Debt Refinancing and Equity Returns*

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Abstract

Previous studies report mixed evidence on how financial leverage affects expected stock returns. Our theoretical and empirical results suggest that these inconclusive findings are driven by differences in firms' debt maturity structures and refinancing needs. In our model, the firm optimizes its capital structure by jointly choosing leverage and the mix of short- and long-term debt, which determines the firm's debt refinancing intensity. Since shareholders commit to cover potential shortfalls from debt rollover, they require a return that increases in, both, leverage and debt refinancing intensity. Our empirical results confirm this model prediction and show that firms with higher (lower) leverage earn higher (lower) stock returns when controlling for the immediacy of debt refinancing. The return differential of high-leverage firms relative to low-leverage firms increases with refinancing intensity and, as also predicted by the model, is directly linked to the value premium. Accounting for differences in firms' debt maturity profiles also provides new insights for the distress puzzle.

JEL Classification: G12, G32, G33.

Keywords: Equity returns, refinancing risk, leverage, value premium, distress puzzle.

I. Introduction

Empirical research reports mixed evidence on how a firm's financial leverage affects the expected return on its equity. Our paper complements these previous findings by showing, theoretically and empirically, that firms' expected equity returns increase with leverage when controlling for the immediacy of debt refinancing. In the model, the firm optimizes its capital structure by jointly choosing the amount of debt as well as the maturity structure of debt. The firm has to refinance debt according to its maturity structure and shareholders commit to cover potential shortfalls arising from the rollover of maturing debt. For shareholders to accept this commitment, expected equity returns have to increase with the firm's leverage *and* with the firm's debt refinancing intensity, which measures the immediacy of debt refinancing needs. As a consequence, leverage alone is insufficient to gauge the effect of debt related risks on expected equity returns.

To model the interaction between leverage, debt refinancing, and equity returns, we use the model of Leland and Toft (1996) and embed insights from the recent bond literature on rollover risk (e.g., He and Xiong, 2012; Chen et al., 2013b). The firm optimizes its capital structure by simultaneously choosing the amount of debt (i.e. its leverage) as well as the underlying debt maturity structure, where we assume that the firm follows a stationary debt maturity policy (e.g., He and Xiong, 2012; He and Milbradt, 2014). More specifically, the firm decides optimally on how much debt to raise by issuing a short-term bond and how much to raise through a long-term bond. Along this maturity dimension, the firm faces a trade-off: On the one hand, short-term debt is cheaper than long-term debt. On the other hand, increasing the fraction of debt issued through the short-term bond exposes the firm to debt refinancing risk. Given this trade-off, the model implies that firms with comparably low cash flow risk choose higher leverage and longer debt maturities, whereas firms with higher cash flow risk choose lower leverage and shorter debt maturities. These leverage/debt maturity patterns are in line with empirical evidence reported by, e.g., Barclay and Smith (1995) and Custódio et al. (2013).

Initially, when the firm chooses its optimal capital structure and debt policy, the model implies a one-to-one mapping between leverage, refinancing intensity, and equity returns. Subsequently, the firm's leverage can change because of fluctuations in the market value of equity but the firm's refinancing intensity remains unchanged. As a consequence, the relation between leverage and refinancing intensity and the link of both to expected equity returns becomes more complex. For a given refinancing intensity, expected stock returns increase with leverage. Similarly, for given leverage, expected stock returns increase with refinancing intensity. Hence, neither leverage nor the refinancing intensity alone are sufficient to understand the impact of a firm's debt related risks on equity returns: a firm with high leverage and low debt refinancing intensity may have the same expected return as a firm with low leverage but high debt refinancing intensity. Put differently, the model implies that, in the cross-section of firms, expected equity returns increase with leverage only when controlling for firms' refinancing intensities.

Additionally, the model implies two further testable predictions for the relation of equity returns to leverage. First, the difference in returns between high- and low-leverage firms increases with refinancing intensity, because shareholders demand a higher premium for holding high- rather than low-leverage firms when debt refinancing needs are more immediate. Second, because the model-implied book-to-market ratio increases with the firm's leverage and with its refinancing intensity, the difference in returns of high- compared to low-leverage firms is directly linked to the value premium, and more so the higher refinancing risk.

For the empirical analysis, we merge the CRSP- and COMPUSTAT-databases to obtain a sample of approximately 1.7 million firm-month observations across more than 15,000 different firms over the period from 1970 to 2014. Our empirical results generally provide strong support for the model predictions. First, we use portfolio sorts to show that the relation between leverage and equity returns is ambiguous, in line with the evidence reported in previous research. For value-weighted portfolios, the three- and four-factor alphas of buying high- and selling low-leverage firms are significantly negative, a finding that reflects the distress puzzle documented by previous research (e.g., Campbell et al., 2008). The results are very similar when sorting firms based on a proxy for their refinancing intensites, which we define as the fraction of long-term debt due in the next year over total assets (see, e.g., Almeida et al., 2012; Chen et al., 2013b).

Next, we test the model's main prediction, that equity returns increase with leverage when controlling for debt refinancing intensities. To evaluate this joint effect on stock returns, we assign firms to tertiles based on their leverage and refinancing intensity, respectively, to construct nine portfolios. Our results generally confirm that stock excess returns increase with leverage within each refinancing tertile. Furthermore, the difference in returns of high- and low-leverage firms increases as the refinancing intensity increases (i.e. debt maturities become shorter). These findings are consistent with the notion that shareholders demand a premium for holding high- instead of low-leverage firms and that this premium increases with the immediacy of debt refinancing.

Using equally-weighted portfolios, we find that buying high- and selling low-leverage firms generates significant raw excess returns and CAPM-alphas for firms with high and medium refinancing intensities. Consistent with our model's prediction that high- minus low-leverage return differentials are directly connected to the value premium, we find that loadings on the HML-factor are very close to one (1.05 and 0.98, respectively) and, consequently, that the three- and four-factor alphas are not different from zero. When we compute the difference in returns of buying high- and selling low-leverage stocks of firms with high compared to low refinancing intensities, we find that this difference is highly significant in terms of raw excess returns, CAPM- as well as three- and four-factor alphas with approximately 7% per year.

The return patterns are very similar when using value-weighted portfolios, except for the biggest firms in our sample. Using all firms, we find that the empirical patterns are the same as for equally-weighted portfolios but that results are not significant or only marginally significant. To explore this apparent size effect, we show that our results for equally-weighted portfolios are not driven by a few small firms but rather that the insignificance of results for the value-weighted portfolios stems only from the biggest firms in our sample that dominate returns in value-weighted portfolios. For instance, when we repeat the empirical analysis for all except the 25% of biggest firms, we find very similar results for equally- and value-weighted portfolios confirming that shareholders demand a premium for holding high- instead of low-leverage firms and that this premium increases with refinancing intensity. Our finding that the interaction of leverage and debt refinancing appears less important for very big firms seems consistent with previous research claiming that big firms are less financially constrained than small firms (see, e.g., Whited and Wu, 2006; Hadlock and Pierce, 2010). Hence, a conceivable interpretation may be that the debt rollover risk channel is less important for firms that do not face financial constraints. We provide empirical evidence which supports this notion.

Overall, this paper provides new insights for the cross-sectional relation between equity returns and leverage by explicitly elaborating on the role of a firm's debt refinancing policies. Our main finding is that equity returns increase with leverage when accounting for firms' refinancing risk. This finding suggests that previous evidence on how stock returns relate to leverage may have remained inconclusive because it ignores firms' debt maturity profiles. Accounting for the interrelation of leverage and refinancing risk also sheds new light on the distress puzzle and provides a novel perspective on the value premium.

Related literature. Our paper is related to the literature that elaborates on the relation between leverage and stock returns. Gomes and Schmid (2010) argue that the mixed empirical evidence on whether this relation is positive, negative, or whether there is no significant relation at all may be a result of previous papers not accurately accounting for the complexity of the link between a firm's financial leverage and the return on its equity (see, e.g., Bhandari, 1988; Fama and French, 1992; Penman et al., 2007; George and Hwang, 2010). Specifically, they argue that the link between leverage and stock returns depends on a firm's investment opportunities. We explore the relation between leverage and stock returns from a different angle which does not require to model the firm's investment policies but emphasizes the role of a firm's debt maturity profile and refinancing risk.

Several empirical studies provide evidence that firms issue debt with dispersed maturity dates and that firms' choices of leverage and debt maturity profile depend on their risk attributes. Choi et al. (2015) argue that firms spread out their debt maturity dates over time in order to avoid lumpiness in the aggregate issuance amount of debt. More specifically, the optimal capital structure implications of our model that firms with comparably low (high) cash flow risk choose higher (lower) levels of leverage with longer (shorter) debt maturities are consistent with empirical evidence provided by, for instance, Barclay and Smith (1995), Stohs and Mauer (1996), Johnson (2003), Custódio et al. (2013), and Gopalan et al. (2014).

The conceptual framework employed in our paper is motivated by trade-off models of optimal capital structure in the spirit of Fischer et al. (1989), Leland (1994b), Leland and Toft (1996, LT) or Leland (1998). These models endogenize a firms' optimal leverage and default decisions. Bhamra et al. (2010a,b) and Chen (2010) are among the first to discuss the asset pricing implications of dynamic leverage models and relate leverage and default decisions to the time-series patterns of equity returns and credit spreads. More recently, the LT model is applied in the structural debt pricing literature that elaborates on the relation between rollover risk and credit risk. He and Xiong (2012) show that short-term debt exacerbates default risk via the rollover channel due to its higher sensitivity to shocks to debt funding costs. Other models that feature a mechanism where debt refinancing costs are bourne by equityholders include, among others, Acharya et al. (2011), Cheng and Milbradt (2012), Chen et al. (2013a), Chen et al. (2013b), and He and Milbradt (2014).

Interestingly, most studies which rely on the LT framework treat leverage, debt maturity, or both as exogenous. Noteable exceptions are Dangl and Zechner (2007) or He and Milbradt (2015), however, their focus is very different compared to the objective of this paper. Dangl and Zechner (2007) study the role of bankruptcy costs for leverage and debt maturity dynamics. He and Milbradt (2015) study a firm's optimal choice of debt maturity structure and default timing, both without commitment. Our paper is the first to explore how refinancing risk associated with the rollover of debt affects equity returns, specifically through its interaction with leverage.

Our theoretical and empirical results that leverage and debt maturity jointly matter for equity returns provide new insights on the relation between leverage and equity returns as such but also on related empirical findings documented in the literature. Previous research identifies a 'distress puzzle', defined as the finding that firms with high distress risk earn anomalously low risk-adjusted returns while being highly exposed to standard risk factors (see, e.g., Dichev, 1998; Griffin and Lemmon, 2002; Campbell et al., 2008). Using leverage as a measure of distress risk, we also find the distress puzzle in our data. However, once we control for refinancing risk, the relation between leverage and equity returns becomes positive, thereby providing a new perspective on the distress anomaly that complements other explanations.[1]

Finally, we revisit the value premium from a new perspective, without relying on arguments related to a firm's investment policy, operating leverage, and/or profitability (e.g. Fama and French, 1993; Carlson et al., 2004; Zhang, 2005; Novy-Marx, 2011, 2013; Fama and French, 2015). In our model, the firm's book-to-market ratio is directly related to its leverage and its debt maturity structure and can be interpreted as a simple measure of how far a firm's

[1] These other explanations build, among others, on arguments related to shareholder recovery (e.g., Garlappi et al., 2008; Garlappi and Yan, 2011; Hackbarth et al., 2015), credit risk premia (e.g., Friewald et al., 2014), and the firm's solvency, where Medhat (2014) elaborates on the role of the firm's cash holdings policy and Opp (2015) emphasizes the valuation effect exerted by active investors who learn about solvency.

capital structure deviates from its (initial) optimum, i.e. the capital structure arising from jointly choosing leverage and the mix of short- and long-term debt. Consistent with the model implications, our empirical results show that the return differential of high- compared to low-leverage firms is significantly related to the HML-factor (consistent with recent evidence that the value premium is related to leverage, e.g., Choi, 2013; Doshi et al., 2014) and that loadings on the HML-factor increase with debt refinancing risk.

The remainder of the paper is organized as follows. Section II describes the structural model and Section III summarizes the testable predictions implied by the model. Section IV describes the data. In Section V, we present and discuss the results of our empirical analysis. The last section concludes and the Appendix contains technical details.

II. Structural Model

In this section, we present a simple model of the firm's capital structure that follows the spirit of Leland and Toft (1996, LT) but endogenizes the firm's optimal choice of leverage and debt maturity. We use this model to illustrate how the interaction between leverage and debt maturity affects the firm's expected equity returns: expected equity returns increase with leverage and also increase with the immediacy of refinancing needs. As a consequence, leverage alone is not sufficient to gauge the effect of debt-related risks on equity returns.

A. Firm value and optimal capital structure

We assume that the firm's instantaneous cash flow (X_t) follows a Geometric Brownian Motion (GBM) under the risk-neutral probability measure ($\mathbb{Q}$) with drift $\mu^{\mathbb{Q}}$ and volatility σ. The instantaneous risk-free rate is denoted by r. The standard trade-off theory of capital structure postulates that a firm maximizes its value by levering up to the extent that the benefits of debt equal its costs. For a debt principal amount P, the value of the levered firm is given by

$$F(X,P) = U(X) + DB(P) \cdot \left[1 - \pi^{\mathbb{Q}}(X,P)\right],$$

where DB and $\pi^{\mathbb{Q}}$ denote the benefits of debt and the probability of default, respectively, which both increase with P.

Understanding a firm's debt maturity profile is important because the optimal choice of debt maturities is also subject to a tradeoff. Previous research provides various arguments as to why short-term debt offers benefits compared to long-term debt. Most closely related to our paper, the recent literature on rollover risk argues that fixed issuance costs are lower for short-term compared to long-term debt (see e.g., Chen et al., 2013b; He and Milbradt, 2014). Furthermore, short-term debt may offer benefits relative to long-term debt by reducing information asymmetries (e.g., Flannery, 1986; Diamond, 1991; Custódio et al., 2013) or by mitigating agency conflicts (Datta et al., 2005; Brockman et al., 2010). These benefits of short-term debt, however, come at the cost of frequently rolling over the firm's debt which exposes the firm to refinancing risk.

In what follows, we discuss the valuation of debt and equity claims as well as the optimal capital structure for a firm that raises debt capital by issuing short-term bonds and long-term bonds. The model implies that firms with comparably low (high) cash flow volatility optimally choose higher (lower) levels of leverage with longer (shorter) debt maturities. These patterns are consistent with empirical evidence on the link between firm risk and debt financing policies (e.g., Barclay and Smith, 1995; Johnson, 2003; Custódio et al., 2013).

A.1 Short-term and long-term debt

In our framework, the firm has access to two types of debt instruments: a short-term zero-coupon bond (S) and a long-term zero-coupon bond (L). At time $t = 0$, the firm raises a principal amount P^i from issuing bond $i \in \{S, L\}$, thus, the aggregate principal amount of debt is given by $P = P^S + P^L$. We model the maturity of bond i by a Poisson process with intensity ϕ^i, and $\phi^S > \phi^L$ reflects the earlier redemption of S relative to L. Assuming a stationary debt structure, refinancing short-term and long-term debt can be equivalently thought of as continuously refinancing the amounts $\phi^S P^S$ and $\phi^L P^L$, respectively.[2] The key question for a value-maximizing firm is to decide on the amounts of short-term and long-term

[2]The assumption that the firm commits to a stationary debt structure follows Leland and Toft (1996), Leland (1998), and He and Xiong (2012) who argue that tight covenants prohibit the firm from changing its debt structure; Fama and French (2002), Baker and Wurgler (2002), Welch (2004), Strebulaev (2007), and Lemmon et al. (2008) provide empirical evidence that firms' debt structures are indeed stationary over time.

debt to raise. To determine the market value of type-i debt (D^i), we start from the required return on debt (rD^i), which is given by

$$rD^i = \underbrace{\mu^{\mathbb{Q}} X D^i_X + \frac{1}{2}\sigma^2 X^2 D^i_{XX}}_{\text{sensitivity of } D^i \text{ to cash flow}} + \underbrace{\phi^i(P^i - D^i)}_{\text{debt refinancing}}. \tag{1}$$

The above equation illustrates the two driving forces behind changes in debt value. The first is the sensitivity of D^i to the firm's cash flows. The second captures the value change in type-i debt due to the firm refinancing the fraction ϕ^i by issuing new debt with identical characteristics. To solve Equation (1) for the value of debt D^i, we impose two standard boundary conditions by evaluating the limits of the cash flow at infinity and at the default boundary, respectively (see, e.g., Leland, 1994b). We discuss the solution below but delegate technical details to Appendix A.1.

