Labor Leverage, Financial Leverage, and the Dissection of Expected Returns[*]

Jaewon Choi[†], Andres Donangelo[‡], and Yongjun Kim[§]

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Abstract

We show, both theoretically and empirically, how labor and financial leverage interact and jointly explain the risk and return of corporate securities. We embed capital structure decisions into a production-based asset pricing model of labor leverage. We test the predictions of the model using a unique dataset of bond and asset returns. We find that (i) financial leverage is positively related to bond returns, negatively related to asset returns, and unrelated to stock returns, (ii) labor leverage amplifies asset, bond, and stock risk, and (iii) it is the unlevered portion of asset risk, as opposed to the asset risk amplification by labor leverage, that explains most of cross-sectional variation in financial leverage ratios.

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[†]Department of Finance, Gies College of Business, University of Illinois at Urbana-Champaign. Email: jaewchoi@illinois.edu.

[‡]Department of Finance, McCombs School of Business, University of Texas at Austin. Email: andres.donangelo@mccombs.utexas.edu.

[§]College of Business, University of Seoul. Email: jkim@uos.ac.kr.

1 Introduction

How do operating and financial leverage drive the riskiness of different corporate securities? We show that these two types of leverage are, jointly and individually, first-order determinants of the risk and returns of firms' assets, bonds, and equity. We provide a unified theoretical framework that combines labor-induced operating leverage (i.e., *labor leverage*) with optimal financing decisions. A key insight from the model is that labor leverage and financial leverage have diametrically opposite relations with business risk. Labor leverage amplifies and is thus positively related to business risk, which in turn makes labor leverage positively related to firms' asset, bond, and equity returns. In contrast, firms with high business risk choose low financial leverage when optimizing their capital structure, which in turn makes financial leverage negatively related to asset returns, positively related to bond returns, and unrelated to stock returns. We confirm these implications empirically, using a unique dataset on the market values of firms' assets, equity, and bonds.

To understand the tradeoff between operating and financial leverage and its impact on security returns, we develop a production-based asset pricing model of labor leverage that extends that of Donangelo, Gourio, Kehrig, and Palacios (2018) by introducing optimal leverage decisions. Labor costs represent a source of operating leverage for firms because wages are relatively smoother than productivity and because of the strict complementarity between labor and capital.[1] Firms issue a perpetual bond with a fixed coupon as in Leland (1994). The optimal coupon is determined by balancing off tax savings and bankruptcy costs and determine the initial financial leverage of the firm. At the time of bond issuance, financial leverage and labor leverage are negatively related because of the business risk amplification by the latter. Over time, however, financial leverage and operating leverage tend to become

[1] See Gourio (2007), Donangelo et al. (2018), León-Ledesma, McAdam, and Willman (2010), Klump, McAdam, and Willman (2012), and Oberfield and Raval (2014) for evidence for the relative smoothness of wages and for the strict complementarity between firm-level labor and capital.

aligned because both types of leverage are negatively related to productivity levels.

The model is rich enough to allow us to draw a set of predictions on the cross-sectional link between operating and financial risk and the risk and return characteristics of firms' contingent claims. The direct effect of high labor leverage is the amplification of asset risk and returns. This effect of high labor leverage will also apply to all the contingent claims of the firms (i.e., equity and bonds). The fact that the model embeds endogenous capital structure decisions allows for any offsetting effects of financial leverage on labor leverage. As firms balance expected bankruptcy costs and tax benefits arising from taking on more debt, firms with high asset risk (i.e., high operating leverage) will maintain low levels of financial leverage. The solution of the model suggests that the offsetting effect of financial leverage does not flip the sign of the relations between financial leverage and the returns of the corporate securities.

Our model sheds light on the interactions between financial leverage and the risk and returns of the different corporate securities. The prediction of the model that firms with greater asset risk optimally choose lower levels of financial leverage implies a negative relation between asset risk and financial leverage. The model also implies that a positive relation between financial leverage and bond returns because debt increases the probability of default. Firm bankruptcy raises bond holders' exposure to systematic risk because bonds are effectively converted in stocks when default is triggered. The flipped signs of the relation between financial leverage and asset and bond risk have opposing effects on the overall relation between financial leverage and equity risk. This last implication of the model offers a new explanation for the documented complex relation between financial leverage and stock returns.

