coupon. The term $\frac{1-\rho}{\rho}\frac{\partial R_2}{\partial K_2}$ accounts for the lower promised interest payments the firm attains through a higher lender recovery value in default. The constant term $\frac{1-\rho}{\rho}$ captures the idea that, under fair debt pricing, higher recovery values effectively transfer resources from default states (which occur with probability $1-\rho$) to solvency states (which occur with probability ρ).

The first-order condition with respect to B_2 is

$$1 - \frac{\partial \Lambda^B(\Delta B_1)}{\partial B_2} = \mathbb{E}_1\left[M_2\left(1 + (1-\tau)\left(c_2 + \frac{1-\rho}{\rho}\left(\frac{R_2}{B_2} - \frac{\partial R_2}{\partial B_2}\right)\right)\right)\right]. \tag{13}$$

The optimal debt level equalizes its net marginal benefit at time 1 (on the left-hand side) and its expected discounted net marginal cost at time 2 (on the right-hand side). The marginal benefit at $t = 1$ is one additional dollar of debt, net of the adjustment cost that arises from the change in debt. The expected discounted marginal cost at $t = 2$ can be decomposed in two parts. First, the promised repayment $1 + (1 - \tau)c_2$, i.e., the principal plus the coupon, net of tax shields. Second, the term multiplying $\frac{1-\rho}{\rho}$ captures the higher coupon that the firm obtains by marginally increasing its debt stock relative to the recovery value ($\frac{R_2}{B_2}$). This term also takes into account the reduction in the recovery value itself, since $\frac{\partial R_2}{\partial B_2} \leq 0$.

Optimal Policies. An analytical solution for the optimal policy (K_2, B_2) can be obtained using the aforementioned assumptions on the recovery value. Combining equations (11) and (12), we get the following analytical expression for K_2

$$K_2 = f_k^{-1} \left(\frac{r_F - \delta(1-\tau) - (1-\tau)\frac{1-\rho}{\rho}\xi_K}{(1+r_F)(1-\tau)\mathbb{E}_1[M_2 A_2 Z_2]} \right), \tag{14}$$

where we define the riskfree rate $r_F \equiv \mathbb{E}_1[M_2]^{-1} - 1$. Because $f(\cdot)$ is increasing and strictly concave, its derivative $f_k(\cdot)$ is strictly decreasing, hence invertible. Observe that the efficient level of capital K_2 that a firm targets at time 2 is independent from the initial debt stock.

K_2 is decreasing with the term $r_F - \delta(1-\tau)$. The term $r_F - \delta(1-\tau)$ corresponds to the opportunity cost of earning the riskfree rate as a dividend in place of the residual value of capital (net of depreciation and tax shields) for an additional unit of forgone investment. The term $(1-\tau)\frac{1-\rho}{\rho}\xi_K$ captures higher values of K_2 when the recovery rate of capital ξ_K is high, as the firm can lower its debt coupon (net of tax shields). Finally, the denominator is the future marginal product of capital, which provides the firm motives to increase its scale. Within this tradeoff economy, K_2 remains unaffected by the initial capital and debt stocks, as firms can fund their investments by issuing equity, in the absence of capital adjustment costs.[13]

[13] The calibrated model prevents excessive profit volatility through capital structure rebalancing and equity issuance costs.

Equations (11) and (13) yield

$$B_2 = \frac{\lambda_B B_1 + \tau\left(1 - \rho \mathbb{E}_1\left[M_2\right]\right)}{\lambda_B + (1-\tau)(1-\rho)\mathbb{E}_1\left[M_2\right]\xi_B}. \tag{15}$$

The following proposition characterizes the optimal financing policy in terms of leverage gaps.

Proposition 1 ***(Optimal Financing Policy).*** *Given initial conditions K_1, A_1, Z_1, B_1, c_1, the firm optimally:*

a) sets its debt stock B_2 to close a fraction λ_1 of the gap between their initial debt stock B_1 and their target debt stock B_2^*, that is

$$B_2 - B_1 = \lambda_1(B_2^* - B_1), \tag{16}$$

where

$$\lambda_1 = \frac{(1-\tau)(1-\rho)\xi_B}{\lambda_B(1+r_F) + (1-\tau)(1-\rho)\xi_B}, \tag{17}$$

and

$$B_2^* = \frac{\tau(r_F + 1 - \rho)}{(1-\tau)(1-\rho)\xi_B}. \tag{18}$$

b) sets its leverage ratio $\frac{B_2}{K_2}$ according to

$$\frac{B_2}{K_2} - \frac{B_1}{K_1} = \lambda_1\left(\frac{B_2^*}{K_2^*} - \frac{B_1}{K_1}\right) + (1-\lambda_1)\left(\frac{B_1}{K_2} - \frac{B_1}{K_1}\right), \tag{19}$$

with $K_2^* = K_2$.

Proof. See Appendix.

Part a) of Proposition 1 shows that the optimal debt adjustment policy can be understood as a partial adjustment rule. We define the debt gap, $Gap_1^B \equiv B_1 - B_2^*$, as the difference between actual and target debt. Because $\lambda_1 \in [0, 1]$, firms always close a fraction of their gap toward the target. When firms have excess debt compared to their target, they decrease their debt stock, and vice versa, as

$$B_2 - B_1 = -\lambda_1 Gap_1^B.$$

Expression (18) shows that firms target higher debt stock the higher the marginal tax shield in case of solvency. The term that multiplies the tax rate τ in the numerator captures tax-deductible interest expenses, which include the riskfree rate r_F and the credit spread to compensate for default with probability $1-\rho$. The term $(1-\tau)(1-\rho)\xi_B$ is the marginal bankruptcy cost. Higher values of ξ_B reduce the debt recovery rate in the case of default per dollar of debt, since $\frac{\partial R_2}{\partial B_2} = -\xi_B B_2$. The factor $1-\tau$ accounts for the indirect tax benefit of bankruptcy costs, which increases the tax deductible interests in solvency states.

Part b) of Proposition 1 turns to leverage dynamics by looking at adjustments in the firms' debt-to-asset ratios. As for debt stocks, firms close a fraction λ_1 of the gap Gap_1^L between observed and target leverage, defined as

$$Gap_1^L \equiv \frac{B_1}{K_1} - \frac{B_2^*}{K_2^*}.$$

Firms with positive gaps are *overlevered*, i.e., their observed leverage is above the target, while firms with negative gaps are *underlevered*. Hence, equation (19) can be rewritten as:

$$\frac{B_2}{K_2} - \frac{B_1}{K_1} = -\lambda_1 Gap_1^L + (1-\lambda_1)\left(\frac{B_1}{K_2} - \frac{B_1}{K_1}\right).$$

The term $(1-\lambda_1)\left(\frac{B_1}{K_2} - \frac{B_1}{K_1}\right)$ accounts for the indirect effect of investment on debt-to-asset ratios. Firms that increase their scale (i.e., $K_2 > K_1$) effectively reduce their leverage even without actively issuing (or withdrawing) debt with respect to their initial stock B_1. If the firm starts at the efficient level of capital at $t = 1$ (i.e., $K_1 = K_2$), then the overlevered firms always reduce their leverage, and the underlevered firms always increase it, similar to the debt policy in (16). Occasionally, the firm can move away from the target by disinvesting enough to increase its debt-to-asset ratio if overlevered, or by expanding enough to reduce it if underlevered.[14] Similarly, the firm can "overshoot" and choose a leverage ratio even higher then the target leverage when overlevered, or even lower than its target leverage when underlevered.[15] In an environment with full financial flexibility, i.e., $\lambda_B = 0$, it follows that $B_2 = B_2^*$, and $\lambda_1 = 1$. λ_1 decreases with λ_B, as financial

[14]Formally, this occurs when the "passive" change in leverage due to the indirect effect of the denominator is large enough in absolute value, i.e., $\frac{B_1}{K_2} - \frac{B_1}{K_1} > -\frac{\lambda_1}{1-\lambda_1} Gap_1^L$ for overlevered firms, and $\frac{B_1}{K_2} - \frac{B_1}{K_1} < -\frac{\lambda_1}{1-\lambda_1} Gap_1^L$ for underlevered firms.

[15]This requires that firms, despite being underlevered, have excess debt, i.e., $B_1 > B_2^*$. Symmetrically, overlevered firms "overshoot" when $B_1 < B_2^*$.

flexibility is helpful in closing gaps.[16]

Financial Flexibility and Equity Returns. We now investigate the impact of limited financial flexibility on the firm's stock return. Since $V_1 = D_1 + \mathbb{E}_1[M_2 D_2]$ is the cum-dividend equity value of the firm, $P_1 = V_1 - D_1$ is the (ex-dividend) stock prices at time $t = 1$, P_2 at $t = 2$ is zero because there are no more cash flows after that time, and the realized firm's stock return R^E is defined as

$$R_2^E = \frac{D_2}{\mathbb{E}_1[M_2 D_2]}. \tag{20}$$

Proposition 2 ***(Financial Flexibility and Equity Returns).*** *Given initial conditions K_1, A_1, Z_1, B_1, c_1:*

a) realized equity returns of the firm between $t = 1$ and $t = 2$ are related to leverage targets and gaps through the following relationship:

$$R_2^E = \frac{R_2^A}{\gamma_A(K_2)} + \frac{B_2\gamma_D(B_2)}{K_2\gamma_A(K_2) - B_2\gamma_D(B_2)}\left(\frac{R_2^A}{\gamma_A(K_2)} - \frac{R_2^D}{\gamma_D(B_2)}\right), \tag{21}$$

where $\gamma_A(K_2) = \mathbb{E}_1[M_2 R_2^A]$, and $\gamma_D(B_2) \equiv 1 + \frac{\mathbb{E}_1[M_2 BC_2] - \mathbb{E}_1[M_2 TS_2]}{B_2}$;

b) the debt adjustment factor $\gamma_D(B_2)$ is linked to leverage gaps as follows:

$$\gamma_D(B_2) = 1 + \kappa_1 K_2 Gap_2^L + (1-\rho)\mathbb{E}_1\left[M_2 \frac{R_2^A}{\frac{B_2}{K_2}} \middle| DEF_2 = 1\right], \tag{22}$$

where $Gap_2^L = \frac{B_2}{K_2} - \frac{B_2^*}{K_2^*}$, $\kappa_1 \equiv \frac{(1-\tau)(1-\rho)\xi_B}{1+r_F}$, and the notation $\mathbb{E}_1[\cdot|DEF_2 = 1]$ indicates the conditional expectation in case of default.

Proof. See Appendix.

Part a) of Proposition 2 can be seen as an amendment of the celebrated second proposition of Modigliani and Miller (1958), which is a special case of (21) with $\gamma_D(B_2) = 1$ and $\gamma_A(K_2) = 1$.[17]

[16] Observe that the dynamics for debt and leverage in Proposition 1 can be alternatively characterized using the gap with respect to the current debt/leverage (in other words, the "residual gap" after adjustment), that is, $Gap_2^B \equiv B_2 - B_2^*$ and $Gap_2^L \equiv \frac{B_2}{K_2} - \frac{B_2^*}{K_2^*}$. In this case, one obtains $B_2 - B_1 = -\frac{\lambda_1}{1-\lambda_1} Gap_2^B$, and $\frac{B_2}{K_2} - \frac{B_1}{K_2} = -\frac{\lambda_1}{1-\lambda_1} Gap_2^L$.

[17] As in the original second proposition of Modigliani and Miller, leverage would appear as the debt-to-equity ratio $\frac{B_2}{K_2 - B_2}$ in this limiting case. As the debt-to-equity ratio is a monotone increasing function of the debt-to-asset ratio, this definition does not alter the qualitative leverage-returns relationship.

As in Modigliani and Miller (1958), taking expectations of (21) offers a relation between ex-ante expected returns and capital structure. Part b) instead establishes a link between the equity premia of the left-hand side of (21) and financial flexibility through leverage gaps.