In the first case ($X_t = \infty$), the firm never defaults and the associated 'default-free value of debt' (p^i) is given by

$$p^i = \frac{P^i}{1 + r/\phi^i}. \tag{2}$$

In the second case, shareholders will choose to optimally default ($X_t = X_B$, where X_B is the endogenous default boundary) and bondholders take over the firm with the value of debt given by

$$D^i(X_B) = \frac{X_B}{r - \mu^{\mathbb{Q}}}\lambda^i, \tag{3}$$

where λ^i denotes the fraction of debt i to total debt (P^i/P).[3] The difference in debt values in the two boundary scenarios in Equations (3) and (2), $D^i(X_B) - p^i$, reflects the bondholders' loss given default. The market value of bond i is given by

$$D^i(X_t) = p^i + \left[D^i(X_B) - p^i\right]\pi^{i,\mathbb{Q}}_t, \tag{4}$$

where $\pi^{i,\mathbb{Q}}_t$ is a scaling factor approaching zero if ($X_t = \infty$) or one if ($X_t = X_B$). Thus, the bond value may be interpreted as its default-free value adjusted by the expected loss due to default risk.

[3] Note that the boundary condition implies short-term and long-term bondholders to share the remaining value of the firm proportionally to P in the event of default, i.e. there is no maturity-related debt seniority.

A.2 Equity valuation

With shareholders being the residual claimants of the firm, the value of equity (E) is given by the differential of the levered firm value (F) minus the value of debt (D), i.e., $E(X_t) = F(X_t) - \sum_i D^i(X_t)$. Changes in the equity value (rE), thus, depend on the firm's current cash flow, the sensitivity of the equity value to the underlying cash flow process, and debt-related flows (debt benefits and refinancing of, both, short-term and long-term debt). In particular, the equity value satisfies the equation

$$rE = \underbrace{X}_{\text{cash flow}} + \underbrace{\mu^{\mathbb{Q}} X E_X + \frac{1}{2}\sigma^2 X^2 E_{XX}}_{\text{sensitivity of } E \text{ to cash flow}} + \underbrace{k \sum_i \phi^i P^i}_{\text{debt benefits}} - \underbrace{\sum_i \phi^i (P^i - D^i)}_{\text{debt refinancing}}, \tag{5}$$

where $k > 0$ is a scaling factor for the debt benefits. Equation (5) shows how the tradeoff between short- and long-term debt matters for the value of equity. The value of equity increases with debt benefits and decreases with costs related to debt refinancing. The cost of debt refinancing depends on the fraction of debt that has to be rolled over, i.e. the refinancing intensity (ϕ^i), and on the discount at which debt is refinanced, i.e. on the difference between the principal (P^i) and debt value (D_t^i). Since ϕ^i remains constant over time, any time-variation in debt-related flows that matter for the equity value arises from the bond's discount $P^i - D_t^i$, which depends on the firm's current cash flow X_t. In periods with high (low) cash flows, the firm moves further away from (closer to) the default boundary and hence the discount $P^i - D_t^i$ is small (large). Therefore, the trade-off between the benefits of a high level of short-term debt and increased exposure to refinancing risk matters for the firms' optimal leverage and refinancing intensity choice.

A.3 Optimal capital structure

Based on the valuation of the firm's debt and equity, we now explore the implications for the firm's optimal capital structure. At time $t = 0$, the firm chooses the principal amounts for short-term and long-term debt to maximize the initial value of the firm. By simultaneously choosing P^S and P^L, the firm decides on the overall amount of debt to issue as well as on the maturity structure of its debt. In other words, the firm jointly optimizes its leverage and refinancing intensity.

With P^S and P^L being the only decision variables, we fix all other parameters in accordance with the structural equity and bond pricing literature.[4] In particular, we set the initial cash flow level $X_0 = 1$, the riskless rate $r = 5\%$, and the risk-neutral drift of the cash flow process $\mu^{\mathbb{Q}} = 1\%$. Furthermore, we assume short- and long-term debt maturities of one and five years, respectively, implying refinancing intensities of $\phi^S = 1$ and $\phi^L = 0.2$, and we set the scaling factor for debt benefits to $k = 0.01$. Using these parameter values, we study the leverage and debt maturity choices of firms that optimize their capital structure for a given level of cash flow risk σ. We define the firm's leverage as

$$L(X_t) = \frac{P}{P + E(X_t)}, \tag{6}$$

which corresponds to the leverage measure applied in empirical research such as, e.g., Strebulaev and Yang (2013) or Danis et al. (2014). The firm's aggregate refinancing intensity is determined by its optimal debt maturity mix and given by

$$\Phi = \lambda^S \phi^S + \lambda^L \phi^L. \tag{7}$$

Figure 1 presents the optimization results by illustrating how leverage and debt refinancing intensity relate to cash flow risk. Panel A shows that a firm's choice of initial leverage (L) is decreasing in cash flow risk, which reflects that firms with lower cash flow risk have a higher debt bearing capacity. This result matches the implications of standard structural models (e.g, Leland, 1994b) and also lines up well with empirical research that finds an inverse relation between firms' cash flow volatility and leverage (e.g., Lemmon et al., 2008).

Panel B shows that the firm's optimal refinancing intensity (Φ) increases with cash flow volatility, implying that the fraction of short-term relative to long-term debt increases as cash flows become more risky. The intuition is that it is too costly for a firm with very volatile cash flows to issue large amounts of long-term debt. This is the case because the discount $P^i - D^i_t$ of the long-term bond is more sensitive to cash flow volatility compared to the discount of

[4]See, e.g., Leland (1994b), Leland and Toft (1996), Goldstein et al. (2001), Dangl and Zechner (2007), Garlappi and Yan (2011), He and Xiong (2012), Chen et al. (2013a), Chen et al. (2013b), Medhat (2014), He and Milbradt (2014) or Diamond and He (2014).

the short-term bond. Recent empirical work provides evidence that supports this notion by documenting that riskier firms issue relatively more short-term debt (e.g., Gopalan et al., 2014).

FIGURE 1 ABOUT HERE

Overall, our model implies that firms with comparably low (high) cash flow volatility optimally choose higher (lower) levels of leverage with longer (shorter) debt maturities. These implications are consistent with empirical evidence as, e.g., in Barclay and Smith (1995), Stohs and Mauer (1996), Johnson (2003), and Custódio et al. (2013). In the next section, we show how expected equity returns relate to the firm's leverage and refinancing intensity.

B. Leverage, debt refinancing, and expected equity returns

The main objective of our paper is to understand how a firm's debt financing policy affects its expected equity returns. In our framework, the cash flow process X_t is the only source of risk. As illustrated above, the $\mathbb{Q}$-dynamics of X_t can be used for pricing the firm's debt and equity. The firm's expected equity returns depend on the $\mathbb{P}$-dynamics of X_t. Given that equity can be viewed as a call option on the firm's assets (because shareholders are residual claimants with limited liability), expected equity excess returns can be expressed as the firm's asset risk premium adjusted for debt financing effects. Assuming a time-constant asset risk premium, defined as the difference in real-world and risk-neutral drift of the cash flow process ($\xi = \mu^{\mathbb{P}} - \mu^{\mathbb{Q}}$), the time-$t$ expected stock return depends on the sensitivity of equity to cash flows (b_t^X) and can be written as

$$\mathbb{E}^{\mathbb{P}}[R_t] = r + b_t^X \cdot \xi \tag{8}$$

where

$$b_t^X = \frac{d\log E(X_t)}{dX_t}. \tag{9}$$

To understand the link between a firm's time-t expected equity returns and its debt structure, we need to distinguish model-implications at the point in time when the firm chooses its optimal capital structure (i.e. at $t = 0$) and implications after the capital structure has been determined (i.e. at $t > 0$). This distinction is important because changes in the equity value affect the firm's leverage ratio (L) over time.[5] In our analysis below, we use the same parameter values that we used for the optimization of the firm's capital structure above and set the risk premium $\xi = 5\%$.

Expected equity returns at time t=0. At $t = 0$, the firm optimizes its capital structure by jointly choosing the amount and maturity of debt. Specifically, there is a one-to-one relation between the firm's leverage $L(X_0)$ and its refinancing intensity Φ as illustrated above in Figure 1. As a result, there is also a one-to-one relation between the firm's leverage and expected equity excess return as shown in Figure 2: the lower the firm's cash flow risk, the higher the leverage of the firm, and the higher its expected equity excess return because the sensitivity to cash flows (b_0^X) increases.

Figure 2 about here

Expected equity returns at times t>0. By contrast, there may not be a one-to-one mapping between leverage and refinancing intensity at times $t > 0$, because leverage changes over time whereas the refinancing intensity does not. As a consequence, expected equity returns at times $t > 0$ depend on the firm's leverage *and* on the firm's refinancing intensity.

Figure 3 illustrates two stylized examples based on firm value paths implied by our model. Panel A illustrates that two firms that optimally decide on different leverage ratios at $t = 0$ may exhibit the same leverage at $t > 0$, because the low (high) risk firm experiences good (bad) cash flows which naturally decrease (increase) the leverage ratio. Since the debt maturity structure is kept fixed from $t = 0$, these firms have the same leverage ratio but differ with respect to their refinancing risk. Panel B illustrates the opposite case, with two firms that are identical at $t = 0$ but subsequently experience opposing cash flow shocks and evolutions of their leverage ratios while maintaining an identical debt maturity structure.

Figure 3 about here

[5] Given that the firm commits to a stationary debt structure, changes in the leverage ratio are only driven by changes in the equity value. This appears consistent with empirical evidence provided by Welch (2004) who concludes that variation in equity value is the primary determinant of changes in a firm's leverage ratio. This also seems consistent with the notion that most firms do not actively manage their capital structures and that capital structure adjustments occur infrequently; see e.g., Leary and Roberts (2005) and Strebulaev (2007).

To see how stock returns relate to leverage and debt maturity, Figure 4 plots expected equity excess returns for different combinations of leverage and refinancing intensity. Panel A shows that equity returns increase with leverage (for a given refinancing intensity) and increase with refinancing intensity (for given leverage). More specifically, the figure suggests that leverage alone is not sufficient to understand how a firm's debt financing affects expected equity returns. For instance, a firm with high leverage (solid line) but low refinancing intensity may have the same expected return as a firm with medium leverage (dotted line) and medium refinancing intensity or a firm with low leverage (dashed line) and high refinancing intensity. Hence, an (empirical) analysis on how stock returns relate to leverage should account for differences in firms' refinancing risk due to differences in their debt maturity profiles.

In Panel B, we plot the difference in returns of high- compared to low-leverage firms across different values of refinancing intensity. We find that the premium return of high compared to low leverage firms is positive and increases with refinancing intensity. In other words, the additional return that highly levered firms earn in excess of firms with low leverage increases the more immediate the firms debt refinancing needs.

Figure 4 about here

Leverage and book-to-market ratio. Our model also features a natural link between a firm's leverage and its book-to-market ratio (BM) that is consistent with recent empirical evidence suggesting that the value premium is positively related to leverage (see, e.g., Choi, 2013; Doshi et al., 2014). Assuming that equity is priced at its book value when the firm decides on its capital structure at time $t = 0$, we compute BM as

$$BM(X_t) = \frac{E(X_0)}{E(X_t)}. \tag{10}$$

By this definition of BM, all firms have an initial book-to-market ratio of 1. Similar to the firm's leverage L, its BM changes over time as the value of equity evolves in response to cash flow realizations. More specifically, at $t > 0$, a book-to-market ratio of one corresponds to the firm's time-t leverage being at the level initially chosen at $t = 0$ in the joint optimization of leverage and debt maturity structure. Since $BM > 1$ ($BM < 1$) corresponds to leverage having increased (decreased) over time, BM informs about how the firm's leverage has evolved over time relative to its initial level chosen in accordance with its debt maturity profile.

To take a first look at how BM relates to leverage, refinancing intensity, and equity returns, Panel A of Figure 5 extends the plot presented in Panel A of Figure 4 by adding a line for the combinations that imply a BM of one. The intersections of the BM-line with the leverage-lines represent the scenarios in which time-t leverage exactly corresponds to its initial choice, where higher leverage was associated with lower refinancing intensity (i.e. longer debt maturities) and higher expected equity returns. Panel B provides more insights by presenting BM-values for all combinations of leverage and refinancing intensity, showing that BM increases with leverage (for a given refinancing intensity) and increases with refinancing intensity (for given leverage). Other things equal, firms with more (less) leverage have higher (lower) BM values and the difference in BM of high- compared to low-leverage firms increases with refinancing intensity. Since, BM provides a summary measure of how a firm's leverage has changed compared to its initial choice that was set in accordance with the firm's debt maturity profile, the relation between BM and expected stock returns also depends on the firm's debt policies.

Panel C of Figure 5 shows that the relation between BM and expected excess returns on equity depends on the firm's leverage. While expected returns generally increase with BM, these returns are higher for high- compared to low-leverage firms. On the one hand, this result implies that a low leverage firm with a high book-to-market ratio may have the same expected equity return as a firm with high leverage and low BM. On the other hand, our model implies that the difference in returns of high- compared to low-leverage firms is the same across book-to-market values. This finding appears consistent with recent empirical evidence that the value premium is directly related to leverage (e.g., Choi, 2013; Doshi et al., 2014). In this context, it is also interesting to note from Panels B and C that firms with high BM values will typically be firms with high leverage and high refinancing intensity whereas firms with low BM will have low leverage and/or low refinancing intensity. Put differently, firms with high (low) leverage should be more closely related to the long (short) leg of the value premium and, hence, the returns of high- relative to low-leverage firms should become more positively related to the value premium the higher firms' refinancing intensities.

Figure 5 about here

Using the insights of the model discussed above, the next section formulates testable predictions for our empirical analysis of how debt refinancing matters for the relation between leverage and equity returns as well as the link to the value premium.

III. Testable Predictions

The model presented above implies that a firm's expected equity returns depend on the firm's leverage as well as on the maturity structure of its debt. Below we summarize the testable model predictions that guide our empirical analysis.

Prediction 1: Equity returns increase with leverage when controlling for refinancing risk.
In our model, the firm optimally chooses its capital structure by deciding on the amount of debt to raise as well as on the refinancing intensity of debt. Both, the level and the maturity structure of debt affect expected equity returns because shareholders bear the risk that they have to cover shortfalls arising from the rollover of maturing debt. Panel A of Figure 4 illustrates this interaction between expected equity returns, leverage, and refinancing intensity. More specifically, the figure shows that, for any level of refinancing risk, shareholders require a higher return for the high leverage firm (solid line) compared to the low leverage firm (dashed line).

Prediction 2: The equity return differential of high-leverage compared to low-leverage firms increases with refinancing risk.
Panel A of Figure 4 also suggests that the expected equity returns of high-leverage firms are more sensitive to refinancing intensity than expected stock returns of firms with lower leverage, i.e. the solid line is steeper than the dotted line. Panel B illustrates this more explicitly by showing that the high-minus-low-leverage return differential increases with refinancing intensity. In other words, our model implies that the premium that investors require for holding stocks of a high- compared to a low-leverage firm increases with refinancing intensity.

Prediction 3: The equity return differential of high-leverage compared to low-leverage firms is related to the value premium, and more so the higher refinancing risk.
A further implication of our model is that a firm's book-to-market ratio increases with leverage

and refinancing intensity. Panel B of Figure 5 illustrates these patterns and specifically shows that the sensitivity of BM to leverage increases with refinancing risk. Our model implies that expected equity returns increase with BM but that the return differential of high- compared to low- leverage firms does not depend on BM (Panel C in Figure 5). In our empirical analysis, we therefore expect that the returns of buying high-leverage firms and selling low-leverage firms should be related to the HML-factor that measures the value premium. This relation should be more pronounced for firms with higher refinancing risk.

Empirically, we explore whether these model predictions hold true in the data by conducting unconditional portfolio double sorts. Every month, we assign firms to the high, medium, or low-refinancing intensity tertile and, independent of the refinancing intensity classification, to the high, medium, or low-leverage risk tertile. This procedure allows us to evaluate the joint leverage and debt maturity effects on equity returns predicted by the model. By focusing on the relation of equity returns to leverage when accounting for the firm's debt maturity structure, our results can be directly compared to those provided by previous research that does not take this interaction into account.

IV. Data and Descriptive Statistics

In our empirical analysis, we use monthly data on stock returns from the Center for Research in Security Prices (CRSP) and data on firm characteristics from COMPUSTAT. For a firm to be included in the sample, we require the availability of all data items necessary to compute the firm's leverage, refinancing intensity, and book-to-market ratio, as well as stock returns with CRSP share code 10 or 11 (common equity). We exclude financials (SIC codes 6000–6999) and utilities (SIC codes 4900–4999) due to their special financial structures. This selection procedure results in a sample of 15,477 unique firms with a total of 1,770,251 firm-month observations from January 1970 to December 2014.