To test the predictions of the model, we utilize a unique dataset on the market values of equity and of the firm's individual corporate debt securities first employed in Choi (2013). This dataset allows us to measure returns on firms' assets, equity, and bonds. We define firms' assets as the portfolio of all individual securities within the firm (Modigliani and Miller, 1958). This definition implies that asset returns are the value-weighted average of the returns on the firm's individual corporate securities. Bond returns are define as the value-weighted average of the firm's debt instruments. The use of measures of asset and bond returns based on market values enables us to conduct direct tests of the labor and financial leverage mechanisms, which have been inaccessible until now.

Our dataset enables us to present the first direct test of the implications of the labor leverage mechanism for asset returns.[2] As a proxy of labor-induced operating leverage, we employ labor share (LS), following Donangelo et al. (2018), which is measured as the ratio of labor expenses and an empirical measure of value added using data from Compustat. In our empirical results, we find strong evidence consistent with the validity of LS as a measure of operating leverage. There is a strong positive relationship between LS and the risk of firms' assets as measured by asset returns, asset return volatility, asset beta, and cash flow volatility.

We find a positive relation between labor shares and asset returns, which is consistent with the asset risk amplification predicted by earlier literature and by our model. We also find evidence for positive relations between labor leverage and bond returns and between labor leverage and equity returns, which are novel testable implications from our model. Overall, our tests show that labor leverage not only significantly amplifies asset risk, but also bond and equity risk as well.

Using our dataset on asset returns, we also directly test the negative relation between financial leverage and asset returns predicted by classic studies in the capital structure literature.[3] We document a strong negative relationship between financial leverage and

[2]Past studies that study the the labor leverage mechanism focus on indirect proxies of asset and bond risk and returns. Illustrative examples of studies that use stock returns to tests the implication of labor leverage for asset returns are Donangelo (2014) and Favilukis and Lin (2016b).

[3]See Merton (1974) and Leland (1994) for early discussions of the prediction. See also Schwert and Strebulaev (2014) and Choi and Richardson (2016) for empirical evidence on the negative relationship between

the risk of firms' assets. We use three measures of firms' asset risk: asset volatility, asset beta, and cash flow volatility. All these measures are strongly negatively related with both market and book leverage. Consistent with this negative risk-leverage relationship, we find that average asset returns are also negative linked with financial leverage.

Next, we study the relation between financial leverage and bond and equity returns. We find that average future bond returns are positively related to financial leverage.[4] This result is consistent with increased default risk associated elevated financial leverage. Consistent with the opposing relations between financial leverage and asset and bond returns predicted by our theory, we find that future equity returns are negatively related to financial leverage, albeit not significantly. At first glance, this result is puzzling, but it is in fact documented in previous studies (e.g., George and Huang 2008). Our theoretical prediction can also explain this finding insofar as asset risk, or labor leverage, of high financial leverage firms is low enough. Thus, this result calls for a need to simultaneously examine operating and financial leverage to fully understand the fundamental relation between leverage and the risk of equity.

We conclude our empirical analysis by examining the implications of the tradeoff between operating and financial leverage for the risk and returns of the different corporate securities. Also consistent with the tradeoff between operating leverage and financial leverage, we observe from our data a strong negative link between LS and financial leverage. Overall, these results show the importance of considering both operating and financing channels in understanding the fundamental driver of security returns. Our framework is powerful and rich enough with a potential to explain the entire set of contingent claims written on firms' assets. This point is important, as any economic channel that operates through the underlying firms' business should be able to explain not only equity but also bonds as well as the

asset risk and financial leverage.

[4]We contribute to the literature by focusing on bond returns as main measure of risk faced by bond holders. Favilukis, Lin, and Zhao (2018) uses a measure of credit risk based on the KMV model (Gilchrist and Zakrasjek, Bharath and Shumway).

entire assets of firms.