The expression of the debt adjustment factor $\gamma_D(B_2)$ in part a) illustrates how the textbook positive relationship between leverage and expected returns breaks down in our setup. Due to the existence of bankruptcy costs and tax shields, the cost of each dollar of debt for the company R_2^D is not equal to the market return on debt for debt holders $1 + r_2^D$. The net cost to leverage (e.g., Korteweg, 2010), which is the difference between the average bankruptcy costs and tax shields, is denoted by the term $\frac{\mathbb{E}_1[M_2 BC_2] - \mathbb{E}_1[M_2 TS_2]}{B_2}$ in $\gamma_D(B_2)$. Since $\gamma_D(B_2)$ multiplies B_2 in (21), an amplification effect is created if $\gamma_D(B_2) > 1$ and average bankruptcy costs exceed average tax shields in correspondence of optimal leverage choices. Vice versa, a dampening effect arises if $\gamma_D(B_2) < 1$ and average tax shields are larger than average bankruptcy costs. As in Modigliani and Miller (1958), capital structure propagates both good and bad cash flow outcomes (asset risk) to equity payouts. In contrast, the relation between leverage and returns is influenced not only by the amount of debt B_2, but also by the net cost that equity holders bear per dollar of debt.[18]

Part b) of Proposition 2 establishes a connection between the adjustment factor and limited financial flexibility, and illustrates how leverage gaps mediate this relationship. Intuitively, the optimality condition (13) shows that optimal capital structure choices balance the marginal costs of capital structure rebalancing with the wedge between marginal tax shields and bankruptcy costs. Thus, changes in leverage impact the adjustment factor, as financial flexibility, as captured by $\Lambda^B(\Delta B_1)$, depends on debt adjustments ΔB_1. As Proposition 1 establishes, optimal leverage dynamics entail partially closing leverage gaps. As a consequence, leverage gaps enter the adjustment factor $\gamma_D(B_2)$ in (22).

Expression (22) theoretically predicts that equity returns are positively linked to leverage gaps, along the lines of the empirical evidence in Table 1. Leverage gaps Gap_2^L load on $\gamma_D(B_2)$ with a positive sign.[19] All else being equal, shareholders of overlevered firms (positive gaps) bear larger costs per dollar of debt than underlevered firms (negative gaps), controlling for observed leverage.

[18]As the present values of tax shields and bankruptcy costs in $\gamma_D(B_2)$ are computed using the pricing kernel M_2, their risks are priced as they cannot be diversified away.

[19]Empirically, using Gap_1^L in place of Gap_2^L has negligible effects on the results.

Given the optimal policy investment and financing policy B_2 and K_2, the ratio $\frac{B_2\gamma_D(B_2)}{K_2\gamma_A(K_2)-B_2\gamma_D(B_2)}$ increases in leverage gaps, and so does the spread $\mathbb{E}_1\left[\frac{R_2^A}{\gamma_A(K_2)}-\frac{R_2^D}{\gamma_D(B_2)}\right]$.

The relationship between leverage and returns remains ambiguous, even controlling for leverage gaps. Crucially, financial flexibility plays a key role, as firms might choose the same leverage ratio $\frac{B_2}{K_2}$, but have different leverage gaps. Controlling for gaps Gap_2^L, a higher leverage $\frac{B_2}{K_2}$ is associated with a lower adjustment factor. The term $(1-\rho)\mathbb{E}_1\left[M_2\frac{R_2^A}{\frac{B_2}{K_2}}\middle| DEF_2=1\right]$ in (22) is the expected cost per dollar of debt in the event of bankruptcy, equating to the expected return on levered assets during default. Thus, as leverage increases, the cost for equity holders per dollar of debt decreases. The expression of R_2^E in part a) reveals that the adjusted financial leverage ratio $\frac{B_2\gamma_D(B_2)}{K_2\gamma_A(K_2)-B_2\gamma_D(B_2)}=\frac{\frac{B_2}{K_2}\gamma_D(B_2)}{\gamma_A(K_2)-\frac{B_2}{K_2}\gamma_D(B_2)}$ can either increase or decrease in leverage, due to the combined effect of $\frac{B_2}{K_2}$ and $\gamma_D(B_2)$, which attenuates the textbook leverage amplification effect. Finally, the effect of leverage $\frac{B_2}{K_2}$ on the expected debt cost to the firm $\mathbb{E}_1[R_2^D]$ potentially depends on parameterizations, which determine the average tax shields and bankruptcy costs in correspondence of the debt level B_2.

Naturally, the heterogeneity in asset returns R_2^A can also confound the relationship between leverage and gaps and expected equity returns.[20] As standard in the literature, the reduced-form evidence in Table 1 includes variables that capture differences in the riskiness of firms' assets in place and growth options, namely size and book-to-market equity (e.g., Gomes and Schmid, 2010).[21]

Which effects are empirically more relevant is a quantitative question, on which our analysis in Section 4 offers insights. The reduced-form evidence in Table 1 suggests that the ambiguity in the returns-leverage relationship resolves when target leverage is included as a predictor. Since the leverage gap Gap_2^L is the difference between observed leverage and target leverage, the adjustment factor in (22) can be equivalently expressed as

$$\gamma_B(B_2)=1+\kappa_1K_2\left(\frac{B_2}{K_2}-\frac{B_2^*}{K_2^*}\right)+(1-\rho)\mathbb{E}_1\left[M_2\frac{R_2^A}{\frac{B_2}{K_2}}\middle| DEF_2=1\right]. \tag{23}$$

[20] In Appendix B, we show that $\gamma_A(K_2)$ is constant in K_2 for a production function which is homogeneous of degree α in K_2, such as the Cobb-Douglas with decreasing returns to scale we use in the following quantitative analysis. Notice that, in our economy, $\mathbb{E}_1[M_2R_2^A]$ is not equal to one because of decreasing returns to scale. This is the case only when $\alpha=1$, which however is incompatible with an interior solution for K_2.

[21] Hou, Xue, and Zhang (2015) interpret these variables in a neoclassical production economy with endogenous investment. Table A3 shows the results in Table 1 are robust to the inclusion of investment and profitability.

A comparison of the expressions for $\gamma_B(B_2)$ in (22) and (23) suggests that, controlling for leverage targets instead of leverage gaps, helps revive the classic leverage amplification effect on equity returns. Although the relationship between leverage and returns is still formally ambiguous, the term $\left(\frac{B_2}{K_2} - \frac{B_2^*}{K_2^*}\right)$, in lieu of Gap_2^L, adds an additional dimension through which leverage loads positively on the debt adjustment factor. In this specification, target leverage is negatively related to returns, as it loads negatively on $\gamma_B(B_2)$. Intuitively, leverage is less risky for firms with high leverage targets, as their capital structure yields high tax shields compared to bankruptcy costs, as Proposition 1 shows.

3.3 Defining a Dynamic Target

To define a dynamic leverage target, we follow the "gap approach," which has been extensively used to describe costly adjustments of production factors (e.g., Sargent, 1978; Caballero and Engel, 1993; Cooper and Willis, 2004; King and Thomas, 2006; Bayer, 2009). These studies consider adjustments toward a dynamic target, which is termed as the frictionless target. The latter corresponds to the level of a production factor to which an optimizing agent would eventually adjust in the absence of changes in the stochastic variables. More formally, the frictionless target is constructed as the policy function in which adjustment costs are removed for a single period.

In our setup, the frictionless target debt stock $B_{i,t}^* = B_{i,t} + \Delta B_{i,t}^*$ can be obtained from the following optimization problem:

$$\max_{I_{i,t}^*, \Delta B_{i,t}^*} \{0, D_{i,t}^* + \mathbb{E}_t[M_{t+1} \cdot V_{i,t+1}^C]\}, \tag{24}$$

where $D_{i,t}^*$ is the equity payout in which current-period debt adjustment costs are removed, i.e., $\Lambda(\Delta B_{i,t}) = 0$. The continuation value $V_{i,t+1}^C$ is computed using the value function $V_{i,t}$ in (8), as adjustment costs are set to zero only for the current period. We then compute the target leverage ratio as $\frac{B_{i,t}^*}{K_{i,t}^*}$, where $K_{i,t}^* = K_{i,t} + I_{i,t}^*$. As in the gap approach, our dynamic target can be interpreted as the capital structure that, conditional on today's state of the world, optimally positions the firm to deal with the uncertain funding needs it may have in the future. Accordingly, leverage gaps can be defined as $Gap_{i,t}^L = \frac{B_{i,t}}{K_{i,t}} - \frac{B_{i,t}^*}{K_{i,t}^*}$.

An important observation is worth noting. Optimal policy functions, encompassing leverage, leverage gaps, and leverage targets, are ultimately functions of the model's state variables. In this context, however, the direct mapping between state variables (debt stock, capital stock, coupon, and shocks) and equity returns is less revealing compared to the relationships involving control variables and their transformations, particularly leverage, gaps, and targets. This is highlighted from the statements of Propositions 1 and 2. Factoring in these leverage variables allows for a more insightful characterization of empirical predictions concerning leverage dynamics and levered returns. This remark aligns seamlessly with the body of literature surrounding stock market valuations of levered firms. Stemming from the renowned Proposition 2 of Modigliani and Miller (1958) (which our Propositions 1 and 2 generalize), this research stream focuses on the correlation between leverage choices and equity returns, rather than directly mapping onto state variables, as done in the dynamic models of Gomes and Schmid (2010), Bhamra, Kuehn, and Strebulaev (2010), and Obreja (2013), among others. Another illustrative example is the extensive body of work connecting corporate investment to Tobin's Q. In this context, the investment-Q relationship has been exhaustively researched as opposed to the direct correlation with state variables, such as the current capital stock and productivity shocks (for instance, see Hayashi, 1982, Erickson and Whited, 2000, Peters and Taylor, 2017, Andrei, Mann, and Moyen, 2019).

Three remarks are in order. First, the dynamic frictionless target encompasses the definition of target in the two-period setup of Section 3.2 as a special case, as the target debt stock B_2^* in (18) is obtained by removing adjustment costs of capital structure at $t = 1$ ($\lambda_B = 0$), the only period in which firms bear them. Adda and Cooper (2003) offer another interpretation of the frictionless target debt, which extends to linear-quadratic problems and applies to the simplified setup in Section 3.2. Specifically, the frictionless target is a fixed point of the debt policy function. It is immediate to verify that this is the case in (16), as $B_2^*{=}B_2$ only when adjustment costs of capital structure are zero and $\lambda_1 = 1$. Second, the frictionless target generally differs from the static target, defined as the debt level that would arise if there were never any costs of adjustments (e.g., Cooper and Willis, 2004; Bayer, 2009). The static and the frictionless targets coincide in the simple illustrative model of Section 3.2. However, due to its dynamic nature, the frictionless target more closely maps onto the reduced-form empirical specifications commonly used in the empirical corporate finance literature, in which the target depends on firm-level variables (e.g., Flannery and

Rangan, 2006; Lemmon, Roberts, and Zender, 2008).[22] Third, the structure of our model does not mechanically impose convergence to the target. Thus, the calibrated model serves as a lab to quantify to what extent firms adjust their capital structure toward the target.