We compute the firm's leverage (lev), refinancing intensity (ri), book-to-market ratio (bm), and its size (market value, mv) following standard definitions established in the literature.[6] We measure size mv by the firm's market value of equity (stock price times the number of

[6] We briefly describe these measures here and refer to Appendix B for detailed definitions based on the COMPUSTAT data items used for their computation.

common shares outstanding) and bm as the value of book equity divided by mv. Furthermore, we measure leverage as the ratio of book debt to book debt plus market value of equity (e.g., Strebulaev and Yang, 2013; Danis et al., 2014) and the refinancing intensity as the ratio of debt maturing within one year to total assets (e.g., Almeida et al., 2012; Chen et al., 2013b; Gopalan et al., 2014). To account for (varying) time lags between a firm's fiscal year end and information becoming publicly available, we apply a conservative lag of six months before we update information on the firm's debt position in our analysis of stock returns.

Table I presents summary statistics for the firm characteristics defined above as well as for monthly equity excess returns. On average, our sample contains $3,300$ firms per month.

Table I about here

V. Empirical Results

In our empirical analysis, we first show that the relation between leverage and equity returns appears ambiguous, consistent with mixed evidence reported in previous research, and, more specifically, our results point towards the distress puzzle established in the literature. We then show that the relation between equity returns and leverage is generally positive when accounting for firms' debt refinancing risk. As predicted by our model the premium return on high- over low-leverage firms is positive, linked to the value premium, and increases with the immediacy of debt refinancing needs.

A. Portfolios sorted on leverage or refinancing intensity

At the outset, we present results on how equity excess returns relate to leverage and refinancing intensity in individual portfolio sorts. At the end of every month, we allocate firms to decile portfolios such that portfolios P_1 (P_{10}) contain high (low) leverage and high (low) refinancing intensity firms, respectively. Tables II and III summarize portfolio characteristics as well as equally- and value-weighted returns for leverage- and refinancing intensity-sorted portfolios.

Table II shows that the relation between equity returns and leverage is sensitive to risk-adjustments and portfolio weighting schemes. Using equally-weighted portfolios (Panel A), we find that raw excess returns and factor model alphas of buying high- and selling low-leverage firms (HL-returns) are not different from zero. The value-weighted portfolio results in Panel B suggest that HL raw excess returns and CAPM-alphas are not different from zero either, but that the three- and four-factor alphas are significantly negative. These negative alphas are associated with significantly positive exposures to the market-, size-, and value-factors, which seems to reflect the 'distress puzzle' identified in previous research (see, e.g., Campbell et al., 2008). In other words, the low risk-adjusted excess returns of high compared to low leverage firms may be viewed as anomalous because these firms' exposures to standard risk factors are significantly higher. Specifically, the HL-returns most significantly load on the value-factor (HML) with coefficients of 0.99 (equally-weighted) and 1.46 (value-weighted), a finding that is consistent, both, with our model (*Prediction 3*, to be discussed in more detail below) as well as with recent research that argues for a positive relation between leverage and the value premium (see, e.g., Choi, 2013; Doshi et al., 2014).

Table II about here

The results for the portfolios sorted by refinancing intensity, presented in Table III, are qualitatively similar. Using the equally-weighted portfolios, HL-returns from buying high- and selling low-refinancing intensity firms are insignificantly positive or negative. In the value-weighted portfolios, the three- and four-factor alphas of the HL-portfolio are significantly negative and associated with positive exposures to the Fama-French factors, which may again be viewed as resembling the distress puzzle. Very similar to the leverage portfolios, we find that HL-returns are most significantly exposed to the HML-factor.

Table III about here

Taken together, these results suggest that the evidence on how stock returns relate to leverage or refinancing intensity is mixed but points towards an interpretation similar to that of the distress puzzle. Firms with highest risk, in the sense that they either have high leverage or have to roll over a large fraction of their debt in the near future, are most exposed to traditional risk factors but earn the lowest risk-adjusted returns. In both cases, HL-returns appear strongly related to the value-factor. While the leverage and refinancing intensity results above appear very similar when considered in isolation, we show that the relation of equity returns to leverage and refinancing intensity crucially depends on their interaction.

B. Leverage and equity returns when controlling for refinancing intensity

To empirically evaluate the model predictions on the relation between leverage, refinancing intensity and equity returns (formulated in Section III), we conduct unconditional portfolio double sorts. At the end of every month, we assign firms to the high, medium, or low-refinancing intensity tertile. Independent of the refinancing intensity ranking, we also assign firms to the high, medium, or low-leverage tertile. This classification scheme allows us to generate a cross-section of $3 \times 3 = 9$ portfolios $P_{i \times j}$, where i and j denote the indexes for refinancing intensity and leverage, respectively. Hence, $P_{1\times1}$ ($P_{3\times3}$) refers to the portfolio of firms that belongs to the high (low) refinancing intensity tertile and to the high (low) leverage tertile.[7]

Tables IV and V report results for equally- and value-weighted portfolios. Panels A present the nine $P_{i \times j}$ portfolios and Panels B contain the results for trading high- against low-leverage firms when controlling for refinancing intensity. More specifically, in Panel B, HL_1 reports the excess returns from buying high-leverage stocks ($P_{1\times1}$ in Panel A) and selling low-leverage stocks ($P_{1\times3}$) in the high-refinancing intensity tertile; similarly, HL_2 and HL_3 refer to trading on leverage in the medium- and low-refinancing intensity tertiles. Finally, HL reports the differential return of trading high- against low-leverage firms for firms that have high compared to low refinancing intensity (i.e. HL_1 minus HL_3).

Equally-weighted portfolios. We start with the equally-weighted portfolios in Table IV. Panel A shows that the excess returns are most significantly positive for high-leverage firms in all refinancing intensity tertiles (i.e. in all portfolios $P_{\cdot\times1}$) with values of 1.09%, 0.96%, and 0.88% per month, respectively. For high (medium) refinancing intensity firms, the returns monotonically decrease to 0.43% (0.62%) yielding a significant leverage-conditional HL_1- (HL_2-) return of 0.66% (0.33%) in Panel B. These results confirm *Prediction 1* that equity returns increase with leverage when controlling for refinancing intensity. For firms with low re-

[7]Employing an unconditional double sort may result in some variation in the number of firms allocated across the nine portfolios. Our descriptive statistics reported in the tables presenting the unconditional double sort results show that there is indeed some variation in the number of firms assigned to the nine portfolios but also that our dataset is rich enough to ensure that all portfolios are sufficiently well diversified with an average of at least 102 firms. Moreover, our robustness checks below show that results are very similar when using conditional portfolio sorts, which ensure that a comparable number of firms is allocated to all portfolios.

financing intensity, however, this effect does not seem to be important as we find that leverage-conditional return differentials are essentially zero. The difference in leverage-conditional returns decreases in refinancing intensity and the HL-return of 0.61% per month (with a t-statistic of 4.06) confirms *Prediction 2*: the premium return for leverage is higher for firms that have to roll over more debt in the near future.

The results are qualitatively identical and quantitatively slightly more pronounced when estimating CAPM-alphas, thereby lending further support to *Prediction 1* and *Prediction 2*. As to be expected, we do not find significant leverage-conditional return differentials within refinancing intensity tertiles when we compute alphas of factor models that include the HML-factor: the return differentials are highly exposed to the value-factor in all three refinancing intensity tertiles with factor loadings (t-statistics) of 1.05 (10.03), 0.98 (9.54), and 0.84 (11.60), respectively. This finding is consistent with the patterns implied by our model as stated in *Prediction 3*: the difference in returns of high- minus low-leverage firms is directly connected to the value premium, and the relation to the value premium becomes more positive the higher firms' refinancing risk. The HL-returns of trading on leverage in high- compared to low-refinancing intensity firms (i.e. HL_1 minus HL_3) remain highly significant after controlling for the value-factor and the other risk factors. The four-factor alpha is 0.61% per month (t-statistic of 4.20) and returns exhibit a small but significantly positive exposure to the HML-factor. The exposures to the market- and the size-factor are significantly negative but economically small.

TABLE IV ABOUT HERE

Overall, these results provide strong support for the model predictions. Equity returns increase with leverage when controlling for refinancing intensity. The difference in returns of high- compared to low-leverage firms appears closely related to the value premium across all refinancing intensity tertiles, yet, the interaction of leverage and refinancing intensity contains return-relevant information beyond the HML-factor. The returns to buying high- and selling low-leverage firms are more than 7% *p.a.* higher for firms with high refinancing intensity compared to firms with low refinancing intensity.

Value-weighted portfolios. Table V presents the results for value-weighted portfolios. Qualitatively these findings are similar to the equally-weighted portfolios and in line with the model predictions but quantitatively they are less pronounced. While we do find that equity excess returns increase with leverage in all refinancing intensity tertiles, the high-minus-low leverage returns and CAPM-alphas are not or only marginally significant. Within each refinancing intensity portfolio, we again find that the returns to buying high- and selling low-leverage firms are significantly exposed to the HML-factor with loadings close to unity (between 1.01 and 1.11). These return differentials increase with firms' refinancing intensities, however, the HL-returns and -alphas are small and not different from zero. Compared to our findings based on equally-weighted portfolios, these results suggest that firm size matters for the joint effect of leverage and refinancing intensity on equity returns in a way that calls for further investigation.

Table V about here

We therefore provide additional evidence to show that our results are not driven by a few small firms but rather by the observation that the link implied by our model appears not to be economically as important for the biggest firms in our sample. We repeat the empirical analysis for subsamples where we exclude the top quartile or top decile of biggest firms. Table VI summarizes the returns to trading on leverage when controlling for refinancing intensity in these subsamples. When we omit the quartile of biggest firms, we find that equally- and value-weighted results are very similar: excess returns and factor-model alphas are highly significant in the high-refinancing intensity portfolio (HL_1), decrease towards the low-refinancing intensity portfolio (HL_3), and the difference (HL) is highly significant with monthly four-factor alphas of 1.00% and 0.91% for equally- and value-weighted portfolios, respectively. Moreover, the leverage-conditional return differentials are closely related to the HML-factor in all refinancing intensity tertiles (HL_i) for both weighting schemes, and loadings on HML increase with firms' refinancing intensities. Table VI also presents the results for the subsample where we only exclude the top decile of biggest firms. The results become less pronounced but remain highly significant for the equally-weighted portfolios. For the value-weighted portfolios, we find significant HL_1 and HL_2 excess returns and CAPM-alphas and the same applies for HL; the alphas that control for exposure to the HML-factor, however, are not significant because the HL-returns still have a relatively high loading on the value-factor. As we discuss in the next section, one reason as to why the interaction of leverage and refinancing intensity may not be as important for the stock returns of very big firms (which drive results in value-weighted portfolios) is that these firms may be less financially constrained compared to small firms.

Table VI about here

Overall, the empirical results confirm the model predictions in the data. While leverage alone appears to be an insufficient metric to understand the cross-section of equity returns, accounting for firms' debt maturity profiles reveals that equity returns are positively related to leverage. The compensation for holding high- instead of low-leverage firms increases with refinancing intensity.

C. Discussion of results, implications, and robustness checks

This section discusses how our finding that leverage and debt refinancing risk jointly matter for equity returns provides new insights to previous research on the link between leverage, equity returns, the value premium, and the distress puzzle.

Leverage, equity returns, and the distress puzzle. Previous research on how leverage relates to equity returns provides mixed evidence and similarly our analysis of leverage-sorted portfolios implies that this relation is highly sensitive to risk-adjustments and return weighting schemes (see Table II). These results are in line with our model, which implies that equity investors assess a firm's debt-related risk not only in terms of leverage but also in terms of the immediacy of debt refinancing needs, because they have to cover shortfalls occurring in the rollover of maturing debt. Our empirical results (Tables IV to VI) confirm that stockholders are only willing to accept this commitment in exchange for a premium return that increases with the firm's refinancing intensity, i.e. the fraction of capital that has to be refinanced in the near future.

As a consequence, ignoring debt maturity in empirical studies on the link between leverage and equity returns may result in inconclusive evidence (see, e.g., Gomes and Schmid, 2010). More specifically, our results may shed new light on the distress puzzle, i.e. the finding that firms with high distress risk earn low alphas despite having high exposures to standard risk factors (e.g. Campbell et al., 2008). Using leverage as a natural proxy for distress risk, we find exactly this pattern for the value-weighted returns of leverage-sorted portfolios. Once we account for firms' refinancing intensities, the relation between leverage and equity returns becomes positive.

Debt (re)financing and the value premium. The value premium, defined as the returns that high book-to-market stocks earn in excess of low book-to-market stocks, has been explored extensively from different angles. Typically, the notion of value is linked to BM as a valuation ratio, a firm's investments, operating leverage, and/or profitability (e.g. Fama and French, 1993; Carlson et al., 2004; Zhang, 2005; Novy-Marx, 2011, 2013; Fama and French, 2015). Our paper provides a novel perspective on why BM-ratios are informative for expected returns. In our model, BM is a simple measure of how far a firm's capital structure deviates from its (initial) optimum, i.e. the capital structure arising from jointly choosing leverage and the mix of short- and long-term debt. While Fama and French (1992) conclude that leverage effects are subsumed by size and book-to-market, recent papers explicitly study the link between leverage and the value premium and identify a positive relation (see, e.g., Choi, 2013; Doshi et al., 2014). Both, our theoretical as well as our empirical results are consistent with the notion that the value premium is linked to debt (re)financing of firms. In our model, book-to-market ratios increase with leverage *and* refinancing intensity. Empirically, we find that the returns to buying high- and selling low-leverage firms positively load on the HML-factor and that these loadings increase with refinancing risk.

Firm size and financial constraints. While our empirical results generally support the model predictions, we do not find such a pronounced relation when we compute value-weighted returns for the biggest firms in our sample. Our theory provides no predictions related to firm size but an economically plausible reasoning for this finding may be that these very big firms are less financially constrained than small firms. While the literature does not fully agree on how to exactly quantify financial constraints, the following may be viewed as indicators for a firm being financially constraint: no rating, never paid a dividend, long intervals between dividends, young age as measured by CRSP or COMPUSTAT coverage.[8]

Following our analysis that excludes the biggest 10% or 25% of firms (above in Table VI), we provide some statistics on how these indicators for financial constraints relate to the size of firms in our sample in Table VII. Comparing the 10% of biggest firms to the 90% of smaller firms, Panel A shows, first, that the fraction of unrated firms is much lower for big compared to small firms (32% compared to 87%). Second, we find that the fraction of firms that do not pay dividends is much lower for big firms (13% compared to 50%) and also that the frequency of dividend payments is much higher with an average interval of 1.6 years (compared to 4.6 years for smaller firms). Finally, big firms are typically twice the age of smaller firms (29 vs. 14 COMPUSTAT years and 22 vs. 11 CRSP years). When we compare the 25% biggest firms to the 75% smaller firms, the differences in these indicators for financial constraints are still sizeable. For instance, while one out of two big firms has a rating this is only true for one out of eleven smaller firms.

We also compute the commonly used financial constraints metrics developed by Kaplan and Zingales (1997, KZ), Whited and Wu (2006, WW), and Hadlock and Pierce (2010, HP). Every month when we classify firms as big or small, we also classify firms from least to most constrained based on the deciles (or quartiles) of the time-t distribution of the constraints metrics. Panel B of Table VII reports the average and median decile (or quartile) of firms' financial constraints classification for big compared to small firms.[9] While the results are less conclusive when using the metric of KZ, the measures of WW and HP suggest that the biggest firms in our sample are much less constrained than the smaller firms. For WW and HP we find very similarly that the 10% of biggest firms are classified on average (in the median) in the second (first) financial constraint decile whereas the 90% of smaller firms are on average and in the median in the sixth decile.

Table VII about here

On the whole, these results suggest that the biggest firms in our sample, which drive the value-weighted return results in Tables V and VI, are indeed the least financially constrained.

[8] For recent research related to the measurement of and/or implications of financial constraints, see e.g. Kaplan and Zingales (1997), Lamont et al. (2001), Whited and Wu (2006), Hennessy and Whited (2007), and Hadlock and Pierce (2010).

[9] We choose to report decile- and quartile-classifications rather than the raw values of the financial constraints measures to facilitate the comparison across KZ, WW, and HP.

Hence, a conceivable interpretation may be that shareholders do not deem the debt rollover risk channel as important for very big firms because they consider it unlikely that these firms fail to refinance their debt.

Summary of robustness checks. In the previous section, we have used unconditional double sorts to explore how equity returns relate to leverage and debt refinancing intensity. While our dataset is sufficiently rich to ensure that all portfolios are well diversified, we repeat the analysis with conditional double sorts, which ensure that a comparable number of firms is allocated to all portfolios. We first sort firms by their refinancing intensity and subsequently, within each refinancing portfolio, according to their leverage, or vice versa. The numerical results of the conditional sorts are similar to those of the unconditional sorts and our conclusions remain unchanged; for details see Tables IA.1 to IA.6 in the Internet Appendix.

VI. Conclusion

This paper complements previous mixed evidence on the relation between stock returns and leverage by showing that equity returns increase with leverage when controlling for debt refinancing risk. Our model, which draws on the recent bond literature on debt rollover risk, implies that shareholders demand a premium for holding high- compared to low-leverage firms that increases with the immediacy of debt refinancing needs. Because firms optimally choose their capital structure by jointly optimizing the level and the maturity structure of debt, leverage alone is insufficient to understand the cross-sectional relation between debt-related risk and equity returns.

Our empirical results, based on the merged CRSP-COMPUSTAT-universe from 1970 to 2014, match the predictions of the model in that stocks of firms with high leverage earn returns in excess of stocks of low leverage firms when controlling for debt refinancing intensity. Also consistent with the model, we find that these leverage-conditional return differentials are closely related to the value premium (HML-factor). Moreover, the high-minus-low leverage premium return generally increases with firms' debt refinancing intensity, except for the biggest firms in our sample; this finding appears consistent with the notion of very big firms being less financially constrained and shareholders being less concerned about successful refinancing.

Our results also shed new light on the distress puzzle, established as the finding that firms with high distress risk earn anomalously low risk-adjusted excess returns while being highly exposed to standard risk factors. We find exactly the same when we sort firms into portfolios only based on their leverage. Accounting for debt refinancing intensity reverses this link and uncovers that the relation between leverage (as a proxy for distress risk) and equity returns is generally positive.

Appendix

A. Model Solutions

A.1. Debt value

Equation (1) has a particular and a general solution which satisfies the equation,

$$D^i(X) = p^i + A_1^i X^{\beta_1^i} + A_2^i X^{\beta_2^i} \tag{A.1}$$

with β_1^i and β_2^i being the roots of the fundamental quadratic which are given by

$$\beta_1^i = \frac{-(\mu^{\mathbb{Q}} - \frac{1}{2}\sigma^2) + \sqrt{(\mu^{\mathbb{Q}} - \frac{1}{2}\sigma^2)^2 + 2\sigma^2(r + \phi^i)}}{\sigma^2} \quad > \quad 0 \tag{A.2}$$

and

$$\beta_2^i = \frac{-(\mu^{\mathbb{Q}} - \frac{1}{2}\sigma^2) - \sqrt{(\mu^{\mathbb{Q}} - \frac{1}{2}\sigma^2)^2 + 2\sigma^2(r + \phi^i)}}{\sigma^2} \quad < \quad 0. \tag{A.3}$$

The two boundary conditions imposed on debt value are (at $X = \infty$)

$$\lim_{X \to \infty} \qquad D^i(X) = p^i \tag{A.4}$$

and (at $X = X_B$)

$$\lim_{X \to X_B} \qquad D^i(X_B) = \frac{X_B}{r - \mu^{\mathbb{Q}}} \lambda^i. \tag{A.5}$$

These conditions imply $A_1^i = 0$, in order to exclude bubbles, and A_2^i is given by

$$A_2^i = \left[\frac{X_B}{r - \mu^{\mathbb{Q}}} \lambda^i - p^i\right] \left(\frac{1}{X_B}\right)^{\beta_2^i}. \tag{A.6}$$

Therefore, the scaling factor used in Equation (4) is defined by

$$\pi_t^{i,\mathbb{Q}} = \left(\frac{X_t}{X_B}\right)^{\beta_2^i}. \tag{A.7}$$

A.2. Levered firm value

The value of debt benefits DB^i satisfies the equation (where we define $k^i = k \cdot \phi^i$)

$$DB^i(X) = \frac{k^i P^i}{r} + G_1^i X^{\gamma_1} + G_2^i X^{\gamma_2} \tag{A.8}$$

with γ_1 and γ_2 being the roots of the fundamental quadratic which are defined as

$$\gamma_1 = \frac{-(\mu^{\mathbb{Q}} - \frac{1}{2}\sigma^2) + \sqrt{(\mu^{\mathbb{Q}} - \frac{1}{2}\sigma^2)^2 + 2\sigma^2 r}}{\sigma^2} \quad > \quad 0 \tag{A.9}$$

and

$$\gamma_2 = \frac{-(\mu^{\mathbb{Q}} - \frac{1}{2}\sigma^2) - \sqrt{(\mu^{\mathbb{Q}} - \frac{1}{2}\sigma^2)^2 + 2\sigma^2 r}}{\sigma^2} \quad < \quad 0. \tag{A.10}$$

The two boundary conditions imposed on the value of debt benefits are (at $X = \infty$)

$$\lim_{X \to \infty} \qquad DB^i(X) = \frac{k^i P^i}{r} \tag{A.11}$$

and (at $X = X_B$)

$$\lim_{X \to X_B} \qquad DB^i(X_B) = 0. \tag{A.12}$$

In order to exclude bubbles these conditions imply $G_1^i = 0$. Moreover, G_2^i is given by

$$G_2^i = -\frac{k^i P^i}{r} \left(\frac{1}{X_B} \right)^{\gamma_2}. \tag{A.13}$$

Given the value of debt benefits DB^i, the levered firm value F can be computed as

$$F(X_t) = \frac{X_t}{r - \mu^{\mathbb{Q}}} + \sum_i \frac{k^i P^i}{r} \left[1 - \left(\frac{X_t}{X_B} \right)^{\gamma_2} \right]. \tag{A.14}$$

In this expression, the first term represents the value of an unlevered firm and the second term the value of debt benefits. Thus, the scaling factor (probability of default) in this case is defined by

$$\pi_t^{\mathbb{Q}} = \left(\frac{X_t}{X_B} \right)^{\gamma_2}. \tag{A.15}$$

A.3. Optimal default boundary

We adopt the endogenous default notion of, e.g., Black and Cox (1976), Fischer et al. (1989) or Leland (1994b), which postulates that the ex-post optimal default boundary X_B for equityholders satisfies the smooth-pasting condition

$$\left.\frac{\partial E(X_t)}{\partial X_t}\right|_{X_t=X_B} = 0. \tag{A.16}$$

This condition implies that the optimal default boundary is given by

$$X_B = \frac{\frac{k^L P^L}{r}\gamma_2 + \frac{k^S P^S}{r}\gamma_2 - p^L \beta_2^L - p^S \beta_2^S}{\frac{1}{r-\mu^{\mathbb{Q}}}\left(1 - \beta_2^L \lambda^L - \beta_2^S \lambda^S\right)}. \tag{A.17}$$

In the case of debt with only one maturity type, this default boundary is similar to the case of Leland (1994a) for a zero-coupon bond with no exogenous bankruptcy costs. Generally, an increase in the scaling factor k of debt benefits decreases the default boundary (since $\gamma_2 < 0$), whereby short-term debt is more sensitive to a change in k. Moreover, an increase in P^i increases the default boundary since we have that $\gamma_2 k(r+\phi^i) - \beta_2^i r > 0$. The default boundary is more sensitive to an increase in long-term debt compared to short-term debt (since $\beta_2^S < \beta_2^L$). In any case, an increase in P^i increases the likelihood of default.

B. Definition of Variables

This section defines the variables used in the empirical analysis. The capitalized words correspond to the COMPUSTAT data items. We define leverage (lev) following, e.g., Strebulaev and Yang (2013) or Danis et al. (2014) as book debt over book debt plus market value of equity, hence,

$$lev = \frac{\text{DLTT} + \text{DLC}}{\text{DLTT} + \text{DLC} + \text{PRCC\_F} \cdot \text{CSHO}} \tag{B.1}$$

where DLTT denotes item "Long-Term Debt - Total", DLC denotes "Debt in Current Liabilities - Total", PRCC_F denotes "Price Close - Annual - Fiscal" and CSHO denotes "Common Shares Outstanding".

We define our refinancing intensity measure (ri) in accordance with the empirical literature on rollover risk (e.g. Almeida et al., 2012; Chen et al., 2013b; Gopalan et al., 2014) as the fraction of debt maturing within one year to total assets, thus

$$ri = \frac{\text{DD1}}{\text{AT}}, \tag{B.2}$$

where DD1 refers to item “Long-Term Debt Due in One Year” and AT to “Assets - Total”.

We define the book-to-market ratio (bm) following, e.g., Friewald et al. (2014) as

$$bm = \frac{\text{CEQ}}{\text{PRCC\_F} \cdot \text{CSHO}} \tag{B.3}$$

and market value (mv) as

$$mv = \text{PRCC\_F} \cdot \text{CSHO}, \tag{B.4}$$

where CEQ is “Common/Ordinary Equity - Total”.

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Table I: Descriptive Statistics.

This table reports summary statistics of the variables that we use in the empirical analysis. We report the mean, median, standard deviation, 25%- and 75%-quantiles of the excess returns, leverage (*lev*), refinancing intensity (*ri*), market value (*mv*), book-to-market (*bm*), and the number of firms in each month. The dataset comprises joint observations of stock prices and firm characteristics obtained from CRSP and COMPUSTAT for the time period from 1970 to 2014 where we have excluded financials (SIC codes 6000–6999) and utilities (SIC codes 4900–4999).

	Mean	Median	SD	$Q_{25\%}$	$Q_{75\%}$
Excess Return	0.89	−0.44	19.50	−7.96	7.61
Leverage (*lev*)	24.05	17.14	23.86	2.59	39.39
Refinancing Intensity (*ri*)	2.24	0.74	6.08	0.03	2.42
Market Value (*mv*)	1443.84	80.55	10165.16	18.90	418.28
Book-to-Market (*bm*)	0.73	0.56	2.96	0.30	0.98
Number of Firms	3284.32	3246.00	860.25	2631.50	3817.50

Table II: Equity Returns of Portfolios Sorted by Leverage.

We sort stocks based on firm's leverage (*lev*) into decile portfolios and calculate equally- and value-weighted excess returns in Panels A and B, respectively. P_1 contains firms with highest leverage, P_{10} the ones with lowest. HL presents results for going long P_1 and short P_{10}. For each portfolio we report the means of leverage (*lev*), market value (*mv*) and book-to-market (*bm*). Each panel reports monthly means of excess returns given in percentage points, alpha estimates of regressing excess returns on the market (MKT), as well as the three (MKT, SMB, HML) and four (MKT, SMB, HML, UMD) Fama-French factors. Values in parentheses are t-statistics based on HAC standard errors using Newey and West (1987) with optimal truncation lag chosen as suggested by Andrews (1991). Results are based on a data set comprising joint observations of stock prices and firm characteristics obtained from CRSP and COMPUSTAT for the time period from 1970 to 2014 where we have excluded financials (SIC codes 6000–6999) and utilities (SIC codes 4900–4999).

	P_1	P_2	P_3	P_4	P_5	P_6	P_7	P_8	P_9	P_{10}	HL
Portfolio Characteristics											
lev	72.28	52.40	40.52	31.40	23.80	17.18	11.19	6.02	2.17	0.14	36.21
mv	632.98	778.57	1248.57	1762.06	2216.82	2500.56	2334.16	2142.61	932.14	699.22	666.10
bm	1.14	1.12	0.97	0.83	0.74	0.65	0.59	0.54	0.48	0.61	0.88
Panel A: Equally-Weighted Portfolio Returns											
Excess Return	1.20***	0.98***	0.97***	0.91***	0.94***	0.77**	0.72**	0.70*	0.52	0.90**	0.30
	(2.71)	(2.73)	(3.00)	(2.81)	(2.86)	(2.41)	(2.08)	(1.88)	(1.37)	(2.56)	(1.33)
CAPM α	0.53*	0.35*	0.36**	0.30*	0.30*	0.14	0.06	0.00	−0.21	0.25	0.28
	(1.93)	(1.71)	(2.08)	(1.82)	(1.95)	(0.89)	(0.34)	(0.02)	(−1.08)	(1.31)	(1.25)
3-factor α	0.05	−0.01	0.06	0.05	0.13	0.03	0.03	0.04	−0.09	0.29**	−0.24
	(0.28)	(−0.06)	(0.73)	(0.59)	(1.55)	(0.29)	(0.33)	(0.38)	(−0.85)	(2.48)	(−1.44)
4-factor α	0.33*	0.19	0.24**	0.21**	0.28***	0.20**	0.19*	0.27*	0.17	0.46***	−0.14
	(1.78)	(1.58)	(2.33)	(2.26)	(2.79)	(2.01)	(1.80)	(1.90)	(1.24)	(3.55)	(−0.81)
MKT	1.10***	1.03***	1.01***	1.00***	1.01***	0.98***	0.99***	0.99***	1.01***	0.92***	0.18***
	(23.12)	(24.62)	(37.68)	(34.25)	(43.89)	(30.72)	(33.34)	(30.12)	(34.37)	(30.26)	(4.85)
SMB	1.22***	1.04***	0.94***	0.87***	0.85***	0.87***	0.95***	1.00***	1.05***	1.02***	0.21**
	(14.72)	(13.56)	(14.13)	(9.97)	(17.41)	(14.21)	(20.21)	(20.79)	(23.77)	(19.02)	(2.56)
HML	0.74***	0.55***	0.44***	0.36***	0.21***	0.07	−0.11**	−0.27***	−0.45***	−0.25***	0.99***
	(7.49)	(8.05)	(8.44)	(6.42)	(5.19)	(1.32)	(−1.97)	(−3.24)	(−4.05)	(−3.74)	(13.20)
UMD	−0.31***	−0.22***	−0.20***	−0.18***	−0.17***	−0.19***	−0.18***	−0.26***	−0.29***	−0.20***	−0.11
	(−4.56)	(−4.91)	(−4.48)	(−4.69)	(−3.94)	(−5.50)	(−3.97)	(−3.47)	(−3.23)	(−3.36)	(−1.55)
Panel A: Value-Weighted Portfolio Returns											
Excess Return	0.72**	0.92***	0.75***	0.60***	0.75***	0.56**	0.55**	0.53**	0.33	0.49	0.23
	(2.04)	(3.23)	(3.12)	(2.87)	(3.44)	(2.52)	(2.57)	(2.22)	(1.07)	(1.64)	(0.92)
CAPM α	−0.00	0.30**	0.18	0.09	0.21**	0.02	0.01	−0.03	−0.35**	−0.19	0.19
	(−0.00)	(2.20)	(1.64)	(1.01)	(2.56)	(0.27)	(0.14)	(−0.32)	(−1.96)	(−1.32)	(0.72)
3-factor α	−0.43***	0.02	−0.07	−0.04	0.09	−0.02	0.08	0.14	−0.07	0.14	−0.56***
	(−3.09)	(0.17)	(−0.92)	(−0.43)	(1.19)	(−0.22)	(1.22)	(1.44)	(−0.65)	(1.25)	(−3.36)
4-factor α	−0.16	0.21**	0.11	0.08	0.21***	0.09	0.13*	0.30***	0.17	0.32***	−0.48***
	(−1.14)	(2.11)	(1.34)	(0.94)	(2.98)	(0.96)	(1.91)	(2.81)	(1.37)	(2.72)	(−2.61)
MKT	1.33***	1.14***	1.07***	0.95***	1.02***	0.98***	0.98***	0.96***	1.05***	1.03***	0.29***
	(37.99)	(33.85)	(44.11)	(29.55)	(36.48)	(29.01)	(41.67)	(35.65)	(29.17)	(25.70)	(5.98)
SMB	0.50***	0.30***	0.15***	0.03	−0.00	−0.02	−0.10***	−0.11**	0.18***	0.17**	0.33***
	(6.61)	(5.12)	(2.88)	(0.45)	(−0.11)	(−0.41)	(−2.66)	(−2.33)	(3.81)	(2.54)	(3.62)
HML	0.72***	0.48***	0.44***	0.22***	0.18***	0.05	−0.15***	−0.39***	−0.68***	−0.74***	1.46***
	(10.76)	(9.32)	(9.35)	(4.45)	(4.10)	(0.91)	(−3.76)	(−6.01)	(−5.65)	(−8.11)	(14.74)
UMD	−0.30***	−0.21***	−0.21***	−0.13***	−0.13***	−0.12***	−0.05*	−0.17***	−0.27***	−0.20***	−0.10
	(−5.86)	(−5.98)	(−4.55)	(−3.21)	(−4.35)	(−3.14)	(−1.76)	(−2.93)	(−3.81)	(−2.75)	(−1.20)

Table III: Equity Returns of Portfolios Sorted by Refinancing Intensity.