3.4 Functional Forms and Model Solution

Functional Forms. To carry out our quantitative analysis, we add structure to the model with the following functional forms. The production function is a Cobb-Douglas $f(A_t, Z_{i,t}, K_{i,t}) = A_t Z_{i,t} K_{i,t}^{\alpha} - F$, where $\alpha \in (0,1)$, A_t is an exogenous aggregate shock, $Z_{i,t}$ is a firm-specific shock, and $F > 0$ is a fixed production cost. We assume A_t and $Z_{i,t}$ follow AR(1) processes such that:

$$\log A_t = \mu_A(1-\rho_A) + \rho_A \log A_{t-1} + \sigma_A \varepsilon_t^A,$$
$$\log Z_{i,t} = \rho_Z \log Z_{i,t-1} + \sigma_Z \varepsilon_{i,t}^Z.$$

As ε_t^A and $\varepsilon_{i,t}^Z$ are truncated standard normal variables, both A_t and $Z_{i,t}$ are lognormal, with mean $\mu_A \in (-\infty, \infty)$ and 0, persistence $\rho_A \in (0,1)$ and $\rho_Z \in (0,1)$, and volatility $\sigma_A \in (0,\infty)$ and $\sigma_Z \in (0,\infty)$, respectively.[23]

We choose a flexible linear-exponential (LINEX) functional form (e.g., Varian, 1975; Kim and Ruge-Murcia, 2009; Aruoba, Bocola, and Schorfheide, 2017) for the capital structure rebalancing costs, i.e.,

$$\Lambda^B(\Delta B_{i,t}) = \lambda_B(e^{\gamma_B \Delta B_{i,t}} - \gamma_B \Delta B_{i,t} - 1), \tag{25}$$

with $\lambda_B \in (0,\infty)$ and $\gamma_B \in (-\infty,\infty)$. In our context, the LINEX adjustment cost function is attractive as it parsimoniously captures limited financial flexibility arising from different sources we do not explicitly model. Varying only two parameters, the "scale" λ_B and the "asymmetry" γ_B, $\Lambda(\Delta B_{i,t})$ spans a broad spectrum of functional forms.[24] As previous studies provide limited guidance on functional forms and economic magnitudes for the overall debt adjustment costs firms face, we exploit data restrictions to calibrate them to realistic values in the context of our model.

[22] DeAngelo, DeAngelo, and Whited (2011) consider a static long-run target to which firms would converge after receiving neutral shocks for many periods in a row.

[23] As common in the literature, we set the mean of firm-specific shocks to zero (e.g., Hennessy and Whited, 2007; Gomes and Schmid, 2010).

[24] The LINEX functional form nests the quadratic form as an approximation for $\gamma_B \to 0$.

Altınkılıç and Hansen (2000) provide empirical support for the convex nature of debt issuance costs in the context of straight bond underwriting fees. Their findings instead suggest that fixed costs constitute a minor portion, specifically 10.4% of underwriter spreads.[25]

Following Hennessy and Whited (2007) and Gomes and Schmid (2021), lenders recover a fraction $\xi \in (0,1)$ of firm i's capital stock in bankruptcy, that is, $R_{i,t} = \xi K_{i,t}$. Different from the illustration model in Section 3.2 with exogenous default, we do not explicitly link ex-post realized bankruptcy costs to the stock of debt $B_{i,t}$. Since default in now endogenous, however, expected bankruptcy costs are increasing with debt.

Several studies, for example, Gomes (2001) and Falato, Kadyrzhanova, Sim, and Steri (2022), choose equity issuance costs $\Lambda(E_{i,t})$ with both a fixed and a proportional component, i.e.,

$$\Lambda^E(E_{i,t}) = (\lambda_0 + \lambda_1 E_{i,t})\chi_{\{E_{i,t}>0\}}, \tag{26}$$

with $\lambda_0 \in [0,\infty)$ and $\lambda_1 \in [0,\infty)$. Considering the extensive adoption of this simple functional form for the quantitative analysis of corporate equity issuance, we utilize it instead of pursuing a more flexible approach like the one for debt adjustment costs.

Following several studies in cross-sectional production-based asset pricing (e.g., Berk, Green, and Naik, 1999; Zhang, 2005), we parameterize the stochastic discount factor of the economy without explicitly modeling the investor's problem. Observe that, however, the qualitative results in 3.2 only require the existence of a stochastic discount factor, and are consistent with arbitrage-free general equilibrium economies. As in Zhang (2005), we assume the following stochastic process for the stochastic discount factor:

$$\log M_t = \log \beta + \gamma_t (A_t - A_{t+1}), \tag{27}$$

where $\beta \in (0,1)$, $\gamma_t = \gamma_0 + \gamma_1(A_t - \mu_A)$, $\gamma_0 \in (0,\infty)$, and $\gamma_1 \in (-\infty, 0)$. This functional form naturally links to the time-varying risk aversion in Campbell and Cochrane (1999), in which γ_0 is interpreted as a "risk aversion" parameter and γ_1 as "habit formation" parameter. However, as we do not model the household problem explicitly, we remain agnostic about the specific sources of time-varying risk aversion.

[25] Other studies, such as Jungherr, Meier, Reinelt, Schott, et al. (2022), also assume convex functional forms.

Model Solution. As the model admits no closed-form solution, we resort to numerical dynamic programming in our quantitative analysis. The model solution is computationally challenging because of three reasons. First, the problem features a large number of state variables and policy functions. Equity and debt values are mutually dependent since the default condition affects the debt pricing equation. In a similar context, Gomes and Schmid (2010) reduce the dimensionality of the state space using total debt commitments as a state variable. However, their approach is not viable in our case because of the presence of debt adjustment costs. Hence, we need to keep track of all five state variables $S_{i,t} \equiv \{K_{i,t}, B_{i,t}, c_{i,t}, z_{i,t}, A_t\}$ separately, for each firm i. Thus, we need to solve jointly for four policy functions: (i) default decisions $\mathcal{I}_{i,t} = \mathcal{I}(S_{i,t})$, (ii) new level of physical capital $K_{i,t+1} = K(S_{i,t})$ after investment, (iii) new debt issuance $B_{i,t+1} = B(S_{i,t})$, and (iv) interest rate schedule $c_{i,t+1} = c(S_{i,t})$. Second, the optimal policy $\mathcal{P}(S_{i,t}) \equiv \{\mathcal{I}(S_{i,t}), K(S_{i,t}), B(S_{i,t}), c(S_{i,t})\}$ is not differentiable because of the presence of the discrete choice to default $\mathcal{I}(S_{i,t})$. Hence, we cannot use a projection method based on first-order conditions; instead, we need to tackle problem (8) directly and reduce the dimensionality by projecting the value function $V(S_{i,t})$ on a non-parametric structure for interpolation. Third, problem (8) contains a forward-looking constraint (i.e., the debt's pricing equation (7)), which pins down the interest rate schedule $c_{i,t+1} = c(S_{i,t})$. Hence, since $c_{i,t+1} = c(S_{i,t})$ enters the future default choices directly, its solution is significantly sensitive to the initial guess of the value function (especially in proximity of the default region). Appendix C details our numerical solution method.

4 Quantitative Analysis

The illustration in Section 3.2 provides intuition for our key results. However, it is too stylized to serve as a basis for a quantitative investigation of its predictions. In this section, we calibrate the quantitative model to U.S. data and present a host of quantitative results.

4.1 Calibration and Model Fit

Table 2 summarizes our baseline calibration. The calibration frequency is monthly. Details about the computation of the model-based and data variables are provided in Appendix A. The model features 17 parameters. The first 8 parameters in the table are on the technology side. We set the curvature of the profit function, α, to 0.4, to roughly match the capital share from the Bureau of Economic Analysis (BEA). This value is similar, for example, to the ones used by Kydland and Prescott (1982), Gomes (2001), and Gomes, Jermann, and Schmid (2016). The depreciation rate δ is set to be 0.01. This is a fairly common value in the literature, as it implies an annual rate of roughly 12%. This value is in line with the empirical estimates in Cooper and Haltiwanger (2006) and comparable to those used by previous studies. For example, Gomes (2001) uses a depreciation rate of 0.145, while Hennessy and Whited (2005) estimate a value of 0.10. We choose the persistence of the aggregate productivity process, ρ_A, and its volatility, σ_A, to be $0.95^{\frac{1}{3}}$ and 0.007/3, respectively. These monthly values correspond to 0.95 and 0.007 at the quarterly frequency, consistent with several studies, including Cooley and Prescott (2021), Zhang (2005), and Gomes, Jermann, and Schmid (2016). We normalize the average aggregate productivity, μ_A, to -2. μ_A is purely a scaling constant that determines the long-run average scale of the economy. As in Zhang (2005), we calibrate the persistence ρ_Z and volatility σ_Z of the idiosyncratic shock process to 0.97 and 0.1, respectively. The fixed cost of operation, F, is chosen to approximately match average profitability in our sample, which leads to a value of 0.18 (or 2.25% of the average capital stock).

The next three parameters describe the dynamics of the pricing kernels. We choose β, γ_0, and γ_1 to minimize mean square errors with respect to three aggregate data moments, namely the average Sharpe ratio, the average risk-free rate, and its volatility (as in Zhang, 2005). This procedure yields $\beta = 0.9928$, $\gamma_0 = 52.71$, and $\gamma_1 = -50.19$.

The remaining six parameters are on the financing side. We pick the fixed and proportional equity flotation costs, λ_0 and λ_1, to be 0.5 and 0.025. Like, for example, Kuehn and Schmid (2014) and Bolton, Wang, and Yang (2021), we choose λ_0 to approximately match the frequency of equity issuance in the data. For the proportional component λ_1, we pick the same value as in Gomes and Schmid (2010), who also study levered returns. This is also close to Gomes (2001), who chooses 0.028, based on regressions of flotation costs on amount issued. We choose the recovery rate parameter ξ to be 0.125 of the firm's capital stock. This implies an average debt recovery rate of 53.9%, which is close to the 51% recovery rate for creditors when the firm defaults in Huang and Huang (2012).

We calibrate the debt adjustment cost parameters λ_B and γ_B to approximately target the average debt issuance and the frequency of default in our sample, respectively. The scale parameter

λ_B affects the marginal cost of issuing debt and, in the model, discourages the use of external debt financing. Instead, positive values of γ_B imply that issuing debt is more costly than withdrawing debt. Thus, the lower γ_B (i.e., negative large values), the more likely firms default due to their inability of reducing leverage following negative shocks. These values imply an average cost of issuing debt, as a share of the total amount of debt issued, that is toward the lower end of the range used by Strebulaev (2007). The average costs of reducing debt as the total amount of debt withdrawn are roughly 30% larger than issuance costs. Overall, the magnitude of debt adjustment costs suggests that, as in Fischer, Heinkel, and Zechner (1989), Goldstein, Ju, and Leland (2001), and Strebulaev (2007), relatively small adjustment costs significantly affect leverage dynamics. Finally, following Nikolov and Whited (2014), we choose the tax rate τ to be 0.20. This is as an approximation of the statutory corporate tax rate relative to personal tax rates.

Table 2
PARAMETER VALUES

The table reports parameter choices for the calibrated model. The frequency of calibration is monthly.

Category	Description	Symbol	Value
Technology	Capital share	α	0.4
	Depreciation	δ	0.01
	Persistence of aggregate shock	ρ_A	$0.95^{\frac{1}{3}}$
	Standard deviation of aggregate shock	σ_A	0.007/3
	Mean of aggregate shock	μ_A	-2
	Persistence of idiosyncratic shock	ρ_z	0.97
	Standard deviation of idiosyncratic shock	σ_z	0.1
	Mean of idiosyncratic shock	μ_z	0
	Fixed cost of operations	F	0.18
Pricing Kernel	Time discount	β	0.9928
	Constant "risk aversion"	γ_0	52.71
	Time varying "risk aversion"	γ_1	-50.19
Financing	Fixed equity flotation cost	λ_0	0.5
	Proportional equity flotation cost	λ_1	0.025
	Debt recovery in bankruptcy	ξ	0.125
	Debt adjustment cost ("scale")	λ_B	0.4
	Debt adjustment cost ("asymmetry")	γ_B	-0.2
	Corporate tax rate	τ	0.2

Table 3 summarizes the overall model fit under the parameterization reported in Table 2. The table compares model-implied moments, which are tabulated in the first column, with their empirical counterparts, which are tabulated in the second column. Overall, the model does a reasonable job at matching key variables describing the financing policies of U.S. firms. The model matches quite closely the Sharpe ratios, the annual risk-free rate, and the rate's volatility. The model produces a sizable equity premium, which we do not target in the calibration. Both in the model and in the data, this moment is around 6%. The second set of moments in the table refers to firms' real and financial policies. On the real side, the model matches fairly closely average profitability, the volatility and autocorrelation of profitability, and investment ratios. The model does a reasonable job of reproducing average leverage, an untargeted quantity. The model-implied leverage is 21%, a slight overestimation of its data counterpart of 16%. Our parameterization also produces default rates and book-to-market ratios with comparable magnitudes to the data. The third set of moments in the table describe firms' capital structure rebalancing. Debt issuance is 19% in the model, and 22% in the data. Although we target this moment in our calibration, we report model-implied and data moments that describe the relative frequency of positive and negative debt adjustments. The model-implied magnitudes of these additional non-targeted moments are also close to the data. Finally, the frequency of equity issuance in the model is 5%, fairly close to its data value of 4%. Overall, the model provides a reasonably good fit both for moments that serve as targets in the calibration, and for untargeted key statistics.