We sort stocks based on firm's refinancing intensity (ri) into decile portfolios and calculate equally- and value-weighted excess returns in Panels A and B, respectively. P_1 contains firms with highest refinancing intensity, P_{10} the ones with lowest. HL presents results for going long P_1 and short P_{10}. For each portfolio we report the means of the refinancing intensity (ri), market value (mv) and book-to-market (bm). Each panel reports monthly means of excess returns given in percentage points, alpha estimates of regressing excess returns on the market (MKT), as well as the three (MKT, SMB, HML) and four (MKT, SMB, HML, UMD) Fama-French factors. Values in parentheses are t-statistics based on HAC standard errors using Newey and West (1987) with optimal truncation lag chosen as suggested by Andrews (1991). Results are based on a data set comprising joint observations of stock prices and firm characteristics obtained from CRSP and COMPUSTAT for the time period from 1970 to 2014 where we have excluded financials (SIC codes 6000–6999) and utilities (SIC codes 4900–4999).

	P_1	P_2	P_3	P_4	P_5	P_6	P_7	P_8	P_9	P_{10}	HL
Portfolio Characteristics											
ri	13.39	4.50	2.86	1.93	1.30	0.85	0.53	0.28	0.09	0.00	6.69
mv	1026.66	1760.21	1866.58	1916.45	1677.07	1498.52	1609.39	1919.58	2223.57	839.18	932.92
bm	0.70	0.83	0.83	0.88	0.85	0.79	0.76	0.74	0.67	0.68	0.69
Panel A: Equally-Weighted Portfolio Returns											
Excess Return	0.95**	0.90**	1.01***	0.89**	0.88***	0.79**	0.79**	0.80**	0.70**	0.88**	0.07
	(2.40)	(2.47)	(2.88)	(2.56)	(2.61)	(2.30)	(2.37)	(2.44)	(2.20)	(2.52)	(0.64)
CAPM α	0.29	0.25	0.36**	0.25	0.23	0.13	0.13	0.14	0.04	0.25	0.05
	(1.28)	(1.38)	(2.05)	(1.49)	(1.49)	(0.81)	(0.81)	(0.95)	(0.26)	(1.37)	(0.42)
3-factor α	0.07	0.05	0.16*	0.04	0.08	−0.00	−0.01	0.01	−0.09	0.18	−0.11
	(0.48)	(0.60)	(1.75)	(0.54)	(0.99)	(−0.01)	(−0.15)	(0.18)	(−1.13)	(1.59)	(−1.16)
4-factor α	0.25	0.25**	0.31***	0.22**	0.29***	0.22**	0.21*	0.24**	0.11	0.36***	−0.11
	(1.47)	(2.09)	(2.84)	(2.24)	(3.06)	(1.99)	(1.96)	(2.45)	(1.15)	(2.99)	(−1.03)
MKT	0.99***	0.99***	1.00***	1.01***	1.01***	1.01***	1.04***	1.04***	1.05***	0.94***	0.06**
	(23.01)	(32.77)	(34.54)	(37.82)	(38.37)	(30.78)	(39.10)	(42.02)	(40.55)	(30.67)	(2.15)
SMB	1.24***	1.13***	1.03***	0.95***	0.93***	0.92***	0.88***	0.83***	0.83***	1.01***	0.22***
	(13.96)	(18.46)	(18.50)	(18.43)	(21.84)	(23.02)	(15.50)	(15.74)	(13.11)	(18.33)	(4.44)
HML	0.26***	0.21***	0.24***	0.24***	0.13**	0.09*	0.11*	0.08	0.09*	−0.04	0.30***
	(2.63)	(2.81)	(4.26)	(5.44)	(2.32)	(1.65)	(1.83)	(1.55)	(1.90)	(−0.75)	(5.76)
UMD	−0.21***	−0.21***	−0.17***	−0.20***	−0.24***	−0.25***	−0.25***	−0.25***	−0.22***	−0.20***	−0.01
	(−3.00)	(−4.01)	(−4.01)	(−6.22)	(−5.44)	(−6.37)	(−4.68)	(−5.33)	(−6.05)	(−4.25)	(−0.17)
Panel A: Value-Weighted Portfolio Returns											
Excess Return	0.59*	0.54**	0.63**	0.61**	0.54**	0.46*	0.59***	0.54**	0.46**	0.61**	−0.02
	(1.86)	(2.08)	(2.52)	(2.43)	(2.36)	(1.84)	(2.60)	(2.37)	(2.00)	(2.32)	(−0.13)
CAPM α	−0.09	−0.06	0.07	0.04	−0.01	−0.12	0.03	−0.02	−0.12*	−0.01	−0.08
	(−0.63)	(−0.48)	(0.66)	(0.48)	(−0.09)	(−1.11)	(0.46)	(−0.25)	(−1.73)	(−0.13)	(−0.39)
3-factor α	−0.27**	−0.10	0.02	−0.04	−0.04	−0.16*	0.03	0.02	−0.03	0.16*	−0.43***
	(−1.99)	(−0.84)	(0.18)	(−0.48)	(−0.51)	(−1.66)	(0.43)	(0.26)	(−0.39)	(1.65)	(−2.60)
4-factor α	−0.09	0.01	0.10	0.04	0.06	0.06	0.13	0.18**	0.15**	0.34***	−0.43***
	(−0.69)	(0.12)	(1.04)	(0.48)	(0.79)	(0.56)	(1.56)	(2.39)	(2.29)	(3.87)	(−2.74)
MKT	1.20***	1.06***	0.99***	1.06***	1.00***	1.03***	1.02***	1.00***	1.01***	1.00***	0.21***
	(32.05)	(24.83)	(24.61)	(37.54)	(39.78)	(30.17)	(42.46)	(43.39)	(61.93)	(27.35)	(4.34)
SMB	0.39***	0.13	0.16**	0.06	0.01	0.03	−0.05	−0.07**	−0.12***	0.20***	0.18**
	(3.72)	(1.24)	(2.55)	(0.88)	(0.24)	(0.79)	(−1.18)	(−2.07)	(−3.42)	(3.68)	(2.03)
HML	0.25***	0.03	0.07	0.13***	0.04	0.01	−0.02	−0.13***	−0.24***	−0.44***	0.69***
	(3.42)	(0.35)	(0.76)	(2.74)	(0.78)	(0.18)	(−0.53)	(−3.06)	(−7.08)	(−5.01)	(6.40)
UMD	−0.20***	−0.12**	−0.09*	−0.09**	−0.12***	−0.25***	−0.10***	−0.18***	−0.20***	−0.21***	0.01
	(−3.15)	(−2.23)	(−1.82)	(−2.54)	(−2.99)	(−5.07)	(−3.04)	(−4.35)	(−6.77)	(−3.21)	(0.06)

Table IV: Portfolios Sorted by Leverage and Refinancing Intensity: Equally-Weighted Returns.

We independently double-sort stocks into three portfolios based on firm's refinancing intensity (ri) and into three portfolios based on firm's leverage (lev) and calculate equally-weighted excess returns. Panel A (B) reports the results for the individual (long-short) portfolios. $P_{1\times \cdot}$ contains firms with highest refinancing intensity, $P_{2\times \cdot}$ with medium and $P_{3\times \cdot}$ with lowest. $P_{\cdot\times 1}$ contains firms with highest leverage, $P_{\cdot\times 2}$ with medium and $P_{\cdot\times 3}$ with lowest. $HL_{\cdot}$ presents results for going long $P_{\cdot\times 1}$ and short $P_{\cdot\times 3}$ and HL presents results for going long HL_1 and short HL_3. *Portfolio Characteristics* reports the portfolio means of the number of firms (obs), refinancing intensity (ri), leverage (lev), market value (mv) and book-to-market (bm). *Portfolio Returns* reports monthly means of excess returns given in percentage points, alpha estimates of regressing excess returns on the market (MKT), as well as the three (MKT, SMB, HML) and four (MKT, SMB, HML, UMD) Fama-French factors. Values in parentheses are t-statistics based on HAC standard errors using Newey and West (1987) with optimal truncation lag chosen as suggested by Andrews (1991). Results are based on a data set comprising joint observations of stock prices and firm characteristics obtained from CRSP and COMPUSTAT for the time period from 1970 to 2014 where we have excluded financials (SIC codes 6000–6999) and utilities (SIC codes 4900–4999).

Panel A: Individual Portfolios

	$P_{1\times 1}$	$P_{1\times 2}$	$P_{1\times 3}$	$P_{2\times 1}$	$P_{2\times 2}$	$P_{2\times 3}$	$P_{3\times 1}$	$P_{3\times 2}$	$P_{3\times 3}$
Portfolio Characteristics									
obs	574.35	409.71	101.83	362.38	421.74	301.67	158.04	263.32	691.28
ri	6.54	5.03	3.78	0.89	0.84	0.74	0.12	0.12	0.06
lev	53.80	20.01	5.27	50.32	19.30	4.45	48.98	18.68	2.02
mv	1260.15	2211.39	809.64	917.99	2839.28	1073.62	642.09	1650.42	936.23
bm	1.01	0.64	0.33	1.11	0.74	0.52	1.05	0.70	0.60
Portfolio Returns									
Excess Return	1.09***	0.88**	0.43	0.96***	0.84***	0.62*	0.88**	0.80**	0.83**
	(2.91)	(2.47)	(1.01)	(2.73)	(2.69)	(1.67)	(2.39)	(2.40)	(2.37)
CAPM α	0.47**	0.22	−0.34	0.32*	0.21	−0.09	0.26	0.16	0.17
	(2.26)	(1.20)	(−1.37)	(1.69)	(1.51)	(−0.48)	(1.17)	(1.06)	(0.93)
3-factor α	0.11	0.12	−0.18	−0.05	0.07	0.02	−0.13	0.02	0.20*
	(0.92)	(1.22)	(−1.12)	(−0.42)	(0.97)	(0.16)	(−0.90)	(0.24)	(1.84)
4-factor α	0.31**	0.27**	0.03	0.18	0.25***	0.27**	0.05	0.21*	0.38***
	(2.34)	(2.45)	(0.17)	(1.61)	(2.91)	(2.07)	(0.35)	(1.81)	(3.03)

Panel B: Long-Short Portfolios

	HL_1	HL_2	HL_3	HL
Excess Return	0.66***	0.33*	0.05	0.61***
	(2.75)	(1.74)	(0.31)	(4.06)
CAPM α	0.80***	0.41**	0.09	0.71***
	(3.21)	(1.97)	(0.50)	(4.83)
3-factor α	0.29*	−0.06	−0.32***	0.62***
	(1.70)	(−0.53)	(−2.88)	(4.29)
4-factor α	0.28	−0.10	−0.33**	0.61***
	(1.58)	(−0.67)	(−2.32)	(4.20)
MKT	−0.02	0.08**	0.10***	−0.12***
	(−0.44)	(2.52)	(3.27)	(−3.46)
SMB	−0.12	−0.08	0.03	−0.15***
	(−1.18)	(−1.24)	(0.45)	(−2.88)
HML	1.05***	0.98***	0.84***	0.22***
	(10.03)	(9.54)	(11.60)	(4.03)
UMD	0.01	0.04	0.01	0.01
	(0.15)	(0.45)	(0.08)	(0.18)

Table V: Portfolios Sorted by Leverage and Refinancing Intensity: Value-Weighted Returns.

We independently double-sort stocks into three portfolios based on firm's refinancing intensity (*ri*) and into three portfolios based on firm's leverage (*lev*) and calculate value-weighted excess returns. Panel A (B) reports the results for the individual (long-short) portfolios. $P_{1\times\cdot}$ contains firms with highest refinancing intensity, $P_{2\times\cdot}$ with medium and $P_{3\times\cdot}$ with lowest. $P_{\cdot\times 1}$ contains firms with highest leverage, $P_{\cdot\times 2}$ with medium and $P_{\cdot\times 3}$ with lowest. $HL_{\cdot}$ presents results for going long $P_{\cdot\times 1}$ and short $P_{\cdot\times 3}$ and HL presents results for going long HL_1 and short HL_3. *Portfolio Characteristics* reports the means of the number of firms (*obs*), refinancing intensity (*ri*), leverage (*lev*), market value (*mv*) and book-to-market (*bm*). *Portfolio Returns* reports monthly means of excess returns given in percentage points, alpha estimates of regressing excess returns on the market (MKT), as well as the three (MKT, SMB, HML) and four (MKT, SMB, HML, UMD) Fama-French factors. Values in parentheses are t-statistics based on HAC standard errors using Newey and West (1987) with optimal truncation lag chosen as suggested by Andrews (1991). Results are based on a data set comprising joint observations of stock prices and firm characteristics obtained from CRSP and COMPUSTAT for the time period from 1970 to 2014 where we have excluded financials (SIC codes 6000–6999) and utilities (SIC codes 4900–4999).

Panel A: Individual Portfolios

	$P_{1\times1}$	$P_{1\times2}$	$P_{1\times3}$	$P_{2\times1}$	$P_{2\times2}$	$P_{2\times3}$	$P_{3\times1}$	$P_{3\times2}$	$P_{3\times3}$
Portfolio Characteristics									
obs	574.35	409.71	101.83	362.38	421.74	301.67	158.04	263.32	691.28
ri	6.54	5.03	3.78	0.89	0.84	0.74	0.12	0.12	0.06
lev	53.80	20.01	5.27	50.32	19.30	4.45	48.98	18.68	2.02
mv	1260.15	2211.39	809.64	917.99	2839.28	1073.62	642.09	1650.42	936.23
bm	1.01	0.64	0.33	1.11	0.74	0.52	1.05	0.70	0.60
Portfolio Returns									
Excess Return	0.75***	0.53**	0.32	0.66**	0.63***	0.28	0.83***	0.65***	0.59**
	(2.66)	(2.19)	(0.88)	(2.43)	(2.98)	(1.00)	(3.23)	(2.98)	(2.11)
CAPM α	0.13	−0.03	−0.39*	0.06	0.12*	−0.37**	0.29*	0.08	−0.06
	(1.05)	(−0.30)	(−1.83)	(0.47)	(1.78)	(−2.54)	(1.84)	(1.03)	(−0.52)
3-factor α	−0.13	−0.06	−0.12	−0.21**	0.07	−0.13	−0.01	0.08	0.19**
	(−1.29)	(−0.59)	(−0.68)	(−2.08)	(0.89)	(−1.43)	(−0.11)	(0.95)	(2.09)
4-factor α	0.01	0.03	−0.01	0.01	0.15**	0.09	0.15	0.20**	0.39***
	(0.08)	(0.36)	(−0.07)	(0.06)	(2.17)	(0.75)	(1.24)	(2.52)	(3.91)

Panel B: Long-Short Portfolios

	HL_1	HL_2	HL_3	HL
Excess Return	0.43	0.38*	0.24	0.18
	(1.63)	(1.89)	(1.19)	(0.75)
CAPM α	0.52*	0.43*	0.35	0.17
	(1.93)	(1.88)	(1.61)	(0.73)
3-factor α	−0.01	−0.08	−0.20	0.19
	(−0.05)	(−0.60)	(−1.57)	(0.76)
4-factor α	0.02	−0.09	−0.24*	0.26
	(0.09)	(−0.55)	(−1.70)	(0.97)
MKT	0.06	0.08**	−0.00	0.06
	(0.89)	(1.97)	(−0.00)	(0.78)
SMB	−0.06	0.17***	0.22***	−0.27
	(−0.43)	(3.74)	(3.90)	(−1.62)
HML	1.07***	1.01***	1.11***	−0.03
	(10.56)	(7.08)	(11.72)	(−0.29)
UMD	−0.04	0.01	0.03	−0.07
	(−0.52)	(0.10)	(0.50)	(−0.71)

Table VI: Leverage- and Refinancing Intensity-Sorted Portfolios: Excluding the Biggest Firms.

We independently double-sort stocks into three portfolios based on firm's refinancing intensity (ri) and into three portfolios based on firm's leverage (lev) and calculate equally- and value-weighted excess returns in Panels A and B, respectively. We first construct the following portfolios: $P_{1\times\cdot}$ contains firms with highest refinancing intensity, $P_{2\times\cdot}$ with medium and $P_{3\times\cdot}$ with lowest. $P_{\cdot\times 1}$ contains firms with highest leverage, $P_{\cdot\times 2}$ with medium and $P_{\cdot\times 3}$ with lowest. We then compute long-short portfolios where HL_1 presents results for going long $P_{\cdot\times 1}$ and short $P_{\cdot\times 3}$. HL presents results for going long HL_1 and short HL_3. Panel 1 (2) reports results for a sample with the largest 25% (10%) of firms in each month being excluded. We report monthly means of excess returns given in percentage points, alpha estimates of regressing excess returns on the market (MKT), as well as the three (MKT, SMB, HML) and four (MKT, SMB, HML, UMD) Fama-French factors. Values in parentheses are t-statistics based on HAC standard errors using Newey and West (1987) with optimal truncation lag chosen as suggested by Andrews (1991). Results are based on a data set comprising joint observations of stock prices and firm characteristics obtained from CRSP and COMPUSTAT for the time period from 1970 to 2014 where we have excluded financials (SIC codes 6000–6999) and utilities (SIC codes 4900–4999).

Panel A.1: Equally-Weighted Portfolio Returns

	HL_1	HL_2	HL_3	HL
Excess Return	0.94***	0.34	−0.04	0.98***
	(3.48)	(1.61)	(−0.22)	(5.15)
CAPM α	1.11***	0.42*	−0.02	1.13***
	(4.15)	(1.93)	(−0.12)	(6.07)
3-factor α	0.61***	−0.02	−0.39***	1.01***
	(2.68)	(−0.16)	(−2.91)	(5.07)
4-factor α	0.62**	−0.02	−0.38**	1.00***
	(2.58)	(−0.15)	(−2.41)	(5.09)
MKT	−0.07	0.06*	0.11***	−0.18***
	(−1.07)	(1.81)	(2.98)	(−2.76)
SMB	−0.14	−0.13**	0.02	−0.16**
	(−1.52)	(−2.04)	(0.37)	(−2.49)
HML	1.02***	0.91***	0.75***	0.28***
	(8.35)	(10.67)	(10.06)	(2.90)
UMD	−0.01	0.00	−0.01	0.01
	(−0.07)	(0.01)	(−0.18)	(0.16)

Panel B.1: Value-Weighted Portfolio Returns

	HL_1	HL_2	HL_3	HL
Excess Return	1.01***	0.37*	0.06	0.95***
	(3.45)	(1.85)	(0.32)	(4.31)
CAPM α	1.12***	0.45**	0.10	1.02***
	(3.71)	(2.11)	(0.50)	(4.68)
3-factor α	0.53**	−0.02	−0.32**	0.85***
	(2.29)	(−0.17)	(−2.25)	(3.78)
4-factor α	0.57**	−0.03	−0.34*	0.91***
	(2.33)	(−0.21)	(−1.87)	(4.13)
MKT	0.06	0.07**	0.11***	−0.05
	(0.92)	(2.55)	(2.69)	(−0.82)
SMB	−0.08	−0.11**	0.00	−0.08
	(−0.72)	(−2.20)	(0.03)	(−0.90)
HML	1.20***	0.97***	0.85***	0.34***
	(8.68)	(10.45)	(8.92)	(3.85)
UMD	−0.04	0.01	0.02	−0.07
	(−0.46)	(0.14)	(0.22)	(−1.22)

Panel A.2: Equally-Weighted Portfolio Returns

	HL_1	HL_2	HL_3	HL
Excess Return	0.75***	0.33*	0.03	0.72***
	(2.87)	(1.67)	(0.17)	(4.21)
CAPM α	0.90***	0.41*	0.06	0.84***
	(3.35)	(1.96)	(0.33)	(5.04)
3-factor α	0.37*	−0.04	−0.34***	0.71***
	(1.85)	(−0.35)	(−2.89)	(4.41)
4-factor α	0.36*	−0.07	−0.34**	0.69***
	(1.70)	(−0.49)	(−2.26)	(4.20)
MKT	−0.03	0.07**	0.11***	−0.13***
	(−0.58)	(2.08)	(3.28)	(−3.80)
SMB	−0.11	−0.12*	0.01	−0.12**
	(−1.15)	(−1.76)	(0.13)	(−2.45)
HML	1.09***	0.95***	0.80***	0.29***
	(9.70)	(9.69)	(11.03)	(4.89)
UMD	0.01	0.03	−0.00	0.02
	(0.16)	(0.38)	(−0.04)	(0.39)

Panel B.2: Value-Weighted Portfolio Returns

	HL_1	HL_2	HL_3	HL
Excess Return	0.55**	0.31*	0.16	0.39**
	(1.97)	(1.65)	(0.88)	(2.01)
CAPM α	0.65**	0.41*	0.23	0.42**
	(2.12)	(1.90)	(1.19)	(2.15)
3-factor α	−0.04	−0.07	−0.24*	0.20
	(−0.20)	(−0.77)	(−1.73)	(1.05)
4-factor α	−0.01	−0.17	−0.29*	0.28
	(−0.04)	(−1.10)	(−1.81)	(1.51)
MKT	0.11**	0.08**	0.08**	0.02
	(2.40)	(2.16)	(2.43)	(0.59)
SMB	−0.06	−0.17**	−0.04	−0.02
	(−0.51)	(−2.58)	(−0.63)	(−0.27)
HML	1.39***	1.04***	0.97***	0.42***
	(9.58)	(7.40)	(9.32)	(5.53)
UMD	−0.04	0.11	0.05	−0.09*
	(−0.36)	(1.03)	(0.68)	(−1.89)

Table VII: Firm Size and Proxies for Financial Constraints

This table presents descriptive statistics for the relation between firms size and financial constraints. Every month we classify firms as big or small if they belong to the top quartile (or top decile) of the time-t firm size distribution and as small if they belong to the remaining three quartiles (or nine deciles) of the size distribution. Panel A presents results for proxies for financial constraints by reporting average values of the fraction of unrated firms, fraction of non-dividend payers, years from last dividend payment as well as firm age (COMPUSTAT, CRSP). Panel B provides results for the financial constraints indices of Kaplan and Zingales (1997), Whited and Wu (2006) and Hadlock and Pierce (2010). Every month when we classify firms as big or small, we also classify firms from least to most constrained based on the quartiles (or deciles) of the time-t distribution of the financial constraints metrics; the least constrained firms are the firms assigned to the first quartile or first decile, respectively. For each metric we report the average quartile (or decile) in the first row and the median quartile (or decile) in the second row. The results are based on a data set comprising joint observations of stock prices and firm characteristics obtained from CRSP and COMPUSTAT for the time period from 1970 to 2014 where we have excluded financials (SIC codes 6000–6999) and utilities (SIC codes 4900–4999).

		Size Quartiles		**Size Deciles**	
	Observations	Biggest 25%	Rest 75%	Biggest 10%	Rest 90%
Panel A: Proxies for Financial Constraints					
Unrated [%]	1,465,641	50.55	92.11	31.78	87.27
Never paid dividend [%]	1,770,133	22.37	54.71	13.23	50.34
Last dividend payment [years]	1,770,133	2.26	4.98	1.60	4.60
COMPUSTAT age [years]	1,770,251	23.13	13.13	28.80	14.17
CRSP age [years]	1,770,251	17.96	10.49	22.15	11.27
Panel B: Indices for Financial Constraints					
Kaplan & Zingales (1997)	1,678,409	2.27	2.58	4.74	5.58
		2.00	3.00	5.00	6.00
Whited & Wu (2006)	1,718,436	1.47	2.84	1.99	5.89
		1.00	3.00	1.00	6.00
Hadlock & Pierce (2010)	1,770,251	1.41	2.86	1.80	5.91
		1.00	3.00	1.00	6.00

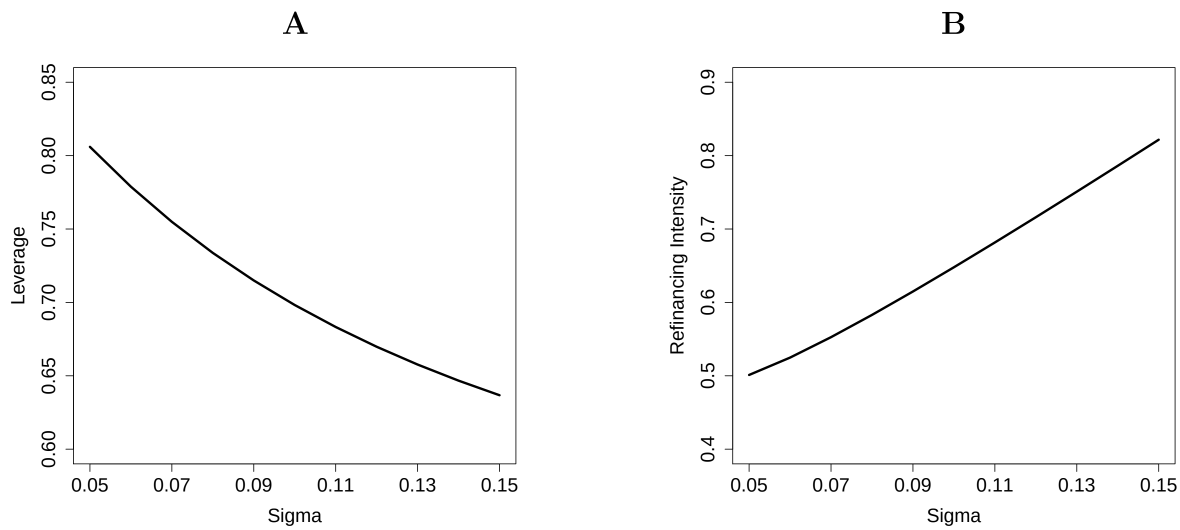

Figure 1: Optimal Financing Choice at $t = 0$. This figure reports the optimal initial financing choices of firms with respect to different cash flow risks given by σ. Panel A shows the leverage and Panel B the refinancing intensity. We set the initial cash flow level $X_0 = 1$, riskless interest rate $r = 5\%$, risk-neutral drift $\mu^{\mathbb{Q}} = 1\%$, short-term debt refinancing intensity $\phi^S = 1$, long-term debt refinancing intensity $\phi^L = 0.2$ and debt benefits $k = 0.01$.

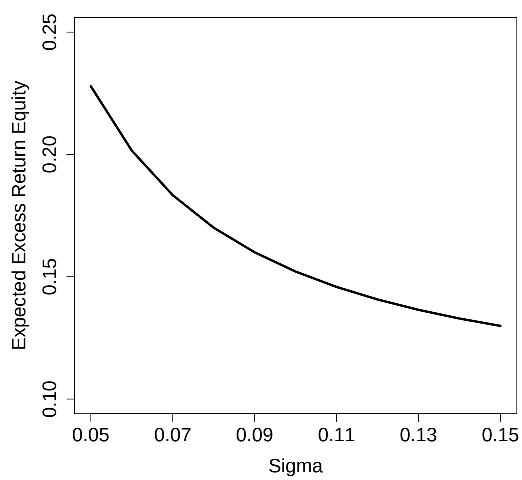

Figure 2: Equity Returns at $t = 0$. This figure reports the relation between expected excess returns on equity and cash flow risk at $t = 0$, hence, at the optimal initial financing choices of firms. We set the initial cash flow level $X_0 = 1$, riskless interest rate $r = 5\%$, risk-neutral drift $\mu^{\mathbb{Q}} = 1\%$, short-term debt refinancing intensity $\phi^S = 1$, long-term debt refinancing intensity $\phi^L = 0.2$, debt benefits $k = 0.01$ and equity risk premium $\xi = 5\%$.

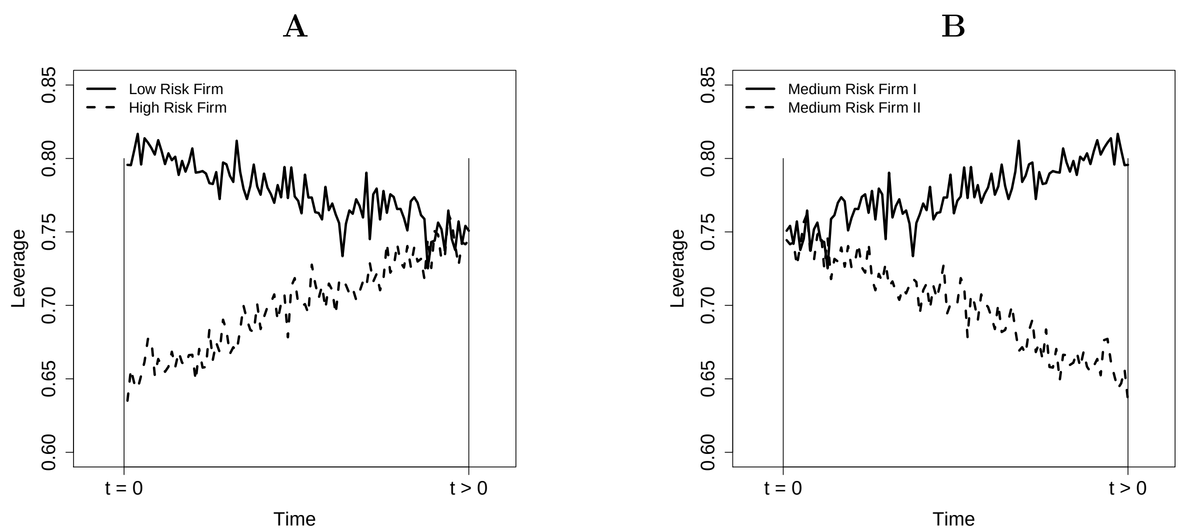

Figure 3: Example of Leverage Evolution. This figure displays examples of the evolution of leverage between the initial financing choice at $t = 0$ and at some time $t > 0$. Panel A shows examples for two firms exhibiting high and low cash flow risk, respectively. Panel B displays two examples for a medium risk firm.

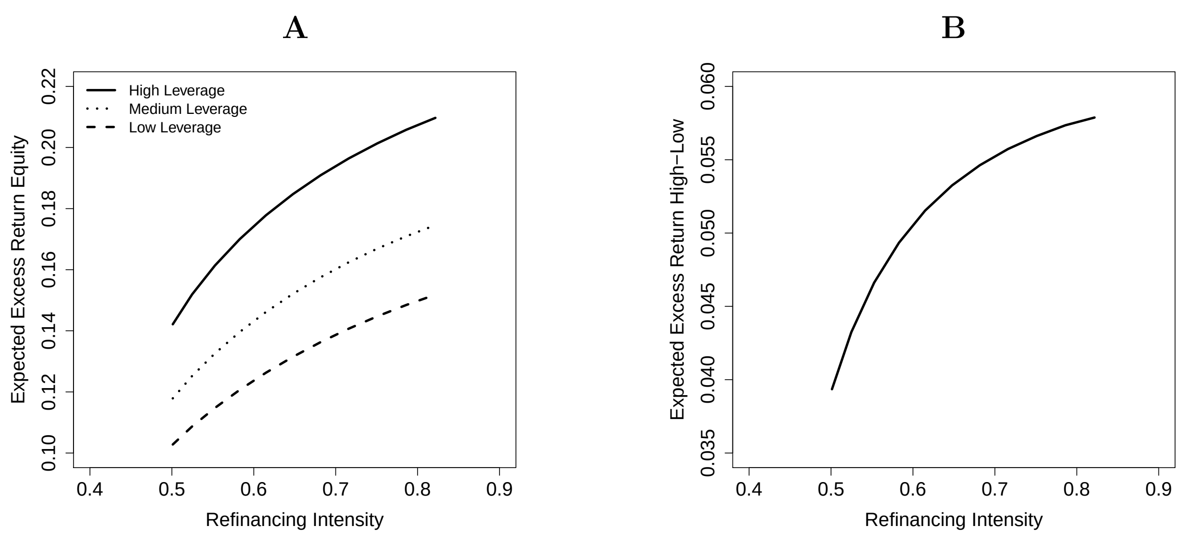

Figure 4: Cross-Section of Returns at $t > 0$: Trading on Leverage in Refinancing Intensity Portfolios. This figure reports the cross-sectional relation between leverage and expected excess returns on equity for a given level of the refinancing intensity. Panel A gives the expected excess return on equity and Panel B the expected return of a long-short portfolio based on leverage. We report three levels of leverage given by high leverage = 76%, medium leverage = 71% and low leverage = 68%. We set the riskless interest rate $r = 5\%$, risk-neutral drift $\mu^{\mathbb{Q}} = 1\%$ and equity risk premium $\xi = 5\%$.