4.2 Capital Structure Dynamics

Table 4 describes capital structure dynamics around leverage targets under the baseline calibration of Table 2. Panel A breaks down the simulated data into quintiles of leverage gaps. All entries are in percentage points. The top row reports the average leverage gap for each quintile. As leverage gaps are defined as the difference between leverage and the frictionless target defined as in (24), negative (positive) values refer to underlevered (overlevered) firms. The bottom row tabulates the corresponding one-period-ahead changes in leverage. Overlevered firms tend to lever down, while underlevered firms tend to lever up.

Panel B reports model-implied and data estimates of adjustment speeds, both in the model and in the data. Data estimates are from the estimation of the model of Flannery and Rangan (2006) in

Table 3
MOMENTS

The table reports model-implied and data moments for the baseline calibration of Table 2. The model-implied moments are calculated as averages of simulations of 10,000 firms and 2000 time periods. The data source for the Sharpe Ratio and risk-free rate moments is Zhang (2005). The average annual equity return is computed using data from Kenneth French's data library. Default rates are taken from Covas and Den Haan (2011). The remaining data moments are computed from our sample of nonfinancial, unregulated firms from the annual Compustat dataset. All moments are annualized. Details on model and data variable definitions are provided in Appendix A.

	Model	Data
Average Sharpe Ratio	0.43	0.43
Average risk-free rate	0.02	0.02
Volatility of risk-free rate	0.04	0.03
Average equity premium	0.06	0.06
Average profitability	0.16	0.15
Volatility of profitability	0.07	0.09
Autocorrelation of profitability	0.61	0.75
Average investment	0.16	0.14
Average leverage	0.21	0.16
Frequency of default	0.03	0.02
Average book-to-market ratio	0.48	0.57
Average debt issuance	0.19	0.22
Frequency of positive debt adjustments	0.62	0.59
Frequency of negative debt adjustments	0.38	0.41
Frequency of equity issuance	0.05	0.04

(2). As the target is observed within the model, we compute the average speed of adjustment as the average fraction of closed gaps, that is, $\frac{\Delta L_{i,t+1}}{-Gap^L_{i,t}}$, where $\Delta L_{i,t+1} = L_{i,t+1} - L_{i,t}$, and $L_{i,t} = B_{i,t}/K_{i,t}$. Notice that the negative sign in front of $Gap^L_{i,t}$ captures the fact that adjustments toward the target imply that positive values of $Gap^L_{i,t}$ are associated with negative values of $\Delta L_{i,t+1}$, and vice versa. This is because overlevered firms would tend to reduce their leverage (and vice versa), as the non-parametric evidence in Panel A indicates. The average adjustment speed both in the model and in the data is positive and statistically significant at the 1 percent level. In the model firms close slightly lower fractions of their gaps than those implied by reduced-form proxies (0.22 versus 0.33).[26]

[26]Some empirical studies, including Lemmon, Roberts, and Zender (2008), provide estimates of lower adjustment speeds (ranging from 0.2 to 0.25) in the data. These studies utilize the same reduced-form proxies but employ the Blundell-Bond generalized method of moments (GMM) as an estimator.

Taken together, the results in Table 4 suggest that firms adjust their capital structure toward a dynamic target leverage ratio, consistent with the intuition in Proposition 1.

Table 4
Adjustments toward Leverage Targets - Model

Panel A describes firms' capital structure adjustments toward leverage targets under the baseline calibration of Table 2. "Lev. Gap" denotes leverage gaps, (defined as the difference between leverage and target leverage defined as in (24), and "Adjustment" denotes the one-period-ahead change in leverage. Panel B reports model-implied and data estimates of adjustment speeds for the full sample of firms. Data figures are obtained with the measure of target leverage obtained from the estimation of the model of Flannery and Rangan (2006) in Equation (2). Model-implied adjustment speeds are computed as the average fraction of closed gaps. All model-implied quantities are based on simulations of 10,000 firms and 2000 time periods. Leverage gaps and adjustments are multiplied by 100. All variables are defined in Appendix A.

Panel A: Leverage Adjustments					
	Group of Lev. Gap				
	Low	2	3	4	High
Lev. Gap	-5.40	-0.53	0.01	2.31	11.37
Adjustment	3.07	0.41	0.00	-0.44	-3.00

Panel B: Adjustment Speeds		
	Model	Data
All Firms	0.22	0.33

4.3 Revisiting Levered Returns

In Table 5, we present cross-sectional regression estimates of equity returns on various leverage variables, along with size and book-to-market ratios. These estimates are derived from simulated data using the baseline parameterization. Overall, the results suggest that our model is capable of reproducing the empirical patterns highlighted in Section 2.

Table 5 serves as the model-based counterpart to Table 1. Consistent with the findings in Table 1, our results in column (1) of Table 5 reveal a positive relationship between leverage and returns in univariate regressions. This coefficient remains positive even after accounting for the effects of size and book-to-market ratios, as shown in column (2). In column (3), the estimated coefficient on the leverage gap is 0.33. When we include both variables in column (4), this coefficient increases to 0.38, and to 0.45 in column (5), after controlling for size and book-to-market. The coefficients on leverage range from 0.10 to 0.19, which is roughly one-third the magnitude of the coefficients for leverage gaps.[27] Overall, the estimates in columns (1) to (5) align with Proposition 2 and are consistent with the empirical findings presented in Table 5. While the relationship between leverage and returns is weak, our analysis reveals a strong and positive association between leverage gaps and equity returns.

Finally, the results in the two rightmost columns show that, when leverage and leverage targets are included in the same specification, the coefficient on leverage is positive and the one on leverage target is negative. These results support the prediction made by Proposition 2 in Section 3.2, which suggests that the textbook positive relationship between leverage and returns can be restored by controlling for leverage targets.

In summary, the results presented in Table 5 suggest that financial inflexibility plays a crucial role in rationalizing the puzzling empirical patterns surrounding levered returns. Specifically, costly capital structure rebalancing leads to the emergence of leverage gaps, which in turn mediate the relationship between leverage and returns.

Overall, the results in Table 5 suggest that financial inflexibility is key to understand the puzzling empirical patters around levered returns. Costly capital structure rebalancing creates leverage gaps, which mediate the leverage-return relationship. The regression coefficients in Table 5 are not targeted by model calibration, and the mapping between the reduced-form proxies in Section 2 and leverage targets in the model is not exact. Nonetheless, it is reassuring that the sign and relative importance of the coefficients on leverage and leverage gaps are consistent with reduced-form estimates.

[27] Additionally, we explore cross-sectional heterogeneity between large and small firms in Table 7. Notably, the positive leverage-return relationship observed in column (4) after controlling for leverage gaps does not appear to be robust for large firms.

Table 5
EMPIRICAL PATTERNS ON LEVERAGE AND RETURNS - MODEL

The table reports estimated coefficients from cross-sectional regressions of stock returns on leverage ("Leverage"), leverage gaps ("Lev. Gap"), leverage targets ("Lev. Target"), market capitalization ("Size"), and book-to-market equity ("Be/Me") across the entire simulated economy. All figures are based on simulations of 10,000 firms and 2000 time periods under the baseline calibration of Table 2. Note that returns are monthly and expressed in percentage (multiplied by 100), and leverage gaps, leverage targets, and leverage are in levels (not in percentage). Size and Book-to-Market are expressed in log levels. All variables are defined in Appendix A.

Dependent Variable: Monthly Stock Return							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Leverage	0.10	0.11		0.12	0.19	0.50	0.64
Lev. Gap			0.33	0.38	0.45		
Lev. Target						-0.38	-0.45
Size		-0.02			-0.02		-0.02
Be/Me		0.02			0.05		0.05
R^2	0.01	0.02	0.01	0.02	0.04	0.02	0.04

4.4 Effects of Changing Financial Flexibility

Table 6 presents a comparison between counterfactual economies that exhibit varying degrees of financial inflexibility. We implement this comparison by changing the financial inflexibility parameter λ_B around its baseline calibrated value and resolving the model for each λ_B.

Panel A tabulates model-implied estimates of adjustment speeds, which are computed as in Table 4. As expected, the adjustment speeds tend to decrease as the values of λ_B increase, moving from left to right. However, the relationship between inflexibility and adjustment speed is notably nonlinear. Notably, increasing λ_B above its baseline calibrated value does not result in large reductions in the fraction of leverage gaps firms close. This finding suggests that firms encounter significant levels of financial inflexibility, aligning with previous studies that highlight the presence of substantial hysteresis in corporate capital structures (e.g., Hennessy and Whited, 2005; Lemmon, Roberts, and Zender, 2008).

Panel B presents the estimated coefficients obtained from cross-sectional regressions, where stock returns are regressed on leverage and leverage gaps, as well as leverage and leverage targets. The estimates in columns (2) to (5) support the qualitative findings of Proposition 2. Specifically, the results indicate that average returns tend to increase with leverage gaps, while the coefficient on leverage itself is smaller. Additionally, when controlling for leverage targets, returns show an increase in response to leverage. These qualitative patterns are robust across different degrees of inflexibility. However, it is noteworthy that leverage gaps and targets become relatively more influential for higher values of λ_B, as evidenced by the larger magnitudes of their coefficients. In the "full flexibility" benchmark presented in column (1), the coefficients of leverage gaps and targets have no additional explanatory power, as the gaps are null and targets coincide with leverage ratios. This is expected since the financial inflexibility channel is turned off in this scenario.[28]

In summary, our findings indicate that firms encounter substantial financial inflexibility, which hampers their ability to adjust their capital structure. Financial flexibility is priced in the stock market. The return-gap and return-target relationships are more pronounced when financial flexibility is limited.

[28]Appendix Table A5 shows that these patterns persist if we vary equity issuance costs along with the financial inflexibility parameter λ_B. Furthermore, Appendix Table A6 confirms that the findings presented in Panel B of Table 6 remain largely consistent when size and book-to-market equity are included as control variables.

Table 6
COUNTERFACTUALS: INFLEXIBILITY PARAMETER

The table describes capital structure adjustments and levered returns for different degrees of the financial inflexibility parameter λ_B around its baseline calibration. Panel A tabulates model-implied estimates of adjustment speeds for the full sample of firms, computed as the average fraction of closed gaps as in Table 4. Panel B reports the estimated coefficients from cross-sectional regressions of stock returns on leverage ("Leverage"), leverage gaps ("Lev. Gap"), leverage targets ("Lev. Target"), across the entire simulated economy. All figures are based on simulations of 10,000 firms and 2000 time periods. Note that returns are monthly and expressed in percentage (multiplied by 100), and leverage gaps, leverage targets, and leverage are in levels (not in percentage). All variables are defined in Appendix A.

	Full Flex.	(2)	Baseline	(4)	(5)
	$\lambda_B = 0.0$	$\lambda_B = 0.2$	$\lambda_B = 0.4$	$\lambda_B = 0.44$	$\lambda_B = 0.5$
	Panel A: Capital Structure Dynamics				
Adjustment Speed	1.00	0.27	0.22	0.19	0.19
	Panel B: Market Price of Flexibility				
Regression Coefficients	Returns on Gap + Leverage				
Lev. Gap	-	0.25	0.38	0.38	0.38
Leverage	0.08	0.08	0.12	0.12	0.11
	Returns on Target + Leverage				
Lev. Target	-	-0.25	-0.38	-0.38	-0.38
Leverage	0.08	0.32	0.23	0.50	0.49

4.5 Financial Flexibility and Firm Size

Table 7 examines the role of financial flexibility in capital structure adjustments and stock market returns in the cross-section of firms' size. According to Gomes and Schmid (2010), a confounding factor in the relationship between returns and leverage is that, while large mature firms tend to operate with higher leverage than small firms, they differ in terms of riskiness and growth opportunities. These disparities are reflected in heterogeneity in firms' asset returns, resulting in a complex leverage-return relationship. Furthermore, several studies (e.g., Hennessy and Whited, 2005; Nikolov, Schmid, and Steri, 2021) document marked differences in capital structure dynamics between large and small firms.