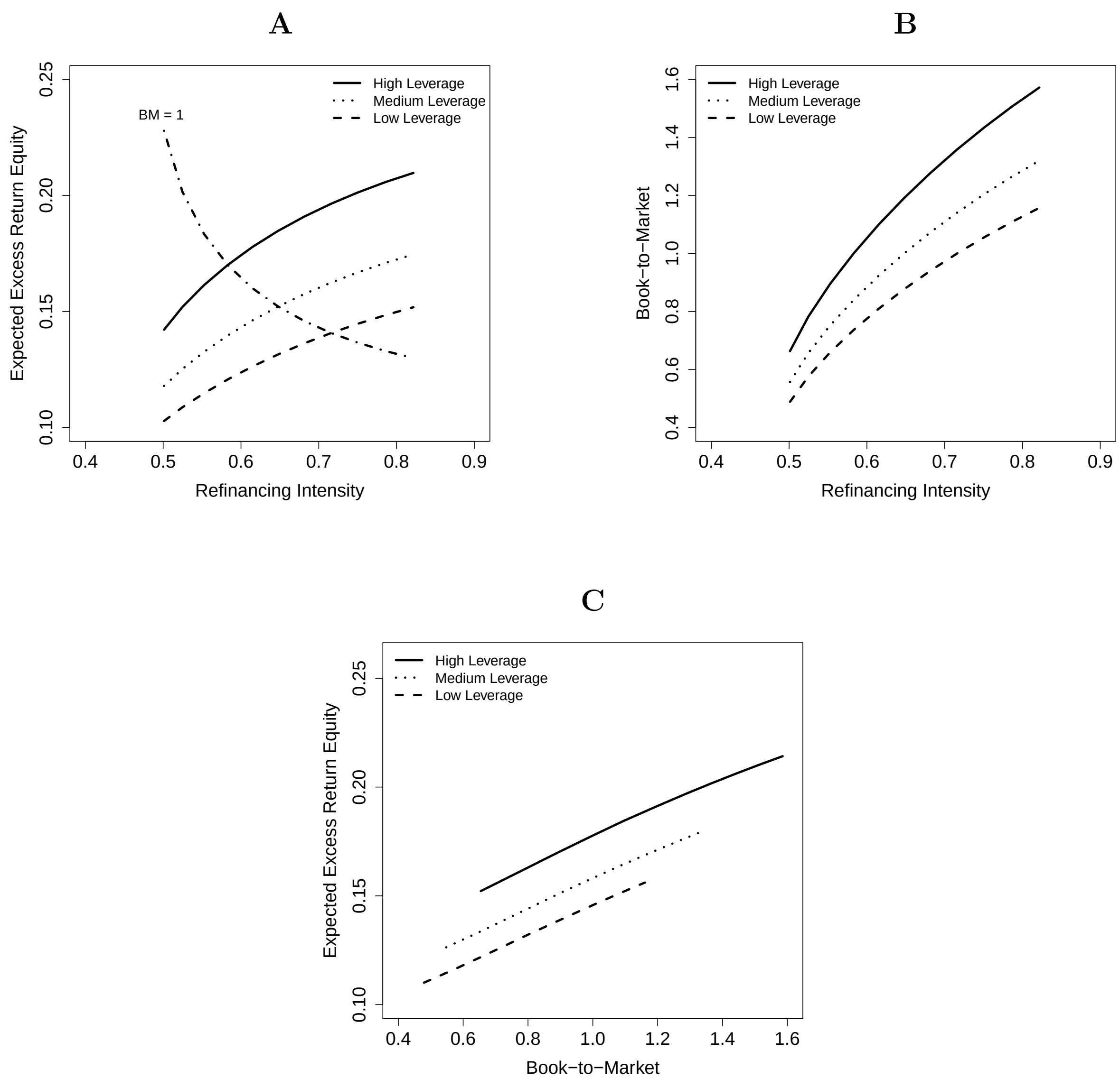

Figure 5: Book-to-Market. This figure reports the cross-sectional relation between book-to-market, leverage and expected excess returns on equity at $t > 0$. Panel A reports the cross-sectional relation between leverage and expected excess returns on equity for a given level of the refinancing intensity. Panel B reports the cross-sectional relation between leverage and book-to-market for a given level of the refinancing intensity. Panel C reports the cross-sectional relation between leverage and expected excess returns on equity for a given level of book-to-market. We report three levels of leverage given by high leverage = 76%, medium leverage = 71% and low leverage = 68%. We set the riskless interest rate $r = 5\%$, risk-neutral drift $\mu^{\mathbb{Q}} = 1\%$ and equity risk premium $\xi = 5\%$.

Internet Appendix for

Debt Refinancing and Equity Returns

(not for publication)

Table IA.1: Portfolios Sequentially Sorted by Refinancing Intensity and Leverage: Equally-Weighted Returns.

We sequentially double-sort stocks first into three portfolios based on firm's refinancing intensity (ri) and then into three portfolios based on firm's leverage (lev) and calculate equally-weighted excess returns. Panel A (B) reports the results for the individual (long-short) portfolios. $P_{1\times\cdot}$ contains firms with highest refinancing intensity, $P_{2\times\cdot}$ with medium and $P_{3\times\cdot}$ with lowest. $P_{\cdot\times 1}$ contains firms with highest leverage, $P_{\cdot\times 2}$ with medium and $P_{\cdot\times 3}$ with lowest. HL. presents results for going long $P_{\cdot\times 1}$ and short $P_{\cdot\times 3}$ and HL presents results for going long HL_1 and short HL_3. *Portfolio Characteristics* reports the portfolio means of the number of firms (obs), refinancing intensity (ri), leverage (lev), market value (mv) and book-to-market (bm). *Portfolio Returns* reports monthly means of excess returns given in percentage points, alpha estimates of regressing excess returns on the market (MKT), as well as the three (MKT, SMB, HML) and four (MKT, SMB, HML, UMD) Fama-French factors. Values in parentheses are t-statistics based on HAC standard errors using Newey and West (1987) with optimal truncation lag chosen as suggested by Andrews (1991). Results are based on a data set comprising joint observations of stock prices and firm characteristics obtained from CRSP and COMPUSTAT for the time period from 1970 to 2014 where we have excluded financials (SIC codes 6000–6999) and utilities (SIC codes 4900–4999).

Panel A: Individual Portfolios

	$P_{1\times1}$	$P_{1\times2}$	$P_{1\times3}$	$P_{2\times1}$	$P_{2\times2}$	$P_{2\times3}$	$P_{3\times1}$	$P_{3\times2}$	$P_{3\times3}$
Portfolio Characteristics									
obs	361.96	361.97	361.96	361.93	361.94	361.93	318.42	318.21	476.02
ri	7.15	5.35	4.73	0.89	0.84	0.75	0.12	0.11	0.03
lev	62.81	33.66	12.49	50.49	21.04	5.63	35.86	6.91	0.26
mv	942.85	2156.09	1807.34	875.22	2682.81	1487.91	886.13	1870.11	714.36
bm	1.09	0.84	0.50	1.11	0.75	0.55	0.88	0.58	0.61
Portfolio Returns									
Excess Return	1.16***	1.01***	0.68*	0.97***	0.83***	0.66*	0.85**	0.68**	0.91**
	(2.90)	(2.99)	(1.78)	(2.74)	(2.70)	(1.78)	(2.40)	(1.97)	(2.58)
CAPM α	0.52**	0.39**	−0.02	0.33*	0.21	−0.06	0.21	0.02	0.25
	(2.24)	(2.29)	(−0.10)	(1.73)	(1.49)	(−0.30)	(1.11)	(0.11)	(1.34)
3-factor α	0.11	0.17**	−0.01	−0.04	0.06	0.03	−0.07	−0.02	0.29**
	(0.74)	(2.04)	(−0.07)	(−0.37)	(0.73)	(0.31)	(−0.63)	(−0.19)	(2.52)
4-factor α	0.33**	0.32***	0.15	0.19*	0.23***	0.29**	0.11	0.20	0.47***
	(2.18)	(2.96)	(1.14)	(1.69)	(2.61)	(2.23)	(0.83)	(1.64)	(3.59)

Panel B: Long-Short Portfolios

	HL_1	HL_2	HL_3	HL
Excess Return	0.49***	0.31*	−0.05	0.54***
	(2.63)	(1.69)	(−0.36)	(4.19)
CAPM α	0.54***	0.38*	−0.04	0.58***
	(2.85)	(1.90)	(−0.26)	(4.54)
3-factor α	0.12	−0.07	−0.36***	0.48***
	(0.81)	(−0.60)	(−3.59)	(3.57)
4-factor α	0.17	−0.11	−0.36***	0.53***
	(1.27)	(−0.71)	(−2.81)	(4.03)
MKT	0.06	0.08**	0.13***	−0.07**
	(1.61)	(2.52)	(4.81)	(−2.03)
SMB	0.02	−0.06	−0.09*	0.11
	(0.22)	(−1.08)	(−1.80)	(1.64)
HML	0.85***	0.94***	0.67***	0.18***
	(12.39)	(8.48)	(10.02)	(2.75)
UMD	−0.06	0.04	−0.00	−0.06
	(−1.06)	(0.43)	(−0.05)	(−1.52)

Table IA.2: Portfolios Sequentially Sorted by Refinancing Intensity and Leverage: Value-Weighted Returns.

We sequentially double-sort stocks first into three portfolios based on firm's refinancing intensity (*ri*) and then into three portfolios based on firm's leverage (*lev*) and calculate value-weighted excess returns. Panel A (B) reports the results for the individual (long-short) portfolios. $P_{1\times\cdot}$ contains firms with highest refinancing intensity, $P_{2\times\cdot}$ with medium and $P_{3\times\cdot}$ with lowest. $P_{\cdot\times 1}$ contains firms with highest leverage, $P_{\cdot\times 2}$ with medium and $P_{\cdot\times 3}$ with lowest. HL. presents results for going long $P_{\cdot\times 1}$ and short $P_{\cdot\times 3}$ and HL presents results for going long HL_1 and short HL_3. *Portfolio Characteristics* reports the portfolio means of the number of firms (*obs*), refinancing intensity (*ri*), leverage (*lev*), market value (*mv*) and book-to-market (*bm*). *Portfolio Returns* reports monthly means of excess returns given in percentage points, alpha estimates of regressing excess returns on the market (MKT), as well as the three (MKT, SMB, HML) and four (MKT, SMB, HML, UMD) Fama-French factors. Values in parentheses are *t*-statistics based on HAC standard errors using Newey and West (1987) with optimal truncation lag chosen as suggested by Andrews (1991). Results are based on a data set comprising joint observations of stock prices and firm characteristics obtained from CRSP and COMPUSTAT for the time period from 1970 to 2014 where we have excluded financials (SIC codes 6000–6999) and utilities (SIC codes 4900–4999).

Panel A: Individual Portfolios

	$P_{1\times 1}$	$P_{1\times 2}$	$P_{1\times 3}$	$P_{2\times 1}$	$P_{2\times 2}$	$P_{2\times 3}$	$P_{3\times 1}$	$P_{3\times 2}$	$P_{3\times 3}$
Portfolio Characteristics									
obs	361.96	361.97	361.96	361.93	361.94	361.93	318.42	318.21	476.02
ri	7.15	5.35	4.73	0.89	0.84	0.75	0.12	0.11	0.03
lev	62.81	33.66	12.49	50.49	21.04	5.63	35.86	6.91	0.26
mv	942.85	2156.09	1807.34	875.22	2682.81	1487.91	886.13	1870.11	714.36
bm	1.09	0.84	0.50	1.11	0.75	0.55	0.88	0.58	0.61
Portfolio Returns									
Excess Return	0.83***	0.77***	0.38	0.68**	0.63***	0.37	0.74***	0.61**	0.51*
	(2.63)	(3.18)	(1.51)	(2.44)	(2.93)	(1.43)	(3.08)	(2.45)	(1.71)
CAPM α	0.17	0.20**	−0.20**	0.07	0.11	−0.24*	0.18	0.01	−0.17
	(1.04)	(2.05)	(−2.05)	(0.53)	(1.47)	(−1.66)	(1.64)	(0.15)	(−1.22)
3-factor α	−0.21*	0.09	−0.13	−0.22**	0.02	−0.00	0.04	0.14*	0.15
	(−1.71)	(0.93)	(−1.50)	(−2.16)	(0.24)	(−0.04)	(0.44)	(1.83)	(1.31)
4-factor α	−0.00	0.16	−0.04	0.01	0.13*	0.18	0.17*	0.35***	0.32***
	(−0.01)	(1.54)	(−0.46)	(0.12)	(1.83)	(1.37)	(1.72)	(4.40)	(2.65)

Panel B: Long-Short Portfolios

	HL_1	HL_2	HL_3	HL
Excess Return	0.45**	0.31	0.23	0.22
	(2.51)	(1.54)	(1.24)	(1.06)
CAPM α	0.37**	0.31	0.35*	0.03
	(2.13)	(1.30)	(1.84)	(0.14)
3-factor α	−0.08	−0.21*	−0.11	0.03
	(−0.63)	(−1.66)	(−0.76)	(0.14)
4-factor α	0.04	−0.17	−0.14	0.18
	(0.31)	(−0.93)	(−0.88)	(0.92)
MKT	0.23***	0.13***	−0.01	0.24***
	(6.73)	(2.81)	(−0.23)	(3.82)
SMB	0.33***	0.29***	−0.02	0.35***
	(6.05)	(6.58)	(−0.34)	(3.48)
HML	0.85***	1.02***	0.94***	−0.09
	(11.44)	(7.18)	(11.04)	(−0.65)
UMD	−0.13***	−0.05	0.04	−0.17*
	(−3.36)	(−0.45)	(0.46)	(−1.70)

Table IA.3: Refinancing Intensity- and Leverage-Sequentially Sorted Portfolios: Excluding the Biggest Firms.

We sequentially double-sort stocks into three portfolios based on firm's refinancing intensity (ri) and then into three portfolios based on firm's leverage (lev) and calculate equally- and value-weighted excess returns in Panels A and B, respectively. We first construct the following portfolios: $P_{1\times\cdot}$ contains firms with highest refinancing intensity, $P_{2\times\cdot}$ with medium and $P_{3\times\cdot}$ with lowest. $P_{\cdot\times 1}$ contains firms with highest leverage, $P_{\cdot\times 2}$ with medium and $P_{\cdot\times 3}$ with lowest. We then compute long-short portfolios where HL_1 presents results for going long $P_{\cdot\times 1}$ and short $P_{\cdot\times 3}$. HL presents results for going long HL_1 and short HL_3. Panel 1 (2) reports results for a sample with the largest 25% (10%) of firms in each month being excluded. We report monthly means of excess returns given in percentage points, alpha estimates of regressing excess returns on the market (MKT), as well as the three (MKT, SMB, HML) and four (MKT, SMB, HML, UMD) Fama-French factors. Values in parentheses are t-statistics based on HAC standard errors using Newey and West (1987) with optimal truncation lag chosen as suggested by Andrews (1991). Results are based on a data set comprising joint observations of stock prices and firm characteristics obtained from CRSP and COMPUSTAT for the time period from 1970 to 2014 where we have excluded financials (SIC codes 6000–6999) and utilities (SIC codes 4900–4999).

	HL_1	HL_2	HL_3	HL
Panel A.1: Equally-Weighted Portfolio Returns				
Excess Return	0.55***	0.32	−0.11	0.66***
	(2.72)	(1.57)	(−0.70)	(4.54)
CAPM α	0.62***	0.39*	−0.11	0.73***
	(3.02)	(1.86)	(−0.71)	(4.78)
3-factor α	0.20	−0.04	−0.43***	0.63***
	(1.26)	(−0.27)	(−3.56)	(3.84)
4-factor α	0.26*	−0.04	−0.41***	0.67***
	(1.72)	(−0.24)	(−3.06)	(4.46)
MKT	0.05	0.07**	0.13***	−0.08*
	(1.21)	(2.03)	(4.31)	(−1.91)
SMB	−0.08	−0.11*	−0.01	−0.07
	(−0.66)	(−1.75)	(−0.15)	(−0.83)
HML	0.83***	0.88***	0.63***	0.20**
	(9.85)	(10.21)	(9.59)	(2.56)
UMD	−0.07	−0.00	−0.02	−0.05
	(−1.01)	(−0.00)	(−0.31)	(−0.87)
Panel B.1: Value-Weighted Portfolio Returns				
Excess Return	0.51**	0.37*	−0.03	0.53***
	(2.46)	(1.94)	(−0.16)	(3.57)
CAPM α	0.53**	0.44**	0.01	0.52***
	(2.44)	(2.16)	(0.05)	(3.49)
3-factor α	0.02	−0.01	−0.37***	0.39**
	(0.12)	(−0.06)	(−2.72)	(2.24)
4-factor α	0.10	−0.00	−0.37**	0.47***
	(0.58)	(−0.00)	(−2.35)	(2.72)
MKT	0.15***	0.08***	0.10***	0.05
	(3.33)	(2.89)	(3.23)	(1.03)
SMB	0.01	−0.09*	−0.06	0.07
	(0.12)	(−1.81)	(−1.13)	(0.92)
HML	1.00***	0.92***	0.77***	0.23***
	(9.75)	(9.31)	(9.35)	(3.07)
UMD	−0.08	−0.01	0.00	−0.09*
	(−1.12)	(−0.08)	(0.05)	(−1.85)

	HL_1	HL_2	HL_3	HL
Panel A.2: Equally-Weighted Portfolio Returns				
Excess Return	0.47**	0.29	−0.07	0.54***
	(2.42)	(1.52)	(−0.46)	(4.14)
CAPM α	0.54***	0.37*	−0.07	0.60***
	(2.67)	(1.81)	(−0.42)	(4.35)
3-factor α	0.11	−0.07	−0.38***	0.49***
	(0.69)	(−0.63)	(−3.31)	(3.36)
4-factor α	0.17	−0.10	−0.38***	0.55***
	(1.17)	(−0.64)	(−2.84)	(3.96)
MKT	0.06	0.07**	0.14***	−0.08**
	(1.52)	(2.19)	(4.71)	(−2.06)
SMB	−0.04	−0.10*	−0.05	0.01
	(−0.34)	(−1.66)	(−0.92)	(0.16)
HML	0.86***	0.92***	0.65***	0.21***
	(11.43)	(9.01)	(9.95)	(3.08)
UMD	−0.07	0.03	−0.00	−0.07
	(−1.12)	(0.31)	(−0.03)	(−1.59)
Panel B.2: Value-Weighted Portfolio Returns				
Excess Return	0.25	0.28	0.13	0.12
	(1.32)	(1.57)	(0.81)	(0.78)
CAPM α	0.24	0.37*	0.20	0.05
	(1.24)	(1.79)	(1.10)	(0.33)
3-factor α	−0.29**	−0.09	−0.18	−0.11
	(−2.03)	(−1.01)	(−1.43)	(−0.67)
4-factor α	−0.19	−0.17	−0.23	0.04
	(−1.35)	(−1.09)	(−1.63)	(0.25)
MKT	0.19***	0.08**	0.07***	0.12***
	(5.52)	(2.44)	(2.63)	(2.87)
SMB	0.12	−0.15**	−0.08	0.20***
	(1.53)	(−2.55)	(−1.33)	(3.33)
HML	1.04***	0.99***	0.80***	0.24***
	(12.86)	(6.66)	(8.56)	(3.33)
UMD	−0.11**	0.09	0.05	−0.16***
	(−2.21)	(0.84)	(0.67)	(−2.80)

Table IA.4: Portfolios Sequentially Sorted by Leverage and Refinancing Intensity: Equally-Weighted Returns.

We sequentially double-sort stocks first into three portfolios based on firm's leverage (*lev*) and then into three portfolios based on firm's refinancing intensity (*ri*) and calculate equally-weighted excess returns. Panel A (B) reports the results for the individual (long-short) portfolios. $P_{1\times\cdot}$ contains firms with highest refinancing intensity, $P_{2\times\cdot}$ with medium and $P_{3\times\cdot}$ with lowest. $P_{\cdot\times 1}$ contains firms with highest leverage, $P_{\cdot\times 2}$ with medium and $P_{\cdot\times 3}$ with lowest. $HL_{\cdot}$ presents results for going long $P_{\cdot\times 1}$ and short $P_{\cdot\times 3}$ and HL presents results for going long HL_1 and short HL_3. *Portfolio Characteristics* reports the portfolio means of the number of firms (*obs*), refinancing intensity (*ri*), leverage (*lev*), market value (*mv*) and book-to-market (*bm*). *Portfolio Returns* reports monthly means of excess returns given in percentage points, alpha estimates of regressing excess returns on the market (MKT), as well as the three (MKT, SMB, HML) and four (MKT, SMB, HML, UMD) Fama-French factors. Values in parentheses are t-statistics based on HAC standard errors using Newey and West (1987) with optimal truncation lag chosen as suggested by Andrews (1991). Results are based on a data set comprising joint observations of stock prices and firm characteristics obtained from CRSP and COMPUSTAT for the time period from 1970 to 2014 where we have excluded financials (SIC codes 6000–6999) and utilities (SIC codes 4900–4999).

Panel A: Individual Portfolios

	$P_{1\times 1}$	$P_{1\times 2}$	$P_{1\times 3}$	$P_{2\times 1}$	$P_{2\times 2}$	$P_{2\times 3}$	$P_{3\times 1}$	$P_{3\times 2}$	$P_{3\times 3}$
Portfolio Characteristics									
obs	364.93	364.92	364.93	364.92	364.93	364.92	280.14	279.78	534.86
lev	54.89	51.74	49.30	20.05	19.37	18.79	4.89	3.36	1.23
ri	8.95	1.86	0.40	5.45	1.08	0.19	1.99	0.24	0.00
mv	1227.17	1070.80	822.77	2125.24	2691.11	2149.89	866.66	1435.10	774.94
bm	0.91	1.14	1.10	0.63	0.75	0.70	0.44	0.56	0.62
Portfolio Returns									
Excess Return	1.12***	1.04***	0.90**	0.86**	0.85***	0.81**	0.53	0.65*	0.89**
	(2.91)	(2.93)	(2.52)	(2.45)	(2.60)	(2.56)	(1.31)	(1.84)	(2.53)
CAPM α	0.49**	0.41**	0.27	0.21	0.22	0.17	−0.21	−0.05	0.24
	(2.29)	(2.10)	(1.35)	(1.12)	(1.49)	(1.21)	(−0.96)	(−0.30)	(1.27)
3-factor α	0.14	0.04	−0.11	0.11	0.08	0.03	−0.07	0.02	0.25**
	(1.14)	(0.35)	(−0.96)	(1.15)	(1.04)	(0.35)	(−0.56)	(0.22)	(2.22)
4-factor α	0.35**	0.24**	0.11	0.26**	0.27***	0.21**	0.17	0.26**	0.44***
	(2.33)	(2.05)	(0.89)	(2.30)	(2.89)	(2.10)	(1.04)	(2.04)	(3.25)

Panel B: Long-Short Portfolios

	HL_1	HL_2	HL_3	HL
Excess Return	0.21**	0.06	−0.36***	0.57***
	(2.44)	(0.63)	(−3.70)	(5.10)
CAPM α	0.22**	0.04	−0.45***	0.67***
	(2.44)	(0.42)	(−4.48)	(5.66)
3-factor α	0.25***	0.08	−0.32***	0.58***
	(3.00)	(1.09)	(−4.29)	(5.06)
4-factor α	0.24**	0.05	−0.27***	0.51***
	(2.47)	(0.69)	(−3.38)	(4.18)
MKT	−0.06**	−0.05**	0.08***	−0.14***
	(−2.34)	(−2.26)	(3.72)	(−3.86)
SMB	0.19***	0.31***	0.12***	0.06
	(3.74)	(7.50)	(2.87)	(0.79)
HML	−0.08	−0.12***	−0.29***	0.22***
	(−1.13)	(−3.07)	(−6.26)	(3.39)
UMD	0.01	0.04	−0.07**	0.08*
	(0.23)	(1.18)	(−2.28)	(1.65)

Table IA.5: Portfolios Sequentially Sorted by Leverage and Refinancing Intensity: Value-Weighted Returns.

We sequentially double-sort stocks first into three portfolios based on firm's leverage (*lev*) and then into three portfolios based on firm's refinancing intensity (*ri*) and calculate value-weighted excess returns. Panel A (B) reports the results for the individual (long-short) portfolios. $P_{1\times\cdot}$ contains firms with highest leverage, $P_{2\times\cdot}$ with medium and $P_{3\times\cdot}$ with lowest. $P_{\cdot\times 1}$ contains firms with highest refinancing intensity, $P_{\cdot\times 2}$ with medium and $P_{\cdot\times 3}$ with lowest. HL. presents results for going long $P_{\cdot\times 1}$ and short $P_{\cdot\times 3}$ and HL presents results for going long HL_1 and short HL_3. *Portfolio Characteristics* reports the portfolio means of the number of firms (*obs*), refinancing intensity (*ri*), leverage (*lev*), market value (*mv*) and book-to-market (*bm*). *Portfolio Returns* reports monthly means of excess returns given in percentage points, alpha estimates of regressing excess returns on the market (MKT), as well as the three (MKT, SMB, HML) and four (MKT, SMB, HML, UMD) Fama-French factors. Values in parentheses are t-statistics based on HAC standard errors using Newey and West (1987) with optimal truncation lag chosen as suggested by Andrews (1991). Results are based on a data set comprising joint observations of stock prices and firm characteristics obtained from CRSP and COMPUSTAT for the time period from 1970 to 2014 where we have excluded financials (SIC codes 6000–6999) and utilities (SIC codes 4900–4999).

Panel A: Individual Portfolios

	$P_{1\times1}$	$P_{1\times2}$	$P_{1\times3}$	$P_{2\times1}$	$P_{2\times2}$	$P_{2\times3}$	$P_{3\times1}$	$P_{3\times2}$	$P_{3\times3}$
Portfolio Characteristics									
obs	364.93	364.92	364.93	364.92	364.93	364.92	280.14	279.78	534.86
lev	54.89	51.74	49.30	20.05	19.37	18.79	4.89	3.36	1.23
ri	8.95	1.86	0.40	5.45	1.08	0.19	1.99	0.24	0.00
mv	1227.17	1070.80	822.77	2125.24	2691.11	2149.89	866.66	1435.10	774.94
bm	0.91	1.14	1.10	0.63	0.75	0.70	0.44	0.56	0.62
Portfolio Returns									
Excess Return	0.73**	0.76***	0.72***	0.54**	0.59***	0.63***	0.38	0.35	0.57*
	(2.37)	(2.86)	(2.78)	(2.22)	(2.78)	(2.93)	(1.31)	(1.30)	(1.96)
CAPM α	0.08	0.17	0.17	−0.02	0.08	0.07	−0.27*	−0.27**	−0.09
	(0.53)	(1.30)	(1.17)	(−0.19)	(1.13)	(1.06)	(−1.71)	(−2.24)	(−0.71)
3-factor α	−0.20	−0.09	−0.13	−0.04	0.01	0.09	−0.03	−0.07	0.17
	(−1.53)	(−0.83)	(−1.35)	(−0.43)	(0.09)	(1.18)	(−0.22)	(−0.70)	(1.56)
4-factor α	−0.04	0.03	0.11	0.05	0.09	0.20***	0.13	0.16	0.36***
	(−0.29)	(0.35)	(1.15)	(0.45)	(1.30)	(2.65)	(1.00)	(1.47)	(3.57)

Panel B: Long-Short Portfolios

	HL_1	HL_2	HL_3	HL
Excess Return	0.00	−0.09	−0.18	0.19
	(0.02)	(−0.81)	(−1.28)	(0.89)
CAPM α	−0.09	−0.10	−0.18	0.09
	(−0.54)	(−0.82)	(−1.27)	(0.46)
3-factor α	−0.08	−0.13	−0.19	0.12
	(−0.47)	(−1.29)	(−1.34)	(0.55)
4-factor α	−0.15	−0.15	−0.23*	0.08
	(−0.88)	(−1.41)	(−1.78)	(0.38)
MKT	0.16***	−0.01	0.00	0.15**
	(2.70)	(−0.19)	(0.03)	(2.14)
SMB	0.12	0.18**	0.04	0.08
	(0.97)	(2.19)	(0.65)	(0.62)
HML	−0.01	0.06	0.03	−0.04
	(−0.15)	(0.67)	(0.39)	(−0.47)
UMD	0.08	0.02	0.04	0.04
	(1.03)	(0.29)	(0.71)	(0.57)

Table IA.6: Leverage- and Refinancing Intensity-Sequentially Sorted Portfolios: Excluding the Biggest Firms.

We sequentially double-sort stocks into three portfolios based on firm's leverage (lev) and then into three portfolios based on firm's refinancing intensity (ri) and calculate equally- and value-weighted excess returns in Panels A and B, respectively. We first construct the following portfolios: $P_{1\times\cdot}$ contains firms with highest leverage, $P_{2\times\cdot}$ with medium and $P_{3\times\cdot}$ with lowest. $P_{\cdot\times 1}$ contains firms with highest refinancing intensity, $P_{\cdot\times 2}$ with medium and $P_{\cdot\times 3}$ with lowest. We then compute long-short portfolios where HL_1 presents results for going long $P_{\cdot\times 1}$ and short $P_{\cdot\times 3}$. HL presents results for going long HL_1 and short HL_3. Panel 1 (2) reports results for a sample with the largest 25% (10%) of firms in each month being excluded. We report monthly means of excess returns given in percentage points, alpha estimates of regressing excess returns on the market (MKT), as well as the three (MKT, SMB, HML) and four (MKT, SMB, HML, UMD) Fama-French factors. Values in parentheses are t-statistics based on HAC standard errors using Newey and West (1987) with optimal truncation lag chosen as suggested by Andrews (1991). Results are based on a data set comprising joint observations of stock prices and firm characteristics obtained from CRSP and COMPUSTAT for the time period from 1970 to 2014 where we have excluded financials (SIC codes 6000–6999) and utilities (SIC codes 4900–4999).

	HL_1	HL_2	HL_3	HL
Panel A.1: Equally-Weighted Portfolio Returns				
Excess Return	0.25***	−0.03	−0.39***	0.64***
	(2.72)	(−0.30)	(−3.51)	(4.84)
CAPM α	0.26***	−0.06	−0.49***	0.76***
	(2.86)	(−0.60)	(−4.45)	(5.75)
3-factor α	0.31***	0.04	−0.36***	0.67***
	(3.59)	(0.38)	(−3.99)	(5.10)
4-factor α	0.29***	0.02	−0.33***	0.62***
	(3.00)	(0.26)	(−3.41)	(4.72)
MKT	−0.07**	−0.03	0.08***	−0.15***
	(−2.18)	(−1.32)	(3.87)	(−3.98)
SMB	0.11**	0.18***	0.17***	−0.06
	(2.38)	(3.81)	(3.77)	(−0.77)
HML	−0.10*	−0.20***	−0.30***	0.20***
	(−1.68)	(−3.71)	(−6.49)	(2.95)
UMD	0.02	0.01	−0.03	0.06
	(0.44)	(0.28)	(−1.09)	(1.52)
Panel B.1: Value-Weighted Portfolio Returns				
Excess Return	0.04	−0.13	−0.37***	0.42***
	(0.41)	(−1.28)	(−3.75)	(3.13)
CAPM α	0.02	−0.18*	−0.44***	0.46***
	(0.22)	(−1.70)	(−4.38)	(3.35)
3-factor α	0.02	−0.08	−0.35***	0.37***
	(0.22)	(−0.83)	(−4.00)	(2.60)
4-factor α	0.04	−0.04	−0.33***	0.36**
	(0.30)	(−0.41)	(−3.84)	(2.48)
MKT	0.00	−0.00	0.05**	−0.05
	(0.05)	(−0.20)	(2.14)	(−1.18)
SMB	0.14***	0.20***	0.15***	−0.00
	(2.63)	(3.92)	(4.60)	(−0.06)
HML	−0.02	−0.24***	−0.21***	0.19***
	(−0.38)	(−3.87)	(−6.71)	(2.68)
UMD	−0.01	−0.04	−0.02	0.01
	(−0.27)	(−0.94)	(−0.96)	(0.22)

	HL_1	HL_2	HL_3	HL
Panel A.2: Equally-Weighted Portfolio Returns				
Excess Return	0.22**	0.03	−0.36***	0.58***
	(2.48)	(0.34)	(−3.47)	(4.98)
CAPM α	0.22**	0.01	−0.46***	0.68***
	(2.48)	(0.13)	(−4.27)	(5.69)
3-factor α	0.25***	0.09	−0.32***	0.57***
	(2.98)	(1.10)	(−4.00)	(4.91)
4-factor α	0.24**	0.07	−0.27***	0.51***
	(2.49)	(0.81)	(−3.24)	(4.21)
MKT	−0.06**	−0.04**	0.08***	−0.14***
	(−2.09)	(−2.11)	(3.83)	(−4.01)
SMB	0.16***	0.22***	0.14***	0.02
	(3.47)	(5.07)	(3.13)	(0.29)
HML	−0.08	−0.18***	−0.32***	0.25***
	(−1.15)	(−3.76)	(−6.48)	(4.15)
UMD	0.01	0.03	−0.06*	0.07
	(0.22)	(0.79)	(−1.85)	(1.54)
Panel B.2: Value-Weighted Portfolio Returns				
Excess Return	−0.04	−0.03	−0.22**	0.19
	(−0.36)	(−0.41)	(−2.03)	(1.47)
CAPM α	−0.09	−0.06	−0.30***	0.21
	(−0.99)	(−0.87)	(−2.65)	(1.57)
3-factor α	−0.11	0.00	−0.15*	0.04
	(−1.12)	(0.01)	(−1.78)	(0.33)
4-factor α	−0.06	−0.03	−0.11	0.04
	(−0.63)	(−0.45)	(−1.20)	(0.32)
MKT	0.06**	0.01	0.04*	0.02
	(2.08)	(0.37)	(1.81)	(0.45)
SMB	0.18***	0.14***	0.13***	0.05
	(2.79)	(4.00)	(3.13)	(0.59)
HML	−0.00	−0.13***	−0.33***	0.33***
	(−0.01)	(−3.75)	(−6.15)	(5.05)
UMD	−0.05	0.03*	−0.05	0.00
	(−0.91)	(1.69)	(−1.56)	(0.01)