Panels A and B of Table 7 provide insights into capital structure dynamics around leverage targets for small and large firms, respectively, under the baseline calibration of Table 2. Large firms are defined as those of above-median size, while small firms are those of below-median size. Similar to Table 4, the panels classify firms into quintiles based on their leverage gaps and report the corresponding leverage adjustment for the subsequent period. The results show that overlevered firms, both small and large, tend to decrease their leverage, while underlevered firms tend to increase it. This is reflected in positive adjustments in correspondence of negative leverage gaps. On the one hand, the distribution of leverage gaps for small firms is skewed toward underlevered firms, suggesting that they are more inclined to increase their leverage, possibly to finance their growth initiatives. On the other hand, large firms, which are typically more mature and prioritize efficiency over growth opportunities, are often overlevered.

Panel C expands on these differences by presenting adjustment speeds for small and large firms separately, using both model-based and data estimates. Both the model and the data indicate that small firms exhibit relatively faster adjustment speeds in closing their leverage gaps, consistent with the estimates in Faulkender, Flannery, Hankins, and Smith (2012).This relative difference is more pronounced in the model than in the estimates implied by reduced-form proxies. The convexity of the marginal cost function $\Lambda^B(\Delta B_{i,t})$ is a key driver of this pattern, as larger debt adjustments incur disproportionately higher costs compared to smaller adjustments.

Finally, Panel D turns to cross-sectional regressions of equity returns on leverage measures and controls. In the specifications of columns (1) and (3), which include leverage gaps alongside leverage, gaps have positive coefficients, aligning with the qualitative patterns predicted by Proposition 2. Notably, the coefficient on leverage is negative for large firms. This observation is consistent with Proposition 2's insight that, even when controlling for leverage gaps, the leverage-return relationship remains ambiguous. However, as the estimates in columns (2) and (4) show, the textbook positive relation between leverage and returns is restored for both small and large firms. As before, the estimated coefficient on leverage targets is negative. Quantitatively, the magnitudes of the coefficients for leverage gaps and targets are larger for large firms. This aligns with the intuition from Table 6 that markets discount limited financial flexibility, which is more pronounced for large firms, as evidenced by their slower adjustment speed. Zhang (2005) offers a related intuition, which he refers to as "the inflexibility mechanism," to provide a rationale for the value premium within a neoclassical investment model. Stocks of mature firms burdened with unproductive capital trade at a discount due to their inflexibility in scaling down their operations. In his model, inflexibility breaks down the intuition that growth opportunities necessarily entail higher risk.

Overall, the results presented in Table 7 underscore the significant role of financial flexibility in understanding the dynamics of capital structure and market valuations for both large and small firms. By incorporating leverage gaps and targets to account for limited financial flexibility, we gain valuable insights into the empirical patterns that link financial leverage and stock returns. These findings challenge the view that the relationship between leverage and returns is solely obscured by variations in firms' growth opportunities, as suggested by Gomes and Schmid (2010). Our findings complement theirs, as after controlling for variables that plausibly absorb some heterogeneity in asset returns (e.g., R_2^A in Section 3.2), predictions for levered returns that involve leverage gaps and targets hold across firms of different sizes. As a result, financial flexibility emerges as a primary driver for rationalizing the stock market valuations of levered firms.

Table 7

LARGE VS SMALL FIRMS - MODEL

Panels A and B describe the small and large firms' capital structure adjustments toward leverage targets under the baseline calibration of Table 2. Firms are split into large and small using the median size (total assets in the data, $K_{i,t}$ in the model). "Lev. Gap" denotes leverage gaps, (defined as the difference between leverage and target leverage), and "Adjustment" denotes the one-period-ahead change in leverage. Panel C reports model-implied and data estimates of adjustment speeds for the full sample of firms and for small and large firms separately. Model-implied adjustment speeds are computed as the average fraction of closed gaps. Data figures are obtained with the measure of target leverage obtained from the estimation of the model of Flannery and Rangan (2006) in Equation (2). Panel D reports the estimated coefficients from cross-sectional regressions of stock returns on leverage ("Leverage"), leverage gaps ("Lev. Gap"), and leverage targets ("Lev. Target"), with the same controls as Table 5, for small and large firms separately. All model-implied quantities are based on simulations of 10,000 firms and 2000 time periods. Leverage gaps and adjustments are multiplied by 100. All variables are defined in Appendix A.

Panel A: Leverage Adjustments Small Firms

	Group of Lev. Gap				
	Low	2	3	4	High
Lev. Gap	-7.88	-2.50	-0.75	0.19	8.31
Adjustment	3.77	2.07	0.65	-0.11	-5.86

Panel B: Leverage Adjustments Large Firms

	Group of Lev. Gap				
	Low	2	3	4	High
Lev. Gap	-0.62	-0.03	1.68	5.89	10.94
Adjustment	0.37	0.01	-0.19	-0.18	-0.45

Panel C: Adjustment Speeds

	Model	Data
All Firms	0.22	0.33
Small Firms	0.39	0.37
Large Firms	0.10	0.30

Panel D: Monthly Stock Return

	Small Firms		Large Firms	
	(1)	(2)	(3)	(4)
Leverage	0.18	0.28	-0.44	0.32
Lev. Gap	0.11		0.76	
Lev. Target		-0.11		-0.76

4.6 Alternative Targets

Despite its appealing properties discussed in Section 3.3, the definition of the dynamic frictionless target based on the "gap approach" can be seen as an add-on to the model structure. This section explores whether dynamic target properties are crucial for obtaining the previous results, or if alternative target definitions can achieve the same objective. We consider an alternative definition, a long-term static target, similar to the one proposed by DeAngelo, DeAngelo, and Whited (2011), which is computed as the average leverage in the simulated economy. A firm would eventually converge to this target after receiving neutral shocks to investment opportunities over several successive periods.

Table 8, Panel A, presents firms classified into quintiles based on their leverage gaps and the ensuing changes in their leverage. Notably, the long-run stable target seems to lack correlation with adjustments to the capital structure. Across all quintiles, the gaps are significantly large, whereas the adjustments are small. Within the fourth quintile, as depicted in column 4, adjustments appear to mirror the direction of the gap, showing over-levered firms further augmenting their leverage. Panel B reinforces the findings of Panel A, reporting the adjustment speeds for the entire simulated economy, alongside large and small ones. These speeds of adjustment appear small when contrasted with those computed using the frictionless target in Tables 4 and 7. In summary, the results in Table 8 suggests that although there is some level of mean reversion in leverage moving toward its average, its predictive power for leverage dynamics is almost negligible.[29] This finding aligns with the results of DeAngelo, DeAngelo, and Whited (2011), who find that firms often deviate from long-term targets, interpreting these adjustments as transitory deviations.

The findings from Table 8 indicate that the results in the previous sections cannot be attributed to mean reversion toward stable long-term targets. These targets offer limited insight into the capital structure dynamics within the model. Instead, a dynamic frictionless target, inspired by the "gap approach," emerges as a compelling reference point when financial flexibility is limited.

[29]Naturally, stable leverage targets, being uniform for all firms which are ex-ante identical in the model, lack predictive power for equity returns as they are multicollinear with the constant term.

Table 8
Alternative Target: Long-Run Mean Leverage

Panel A describes firms' capital structure adjustments toward an alternative target under the baseline calibration of Table 2. Target leverage is computed as the unconditional mean of leverage, that is, a long-term static target to which a firm would converge after receiving neutral shocks to investment opportunities over several successive periods. "Lev. Gap" denotes leverage gaps, (defined as the difference between leverage and target leverage), and "Adjustment" denotes the one-period-ahead change in leverage. Panel B reports model-implied and data estimates of adjustment speeds for the full sample of firms. Model-implied adjustment speeds are computed as the average fraction of closed gaps. Data figures are obtained with the measure of target leverage obtained from the estimation of the model of Flannery and Rangan (2006) in Equation (2). All model-implied quantities are based on simulations of 10,000 firms and 2000 time periods. Leverage gaps and adjustments are multiplied by 100. All variables are defined in Appendix A.

Panel A: Leverage Adjustments

	Group of Lev. Gap				
	Low	2	3	4	High
Lev. Gap	-22.59	-15.77	-12.17	11.60	38.90
Adjustment	0.19	0.01	0.06	0.41	-0.63

Panel B: Adjustment Speeds

	Model	Data
All Firms	0.06	0.33
Small Firms	0.09	0.37
Large Firms	0.03	0.30

5 Conclusions

In this study, we delve into the complex relationship between leverage and the dispersion of equity risk premia across firms. To do so, we build a discrete-time, infinite-horizon neoclassical investment model with heterogeneous firms. In the model, firms optimize their investment, financing, and default decisions to maximize their value in arbitrage-free markets.

Our study makes three main contributions. First, we present qualitative analytical results that illustrate the interplay between financial flexibility, firm dynamics, and the dispersion of risk premia. These findings indicate that two variables, leverage gaps and leverage targets, can provide valuable insights into levered equity risk premia in a world characterized by limited financial flexibility. Second, we uncover two novel empirical facts that align with the model's predictions: (i) there is a strong positive correlation between estimated leverage gaps and stock returns, and (ii) stocks from high-leverage firms command a premium. This premium becomes apparent when we decompose leverage gaps into leverage targets and observed leverage, with leverage targets negatively impacting risk premia. Third, we gauge the quantitative implication of these connections by means of calibration.

Collectively, our results suggest that limited financial flexibility is instrumental in rationalizing the puzzling empirical patterns surrounding levered returns. The costly rebalancing of capital structures gives rise to leverage gaps, which subsequently mediate the relationship between leverage and returns. Our results carry potential implications for capital allocation across firms. As David, Schmid, and Zeke (2022) show, a significant portion of the dispersion in the marginal product of capital among U.S. firms is driven by risk premia. We leave the task of exploring the general-equilibrium links between limited financial flexibility and capital misallocation to future research.

References

Acharya, V. V., S. T. Bharath, and A. Srinivasan, 2007, Does industry-wide distress affect defaulted firms? evidence from creditor recoveries, *Journal of financial economics*, 85(3), 787–821.

Adda, J., and R. W. Cooper, 2003, *Dynamic economics: quantitative methods and applications*. MIT press.

Altınkılıç, O., and R. S. Hansen, 2000, Are there economies of scale in underwriting fees? Evidence of rising external financing costs, *Review of Financial Studies*, 13(1), 191–218.

Andrei, D., W. Mann, and N. Moyen, 2019, Why did the q theory of investment start working?, *Journal of Financial Economics*, 133(2), 251–272.

Aruoba, S. B., L. Bocola, and F. Schorfheide, 2017, Assessing dsge model nonlinearities, *Journal of Economic Dynamics and Control*, 83, 34–54.

Bayer, C., 2009, A comment on the economics of labor adjustment: Mind the gap: Evidence from a monte carlo experiment, *The American Economic Review*, 99(5), 2258–2266.

Belo, F., X. Lin, and F. Yang, 2014, External equity financing shocks, financial flows, and asset prices, working paper, National Bureau of Economic Research.

Benzoni, L., L. Garlappi, R. S. Goldstein, and C. Ying, 2022, Debt dynamics with fixed issuance costs, *Journal of Financial Economics*, 146(2), 385–402.

Berk, J. B., R. C. Green, and V. Naik, 1999, Optimal investment, growth options, and security returns, *The Journal of finance*, 54(5), 1553–1607.

Bhamra, H. S., A. J. Fisher, and L.-A. Kuehn, 2011, Monetary policy and corporate default, *Journal of monetary economics*, 58(5), 480–494.

Bhamra, H. S., L.-A. Kuehn, and I. A. Strebulaev, 2010, The levered equity risk premium and credit spreads: A unified framework, *The Review of Financial Studies*, 23(2), 645–703.

Bhandari, L. C., 1988, Debt/equity ratio and expected common stock returns: Empirical evidence, *The Journal of Finance*, 43(2), 507–528.

Bolton, P., N. Wang, and J. Yang, 2021, Leverage dynamics under costly equity issuance, *NBER Working Paper*, 26802.

Bretscher, L., P. Feldhütter, A. Kane, and L. Schmid, 2020, Marking to market corporate debt, *Swiss Finance Institute Research Paper*, (21-06).

Caballero, R. J., and E. M. Engel, 1993, Microeconomic adjustment hazards and aggregate dynamics, *The Quarterly Journal of Economics*, 108(2), 359–383.

Campbell, J. Y., and J. H. Cochrane, 1999, By force of habit: A consumption-based explanation of aggregate stock market behavior, *Journal of political Economy*, 107(2), 205–251.

Campbell, J. Y., J. Hilscher, and J. Szilagyi, 2008, In search of distress risk, *The Journal of finance*, 63(6), 2899–2939.

Caskey, J., J. Hughes, and J. Liu, 2012, Leverage, excess leverage, and future returns, *Review of Accounting Studies*, 17(2), 443–471.

Chaderina, M., P. Weiss, and J. Zechner, 2022, The maturity premium, *Journal of Financial Economics*, 144(2), 670–694.

Chang, X., and S. Dasgupta, 2009, Target behavior and financing: How conclusive is the evidence?, *The Journal of Finance*, 64(4), 1767–1796.

Chen, H., 2010, Macroeconomic conditions and the puzzles of credit spreads and capital structure, *The Journal of Finance*, 65(6), 2171–2212.

Chen, H., and M. Z. Frank, 2022, Equilibrium defaultable corporate debt and investment, *arXiv preprint arXiv:2202.05885.*

Chen, Z., D. Hackbarth, and I. A. Strebulaev, 2022, A unified model of distress risk puzzles, *Journal of Financial Economics*, 146(2), 357–384.

Cooley, T. F., and E. C. Prescott, 2021, 1. economic growth and business cycles, in *Frontiers of business cycle research*. Princeton University Press, pp. 1–38.

Cooper, R., and J. L. Willis, 2004, A comment on the economics of labor adjustment: Mind the gap, *The American Economic Review*, 94(4), 1223–1237.

Cooper, R. W., and J. C. Haltiwanger, 2006, On the nature of capital adjustment costs, *The Review of Economic Studies*, 73(3), 611–633.

Covas, F., and W. J. Den Haan, 2011, The cyclical behavior of debt and equity finance, *American Economic Review*, 101(2), 877–99.

Croce, M. M., H. Kung, T. T. Nguyen, and L. Schmid, 2012, Fiscal policies and asset prices, *Review of Financial Studies*, 25(9), 2635–2672.

Danis, A., and A. Gamba, 2018, The real effects of credit default swaps, *Journal of Financial Economics*, 127(1), 51–76.

Danis, A., and A. Gamba, 2023, Dark knights: The rise in firm intervention by credit default swap investors, *Management Science*.

David, J. M., L. Schmid, and D. Zeke, 2022, Risk-adjusted capital allocation and misallocation, *Journal of Financial Economics*, 145(3), 684–705.

DeAngelo, H., L. DeAngelo, and T. M. Whited, 2011, Capital structure dynamics and transitory debt, *Journal of Financial Economics*, 99(2), 235–261.

DeAngelo, H., and R. Roll, 2015, How stable are corporate capital structures?, *The Journal of Finance*, 70(1), 373–418.

Diamond, D. W., 1991, Debt maturity structure and liquidity risk, *the Quarterly Journal of economics*, 106(3), 709–737.

Doshi, H., K. Jacobs, P. Kumar, and R. Rabinovitch, 2019, Leverage and the cross-section of equity returns, *The Journal of Finance*, 74(3), 1431–1471.

Erickson, T., and T. M. Whited, 2000, Measurement error and the relationship between investment and q, *Journal of political economy*, 108(5), 1027–1057.

Falato, A., D. Kadyrzhanova, J. Sim, and R. Steri, 2022, Rising intangible capital, shrinking debt capacity, and the us corporate savings glut, *The Journal of Finance*, 77(5), 2799–2852.

Fama, E. F., and K. R. French, 1992, The cross-section of expected stock returns, *The Journal of Finance*, 47(2), 427–465.

Fama, E. F., and K. R. French, 2016, Dissecting anomalies with a five-factor model, *The Review of Financial Studies*, 29(1), 69–103.

Faulkender, M., M. J. Flannery, K. W. Hankins, and J. M. Smith, 2012, Cash flows and leverage adjustments, *Journal of Financial economics*, 103(3), 632–646.

Fischer, E. O., R. Heinkel, and J. Zechner, 1989, Dynamic capital structure choice: Theory and tests, *The Journal of Finance*, 44(1), 19–40.

Flannery, M. J., and K. W. Hankins, 2013, Estimating dynamic panel models in corporate finance, *Journal of Corporate Finance*, 19, 1–19.

Flannery, M. J., and K. P. Rangan, 2006, Partial adjustment toward target capital structures, *Journal of Financial Economics*, 79(3), 469–506.

Friewald, N., F. Nagler, and C. Wagner, 2022, Debt refinancing and equity returns, *The Journal of Finance*, 77(4), 2287–2329.

Friewald, N., C. Wagner, and J. Zechner, 2014, The cross-section of credit risk premia and equity returns, *The Journal of Finance*, 69(6), 2419–2469.

Gamba, A., and A. Triantis, 2008, The value of financial flexibility, *The Journal of finance*, 63(5), 2263–2296.

George, T. J., and C.-Y. Hwang, 2010, A resolution of the distress risk and leverage puzzles in the cross section of stock returns, *Journal of Financial Economics*, 96(1), 56–79.

Goldstein, R., N. Ju, and H. Leland, 2001, An ebit-based model of dynamic capital structure, *The Journal of Business*, 74(4), 483–512.

Gomes, J. F., 2001, Financing investment, *American Economic Review*, pp. 1263–1285.

Gomes, J. F., U. J. Jermann, and L. Schmid, 2016, Sticky leverage, *American Economic Review*.

Gomes, J. F., and L. Schmid, 2010, Levered returns, *The Journal of Finance*, 65(2), 467–494.

Gomes, J. F., and L. Schmid, 2021, Equilibrium asset pricing with leverage and default, *The Journal of Finance*, 76(2), 977–1018.

Graham, J. R., 2000, How big are the tax benefits of debt?, *The Journal of finance*, 55(5), 1901–1941.

——— , 2022, Presidential address: Corporate finance and reality, *The Journal of Finance*, 77(4), 1975–2049.

Harrison, J. M., and D. M. Kreps, 1979, Martingales and arbitrage in multiperiod securities markets, *Journal of Economic theory*, 20(3), 381–408.

Hayashi, F., 1982, Tobin's marginal q and average q: A neoclassical interpretation, *Econometrica: Journal of the Econometric Society*, pp. 213–224.

Hennessy, C. A., and T. M. Whited, 2005, Debt dynamics, *The Journal of Finance*, 60(3), 1129–1165.

———, 2007, How costly is external financing? Evidence from a structural estimation, *The Journal of Finance*, 62(4), 1705–1745.

Hou, K., C. Xue, and L. Zhang, 2015, Digesting anomalies: An investment approach, *The Review of Financial Studies*, 28(3), 650–705.

Huang, J.-Z., and M. Huang, 2012, How much of the corporate-treasury yield spread is due to credit risk?, *The Review of Asset Pricing Studies*, 2(2), 153–202.

Hugonnier, J., S. Malamud, and E. Morellec, 2015, Credit market frictions and capital structure dynamics, *Journal of Economic Theory*, 157, 1130–1158.

Jungherr, J., M. Meier, T. Reinelt, I. Schott, et al., 2022, Corporate debt maturity matters for monetary policy, *Econometrica*, 1(4), 345.

Kim, J., and F. J. Ruge-Murcia, 2009, How much inflation is necessary to grease the wheels?, *Journal of Monetary Economics*, 56(3), 365–377.

King, R. G., and J. K. Thomas, 2006, Partial adjustment without apology, *International Economic Review*, 47(3), 779–809.

Korteweg, A., 2010, The net benefits to leverage, *The Journal of Finance*, 65(6), 2137–2170.

Kuehn, L.-A., and L. Schmid, 2014, Investment-based corporate bond pricing, *The Journal of Finance*, 69(6), 2741–2776.

Kydland, F. E., and E. C. Prescott, 1982, Time to build and aggregate fluctuations, *Econometrica: Journal of the Econometric Society*, pp. 1345–1370.

Lemmon, M. L., M. R. Roberts, and J. F. Zender, 2008, Back to the beginning: persistence and the cross-section of corporate capital structure, *The journal of finance*, 63(4), 1575–1608.

Modigliani, F., and M. H. Miller, 1958, The cost of capital, corporation finance and the theory of investment, *The American economic review*, 48(3), 261–297.

Morellec, E., and A. Zhdanov, 2008, Financing and takeovers, *Journal of Financial Economics*, 87(3), 556–581.

Myers, S. C., 1977, Determinants of corporate borrowing, *Journal of Financial Economics*, 5(2), 147–175.

Nikolov, B., L. Schmid, and R. Steri, 2021, The sources of financing constraints, *Journal of Financial Economics*, 139(2), 478–501.

Nikolov, B., and T. M. Whited, 2014, Agency conflicts and cash: Estimates from a dynamic model, *The Journal of Finance*, 69(5), 1883–1921.

Obreja, I., 2013, Book-to-market equity, financial leverage, and the cross-section of stock returns, *Review of Financial Studies*, 26(5), 1146–1189.

Ozdagli, A. K., 2012, Financial leverage, corporate investment, and stock returns, *The Review of Financial Studies*, 25(4), 1033–1069.

Palazzo, B., and R. Yamarthy, 2022, Credit risk and the transmission of interest rate shocks, *Journal of Monetary Economics*, 130, 120–136.

Penman, S. H., S. A. Richardson, and I. Tuna, 1992, The book-to-price effect in stock returns: Accounting for leverage, *Journal of Accounting Research*, 45(2), 427–467.

Peters, R. H., and L. A. Taylor, 2017, Intangible capital and the investment-q relation, *Journal of Financial Economics*, 123(2), 251–272.

Sargent, T. J., 1978, Estimation of dynamic labor demand schedules under rational expectations, *Journal of political Economy*, 86(6), 1009–1044.

Strebulaev, I. A., 2007, Do tests of capital structure theory mean what they say?, *The Journal of Finance*, 62(4), 1747–1787.

Varian, H. R., 1975, A bayesian approach to real estate assessment, *Studies in Bayesian econometric and statistics in Honor of Leonard J. Savage*, pp. 195–208.

Yamarthy, R., 2020, Corporate debt maturity and the real economy, *Available at SSRN 4145918*.

Zhang, L., 2005, The value premium, *The Journal of Finance*, 60(1), 67–103.

Appendix

A) Variable Definitions

The following table summarizes variable definitions with reference to Compustat and CRSP items.

Variable	Construction
Leverage	$\frac{DLTT+DLC}{AT-BE+PRCC\_F \cdot CSHO}$
Book Leverage	$\frac{DLTT+DLC}{AT}$
Net Market Leverage	$\frac{DLTT+DLC-CHE}{AT-BE+PRCC\_F \cdot CSHO}$
Net Book Leverage	$\frac{DLTT+DLC-CHE}{AT}$
Value of Preferred Stocks (PS)	If available, in this order: $PSTKRV$, $PSTKL$, $PSTK$.
Book Equity (BE)	$CEQ + TXDITC$ (if available) $- PS$
Leverage Growth	$\frac{F.ML-ML}{0.5(F.ML+ML)}$
Market Capitalization	$\log \frac{\lvert PRC \rvert \cdot SHROUT}{1000}$ (in June)
Book-to-Market Equity	$\log \frac{BE}{\lvert PRC \rvert \cdot SHROUT/1000}$
Investment	$\frac{AT-L.AT}{L.AT}$
Profitability	$\frac{REVT-COGS}{BE}$

In Table A4 we consider three additional reduced-form measures of leverage targets. In columns (1) to (3), we run a regression specification as in equation (2), with firm fixed effects. To obtain reliable estimates of the fixed effects, we excluding firms for which the estimate does not converge to a stable value, i.e., for which we cannot find a period t^* such that the fixed effect estimate F_{i,t^*} satisfies

$$|F_{i,t^*} - F_{i,t^*-1}| < 0.05 \text{ and } |F_{i,t^*} - F_{i,t^*-2}| < 0.05.$$

We require that there are no gaps in the firm i's time series of $F_{i,s}$. Whenever it is not possible to estimate leverage targets because of missing data in $X_{i,t-1}$, we temporarily remove the firm from the analysis, and start checking again the stability criterion. In columns (4) to (6), we compute leverage targets as the rolling median at the firm level for all firms in the sample with at least five observations. In columns (7) to (9), leverage targets are computed as the four-digit SIC rolling median ML.

In the model, following Zhang (2005), we define the average Sharpe Ratio as $S_t \equiv \frac{\sigma_t[M_{t+1}]}{E_t[M_{t+1}]}$ and the risk-free rate as $\frac{1}{E_t[M_{t+1}]} - 1$. We define the equity premium as the average value-weighted return in the simulated economy, where realized stock returns are computed ex-dividends as $R_{i,t} \equiv \frac{V_{i,t}}{V_{i,t-1} - D_{i,t-1}}$. Profitability is the ratio of operating profits $\Pi_{i,t}$ to capital $K_{i,t}$, investment is the ratio of $I_{i,t}$ to capital $K_{i,t}$, leverage is the ratio of $B_{i,t}$ to $B_{i,t} + V_{i,t} - D_{i,t}$, book-to-market is the ratio of $K_{i,t}$ to $B_{i,t} + V_{i,t} - D_{i,t}$, debt adjustments are changes in debt stock $B_{i,t} - B_{i,t-1}$ divided by capital $K_{i,t-1}$, debt issuance is $\max\{0, B_{i,t} - B_{i,t-1}\}$ divided by $K_{i,t-1}$, and equity issuance is $\max\{0, E_{i,t}\}$ scaled by capital $K_{i,t}$.

B) Two-Period Case: Derivations and Proofs

Proof of Proposition 1. Part a). Equation (16) follows after subtracting B_1 from both sides of (15) and collecting λ_2 as defined in (17). Part b). Equation (16) can be rewritten as

$$\frac{B_2}{K_2} - \frac{B_1}{K_1} + \frac{B_1}{K_1} - \frac{B_1}{K_2} = \lambda_2 \left(\frac{B_2^*}{K_2} - \frac{B_1}{K_1} + \frac{B_1}{K_1} - \frac{B_1}{K_2} \right), \tag{A1}$$

after dividing both sides by K_2 and summing and subtracting $\frac{B_1}{K_1}$ from both sides. (19) immediately follows after collecting $\frac{B_1}{K_2} - \frac{B_1}{K_1}$ on the right-hand side of (A1). ■

Proof of Proposition 2. Part a). Substituting the definition of D_2 in the definition (20) of the equity return R_2^E yields

$$R_2^E = \frac{R_2^A K_2 - R_2^D B_2}{\mathbb{E}_1[M_2 R_2^A] K_2 - \mathbb{E}_1[M_2 R_2^D] B_2}.$$

Using the definition of $R_2^D = \frac{DR_2 - TS_2 + BC_2}{B_2}$ and defining $\gamma_A(K_2) \equiv \frac{1}{\mathbb{E}_1[M_2 R_2^A]}$, one obtains

$$R_2^E = \frac{R_2^A K_2 - R_2^D B_2}{\gamma_A(K_2) K_2 - \mathbb{E}_1 \left[M_2 \left(\frac{DR_2 - TS_2 + BC_2}{B_2} \right) \right] B_2},$$

Because $\frac{DR_2}{B_2} = 1 + r_2^D$, the debt pricing equation (11) implies that

$$R_2^E = \frac{1}{\gamma_A(K_2)} \frac{R_2^A K_2 - R_2^D B_2}{K_2 - \frac{\gamma_D(B_2)}{\gamma_A(K_2)} B_2}. \tag{A2}$$

Summing and subtracting $R_2^A B_2 \frac{\gamma_D(B_2)}{\gamma_A(K_2)}$ from the numerator of (A2), simplifying, and collecting $B_2 \frac{\gamma_D(B_2)}{\gamma_A(K_2)}$, one obtains

$$R_2^E = \frac{1}{\gamma_A(K_2)} \left(R_2^A + \frac{B_2 \gamma_D(B_2)}{K_2 - B_2 \frac{\gamma_D(B_2)}{\gamma_A(K_2)}} \left(\frac{R_2^A}{\gamma_A(K_2)} - \frac{R_2^D}{\gamma_D(B_2)} \right) \right),$$

which is equivalent to (21).

Part b). To link the adjustment factor $\gamma_D(B_2)$ to leverage gaps, observe that the first-order condition with respect to debt can be rearranged as

$$\frac{\partial D_1}{\partial B_2} + \rho \mathbb{E}_1 \left[M_2 \frac{\partial D_2}{\partial B_2} \middle| DEF = 0 \right] + (1 - \rho) \mathbb{E}_1 \left[M_2 \frac{\partial D_2}{\partial B_2} \middle| DEF = 1 \right] = 0. \tag{A3}$$

Observe that $\left.\frac{\partial D_2}{\partial B_2}\right| DEF = 0$ is equal to $-(1+c_2)+\tau c_2$, that is

$$\begin{aligned}\left.\frac{\partial D_2}{\partial B_2}\right| DEF &= 0 \\ &= -\frac{\partial DR_2^D|DEF=0}{\partial B_2} + \frac{\partial TS_2|DEF=0}{\partial B_2} \\ &= -\frac{DR_2^D|DEF=0}{B_2} + \frac{TS_2|DEF=0}{B_2}.\end{aligned}$$

Summing and subtracting $\frac{1-\rho}{\rho}\frac{DR_2^D|DEF=1}{B_2}$, one obtains

$$\begin{aligned}\left.\frac{\partial D_2}{\partial B_2}\right| DEF &= 0 \\ &= -\frac{DR_2^D|DEF=0}{B_2} - \frac{1-\rho}{\rho}\frac{DR_2^D|DEF=1}{B_2} \\ &\quad + \frac{1-\rho}{\rho}\frac{\left(R_2^A K_2 - BC_2\right)|DEF=1}{B_2} + \frac{TS_2|DEF=0}{B_2}.\end{aligned}$$

Instead,

$$\begin{aligned}\left.\frac{\partial D_2}{\partial B_2}\right| DEF &= 1 \\ &= -\frac{\partial DR_2^D|DEF=1}{\partial B_2} - \frac{\partial BC_2|DEF=1}{\partial B_2} \\ &= -\frac{\partial R_2}{\partial B_2} + \frac{\partial R_2}{\partial B_2} = 0.\end{aligned}$$

The first-order condition (A3) can then be expressed as

$$\begin{aligned}1-\lambda_B(B_2-B_1) &= \rho\mathbb{E}_1\left[M_2\frac{DR_2^D|DEF=0}{B_2}\right] + (1-\rho)\,\mathbb{E}_1\left[M_2\frac{DR_2^D|DEF=1}{B_2}\right] \\ &\quad -(1-\rho)\mathbb{E}_1\left[M_2\frac{R_2^A K_2 - BC_2}{B_2}\right| DEF=1\left.\right] - \rho\mathbb{E}_1\left[M_2\frac{TS_2}{B_2}\right| DEF=0\left.\right],\end{aligned}$$

which, after using the debt pricing equation $\mathbb{E}_1\left[M_2\frac{DR_2}{B_2}\right]=1$, boils down to

$$\lambda_B(B_2-B_1) = (1-\rho)\mathbb{E}_1\left[M_2\frac{R_2^A K_2}{B_2}\right| DEF=1\left.\right] + \frac{E_1[M_2(TS_2-BC_2)]}{B_2}. \tag{A4}$$

From (A4) and using the definition of $\gamma_D(B_2)$, it follows that

$$\gamma_B(B_2) = 1-\lambda_B(B_2-B_1) + (1-\rho)\mathbb{E}_1\left[M_2\frac{R_2^A}{\frac{B_2}{K_2}}\right| DEF=1\left.\right]. \tag{A5}$$

Summing and subtracting $-\lambda_1 B_2$ from the right-hand side of (16), one obtains

$$\frac{B_2}{K_2} - \frac{B_1}{K_2} = -\frac{\lambda_1}{1-\lambda_1} Gap_2^L. \tag{A6}$$

Using (A6) to substitute for $B_2 - B_1$ in (A5) leads to the result in (22). ■

Investment Adjustment Factor ($\gamma_A(K_2)$). In the text, we claim that $\gamma_A(K_2)$ is constant for a production function that is homogeneous of degree α, that is under the assumption that

$$\frac{f(A_2, Z_2, K_2)}{K_2} = \alpha \cdot f_k(A_2, Z_2, K_2),$$

Then

$$\begin{aligned}
\gamma_A(K_2) &= \mathbb{E}_1\left[M_2 R_2^A\right] = \\
&= \mathbb{E}_1\left[M_2\left(1 + (1-\tau)\left(\alpha \cdot f_k(A_2, Z_2, K_2) - \delta\right)\right)\right] \\
&= \mathbb{E}_1\left[M_2\left(\alpha + (1-\tau)\left(\alpha \cdot f_k(A_2, Z_2, K_2) - \alpha\delta\right)\right)\right] + E_1\left[M_2(1-\alpha)\right] - \mathbb{E}_1\left[M_2(1-\tau)(1-\alpha)\delta\right] \\
&= \alpha\mathbb{E}_1\left[M_2\left(1 + (1-\tau)\left(f_k(A_2, Z_2, K_2) - \delta\right)\right)\right] + \frac{1-\delta(1-\tau)}{1+r_F}.
\end{aligned}$$

From the first-order condition (14) with respect to capital K_2, one obtains

$$\gamma_A(K_2) = \alpha\left(1 - \frac{1}{1+r_F}(1-\tau)\frac{1-\rho}{\rho}\frac{\partial R_2}{\partial K_2}\right) + \frac{1-\delta(1-\tau)}{1+r_F},$$

which is constant because $\frac{\partial R_2}{\partial K_2} = \xi_K$. Adding a fixed cost of production does not change this result.

C) Numerical Solution Method

We solve the model using a combination of value function iteration (VFI) and simulation.

Each firm i's problem is characterized by five state variables, i.e. $x_{i,t} \equiv (K_{i,t}, B_{i,t}, c_{i,t}, z_{i,t}, A_t)$. We approximate the value function $V(x_{i,t})$ with piece-wise linear interpolation on a grid $7\times7\times5\times5\times3$, respectively. Note that the projection of $V(x_{i,t})$ onto an interpolated structure allows for a precise solution with a relatively parsimonious number of grid points. We check the robustness of our numerical solution by experimenting with finer grids.

Given $x_{i,t}$, each firm faces three continuous choices, i.e. $(K_{i,t+1}, B_{i,t+1}, c_{i,t+1})$, and one discrete choice, i.e. whether to default or not $\mathcal{I}(x_t)$. Choices $K_{i,t+1}$ and $B_{i,t+1}$ are evaluated on a grid 30×30, and we solve numerically at each step of the VFI for $c_{i,t+1}$ given each fix evaluation of $(K_{i,t}, B_{i,t}, c_{i,t}, z_{i,t}, A_t, K_{i,t+1}, B_{i,t+1})$. This requires to solve for $7 \times 7 \times 5 \times 5 \times 3 \times 30 \times 30$ non-linear equations at each step of the VFI, given the guess of the value function and future default. We solve for the coupon using golden search.

The solution with VFI proceed in two steps. First, we find the equilibrium value function $\tilde{V}(_{i,t})$ associated with an identical model but without endogenous default. Second, we use $\tilde{V}(_{i,t})$ as an initial guess for the model with endogenous default and we progressively increase the fixed cost F, re-converge the value function and re-initialize. The convergence criteria on the value function is defined as a max absolute difference between the value functions in two consecutive iterations of the VFI of 10^{-4}, or lower.

We then use the four policy functions $\{K(x_{i,t}), B_(x_{i,t}), c(x_{i,t}), \mathcal{I}(x_{i,t})\}$ to perform a long simulation of our economy ($T = 2000$) with a panel of $i = 1, ..., 10000$ firms, given random draws of idiosyncratic shocks $\{\{z_{i,t}\}_{t=0}^{T}\}_{i=1}^{10000}$ and aggregate shocks $\{a_t\}_{t=0}^{T}$.

D) Empirical Evidence: Robustness Checks and Sensitivity Analysis

Table A1

VALUE-WEIGHTED PORTFOLIO SORTS: LEVERAGE AND LEVERAGE GAPS

The table reports value-weighted stock returns in excess of the riskfree rate (R^e), t-statistics and Sharpe ratios (SR) for stocks sorted into decile portfolios. Stocks are sorted every June following the standard procedure of Fama and French (1992) based on their values of leverage and leverage gaps. Breakpoints are computed on the subset of firms traded on the NYSE market. The table report estimates for the bottom decile (L), the top decile (H) and for the fourth, sixth and eight decile, as well as for the difference between the top and the bottom decile (H-L). The sample includes all Compustat firms traded on NYSE, AMEX and NASDAQ between 1965 and 2020 and covered by the Center of Research in Security Prices (CRSP). Leverage variables are matched to monthly returns from July 1980 to December 2020. All variables are described in Appendix A.

Sorting Variable		Value-Weighted Portfolio Sorts					
		H-L	L	4	6	8	H
Leverage	R^e	0.69	9.19	9.53	9.29	9.37	9.88
	[t]	0.23	2.67	3.92	3.70	3.11	2.71
	SR	0.04	0.42	0.61	0.57	0.50	0.44
Lev. Gap	R^e	3.60	6.38	9.25	9.13	9.89	9.98
	[t]	1.57	1.96	3.44	3.88	4.32	3.40
	SR	0.25	0.31	0.55	0.58	0.64	0.54

Table A2

Robustness: Alternative Leverage Measures

The table reports coefficient estimates of Fama-MacBeth cross-sectional regression of monthly stock returns on leverage variables and controls. Columns (1) to (3) refer to market leverage net of cash ("Net Market Lev."). Columns (4) to (6) refer to book leverage ("Book Lev."). Columns (7) to (9) refer to book leverage net of cash ("Net Book Lev."). The sample includes all Compustat firms traded on NYSE, AMEX and NASDAQ between 1965 and 2020 and covered by the Center of Research in Security Prices (CRSP). Leverage targets and leverage gaps are the results of the rolling estimation procedure described in Section 2. Years from 1965 to 1979 are used as a "burn in" period. Annual accounting variables are matched to monthly returns from July 1980 to December 2020 following the standard procedure of Fama and French (1992). t-statistics are in parentheses. R^2 and N. Obs. denote the cross-sectional R-squared and the number of observations respectively. All variables are described in Appendix A. The symbols (***), (**) and (*) denote statistical significance at the 1, 5 and 10 percent levels respectively.

	Dependent Variable: Monthly Stock Return								
	Net Market Lev.			Book Lev.			Net Book Lev.		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Leverage	-0.06	0.05	0.50*	0.17	0.12	0.72**	-0.03	-0.01	0.54**
	(-0.20)	(0.20)	(1.96)	(0.58)	(0.44)	(2.33)	(-0.14)	(-0.07)	(2.58)
Lev. Gap		0.45**			0.60***			0.55***	
		(2.26)			(2.61)			(3.06)	
Lev. Target			-0.45**			-0.60***			-0.55***
			(-2.26)			(-2.61)			(-3.06)
Size	-0.21***	-0.19***	-0.19***	-0.21***	-0.19***	-0.19***	-0.21***	-0.18***	-0.18***
	(-4.67)	(-4.63)	(-4.63)	(-4.62)	(-4.58)	(-4.58)	(-4.82)	(-4.72)	(-4.72)
Be/Me	0.18***	0.13*	0.13*	0.18**	0.13*	0.13*	0.17***	0.13**	0.13**
	(2.60)	(1.91)	(1.91)	(2.29)	(1.81)	(1.81)	(2.73)	(2.00)	(2.00)
R^2	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
N. Obs.	1,221,663	880,356	880,356	1,221,663	880,380	880,380	1,221,663	880,356	880,356

Table A3

Robustness: Controlling for Profitability and Investment

The table reports coefficient estimates of Fama-MacBeth cross-sectional regression of monthly stock returns on leverage variables and controls. The sample includes all Compustat firms traded on NYSE, AMEX and NASDAQ between 1965 and 2020 and covered by the Center of Research in Security Prices (CRSP). Leverages targets and leverage gaps are the results of the rolling estimation procedure described in Section 2. Years from 1965 to 1979 are used as a "burn in" period. Annual accounting variables are matched to monthly returns from July 1980 to December 2020 following the standard procedure of Fama and French (1992). t-statistics are in parentheses. R^2 and N. Obs. denote the cross-sectional R-squared and the number of observations respectively. All variables are described in Appendix A. The symbols (***), (**) and (*) denote statistical significance at the 1, 5 and 10 percent levels respectively.

Dependent Variable: Monthly Stock Return			
	(1)	(2)	(3)
Leverage	0.10	0.02	0.86**
	(0.36)	(0.07)	(2.57)
Lev. Gap		0.84***	
		(2.91)	
Lev. Target			-0.84***
			(-2.91)
Size	-0.20***	-0.17***	-0.17***
	(-4.87)	(-4.59)	(-4.59)
Be/Me	0.16**	0.13**	0.13**
	(2.49)	(2.10)	(2.10)
Prof	0.06***	0.05***	0.05***
	(4.93)	(3.35)	(3.35)
Inv	-0.27***	-0.26***	-0.26***
	(-6.05)	(-4.75)	(-4.75)
R^2	0.02	0.02	0.02
N. Obs.	1,140,792	880,338	880,338

Table A4

ROBUSTNESS: ALTERNATIVE TARGET MEASURES

The table reports coefficient estimates of Fama-MacBeth cross-sectional regression of monthly stock returns on leverage variables and controls. Columns (1) to (3) ("TL1: FE Convergence") refer to a measure of target leverage obtained from the estimation of the model of Flannery and Rangan (2006) with firm fixed effects and at least 5 observations for each firm. Columns (4) to (6) ("TL2: Rolling Median") refer to a measure of target leverage which is computed as the rolling median firm leverage for firms with at least 5 observations. Columns (7) to (9) ("TL3: Industry Median") refer to a measure of target leverage which is computed as the rolling median industry leverage at the 4-digit SIC code level. The sample includes all Compustat firms traded on NYSE, AMEX and NASDAQ between 1965 and 2020 and covered by the Center of Research in Security Prices (CRSP). Leverage targets and leverage gaps are the results of the rolling estimation procedure described in Section 2. Years from 1965 to 1979 are used as a "burn in" period. Annual accounting variables are matched to monthly returns from July 1980 to December 2020 following the standard procedure of Fama and French (1992). t-statistics are in parentheses. R^2 and N. Obs. denote the cross-sectional R-squared and the number of observations respectively. All variables are described in Appendix A. The symbols (***), (**) and (*) denote statistical significance at the 1, 5 and 10 percent levels respectively.

	Dependent Variable: Monthly Stock Return								
	TL1: FE Convergence			TL2: Rolling Median			TL3: Industry Median		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Leverage	0.24	0.05	0.87**	0.24	0.03	0.88**	0.24	-0.33	0.53**
	(0.67)	(0.13)	(2.31)	(0.67)	(0.08)	(2.44)	(0.67)	(-0.53)	(2.03)
Lev. Gap		0.82***			0.85**			0.85*	
		(2.74)			(2.45)			(1.66)	
Lev. Target			-0.82***			-0.85**			-0.85*
			(-2.74)			(-2.45)			(-1.66)
Size	-0.21***	-0.18***	-0.18***	-0.21***	-0.18***	-0.18***	-0.21***	-0.20***	-0.20***
	(-4.54)	(-4.45)	(-4.45)	(-4.54)	(-4.50)	(-4.50)	(-4.54)	(-4.56)	(-4.56)
Be/Me	0.16**	0.13**	0.13**	0.16**	0.11*	0.11*	0.16**	0.17***	0.17***
	(2.41)	(2.03)	(2.03)	(2.41)	(1.79)	(1.79)	(2.41)	(2.81)	(2.81)
R^2	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
N. Obs.	1,221,663	895,491	895,491	1,221,663	884,709	884,709	1,221,663	1,122,225	1,122,225

E) Model: Robustness Checks and Sensitivity Analysis

Table A5

ROBUSTNESS: COUNTERFACTUALS ON BOTH EQUITY AND DEBT ISSUANCE COSTS PARAMETERS

The table describes capital structure adjustments and levered returns for different degrees of the financial inflexibility parameters λ_B, λ_0, and λ_1 around the baseline calibration. Model 1 refers to the following combination of parameters: $\lambda_B = 0$, $\lambda_0 = 0$, and $\lambda_1 = 0$. Model 2 (baseline calibration) refers to the following combination of parameters: $\lambda_B = 0.4$, $\lambda_0 = 0.5$, and $\lambda_1 = 0.025$. Model 3 refers to the following combination of parameters: $\lambda_B = 0.44$, $\lambda_0 = 0.55$, and $\lambda_1 = 0.0275$, corresponding to a 10 % increase in all parameters. The column "Adjustment Speed" tabulates model-implied estimates of adjustment speeds for the full sample of firms, computed as the average fraction of closed gaps as in Table 4. The columns "Regression Coefficients" report the estimated coefficients from cross-sectional regressions of stock returns on leverage ("Leverage"), leverage gaps ("Lev. Gap"), leverage targets ("Lev. Target") across the entire simulated economy. All figures are based on simulations of 10,000 firms and 2000 time periods. Note that returns are monthly and expressed in percentage (multiplied by 100), and leverage gaps, leverage targets, and leverage are in levels (not in percentage). All variables are defined in Appendix A.

Model	Lev. Variables	Adjustment Speed	Regression Coefficients	
1		1.00		
	Leverage		0.37	0.37
	Lev. Gap		-	
	Lev. Target			-
2		0.22		
	Leverage		0.12	0.23
	Lev. Gap		0.38	
	Lev. Target			-0.38
3		0.13		
	Leverage		0.07	0.42
	Lev. Gap		0.35	
	Lev. Target			-0.35

Table A6

Robustness: Counterfactuals on Financial Inflexibility with Controls

The table describes levered returns for different degrees of the financial inflexibility parameter λ_B around its baseline calibration. The table reports the estimated coefficients from cross-sectional regressions of stock returns on leverage ("Leverage"), leverage gaps ("Lev. Gap"), leverage targets ("Lev. Target"), with the same controls of Table 5 (i.e., "Size" and "Be/Me"), across the entire simulated economy. All figures are based on simulations of 10,000 firms and 2000 time periods. Note that returns are monthly and expressed in percentage (multiplied by 100), and leverage gaps, leverage targets, and leverage are in levels (not in percentage). All variables are defined in Appendix A.

	Full Flex.	(2)	Baseline	(4)	(5)
	$\lambda_B = 0.0$	$\lambda_B = 0.2$	$\lambda_B = 0.4$	$\lambda_B = 0.44$	$\lambda_B = 0.5$
Regression Coefficients	Returns on Gap + Leverage				
Lev. Gap	-	0.27	0.45	0.45	0.44
Leverage	-0.2	-0.03	0.19	0.16	0.15
	Returns on Target + Leverage				
Lev. Target	-	-0.27	-0.45	-0.45	-0.44
Leverage	-0.2	0.24	0.64	0.62	0.59