We contribute to the growing literature that examines the effect of labor on asset risk and prices. Belo, Lin, and Bazdresch (2014), Belo, Li, Lin, and Zhao (2017) study how demand-side adjustment costs explain the relation between hiring rates and expected returns. Lettau, Ludvigson, and Ma (2017) and Hartman-Glaser, Lustig, and Xiaolan (2017) study changes capital and labor share, respectively, are related to aggregate risk.[5] While aforementioned papers focus on equity risk, Favilukis et al. (2018) examine the effect of labor on credit risk by showing that firms with strong labor obligations tend to have higher credit risk and lower financial leverage.[6] Our paper expands theirs by studying the impact of the labor-finance interaction on the risk and returns of different contingent claims of firms. Furthermore, we examine bond returns as opposed to default risk or credit spreads as in Favilukis et al. (2018), thus providing direct implications for investment returns.

The literature that studies optimal finance and investment has recognized that the effect of leverage on equity returns is more complex than what the simple textbook version of the leverage effect suggests (e.g., Gomes and Schmid (2010)). This literature, however, tends to single out financial leverage and its effect on equity returns, although the underlying economics works through the entire assets of firms. We extend the literature along this line, both by theoretically and empirically. We show the importance of thoroughly considering each claims in corporate capital structure by generating a unique, rich set of predictions, which we test with our unique data

Our paper contributes to the literature that studies the effect of endogenous investment and finance on asset returns. Gomes and Schmid (2010) importantly show that the effect of financial leverage on equity returns is much more complex than what is suggested in the

[5]Other asset pricing papers that study the implication of labor for the firm include Kuehn, Petrosky-Nadeau, and Zhang (2013), Merz and Yashiv (2007), Chen, Kacperczyk, and Ortiz-Molina (2012), Eisfeldt and Papanikolaou (2013), and Favilukis and Lin (2016a).

[6]Michaels, Page, and Whited (2019) also document a negative link between wages and financial leverage.

simple textbook version of the leverage effect. Choi (2013) points out the offsetting effect of financial leverage on the risk of firms' asset returns, which helps explain the value premium. Gomes and Schmid (2017) provide a general equilibrium model that simultaneously match the risk premia in equity and bonds when firms make optimal financing and investment decisions. What is largely missing in the literature is the joint effect of operating and financial leverage on asset returns. We fill the gap in the literature by showing the endogenous tradeoff between operating and financial leverage is an important determinant of the risk and return characteristics of firms.

2 Model

This section presents a parsimonious dynamic model that illustrates the trade off between labor leverage and financial leverage. The model extends that of Donangelo et al. (2018) to incorporate financial leverage. The financial leverage mechanism of the model is based on the model with bond covenants of Leland (1994). We first describe the setup of the model. We then present the solution for the firm's labor demand and financial leverage decisions. We end the section with a discussion of the testable implications of the model.

2.1 Setup

The model represents a firm that is small relative to the rest of the economy, so that it takes the pricing kernel and wages as exogenously given. The dynamics of the pricing kernel Λ are given by

$$\frac{d\Lambda_t}{\Lambda_t} = -rdt - \eta dZ_t^{\Lambda}, \tag{1}$$

where $r > 0$ is the continuously compounded risk-free rate, $\eta > 0$ is the market price of risk, and Z^{Λ} is a Wiener process that represents the single source of priced risk in the economy.

The firm has access to a perfectly competitive labor market, so that it pays the economy-wide wage rate W to its workers. The wage rate W follows the process given by

$$\frac{dW_t}{W_t} = \mu_{\mathrm{W}} dt + \sigma_{\mathrm{W}} \rho_{\mathrm{W}} dZ_t^{\Lambda} + \sigma_{\mathrm{W}} \sqrt{1 - \rho_{\mathrm{W}}^2} dZ_t^{\mathrm{W}}, \tag{2}$$

where Z^{W} is a Wiener process orthogonal to the systematic shock Z^{Λ} and μ_{W}, σ_{W}, and ρ_{W} are the instantaneous drift, volatility, and systematic risk loading of the wage growth, respectively

The firm's productive technology is represented by the constant elasticity of substitution (CES) production function given by:

$$Y_t = \left(\alpha (X_t L_t)^{\rho} + (1 - \alpha) K^{\rho}\right)^{\frac{1}{\rho}}, \tag{3}$$

where $L_t > 0$ and X_t are the time-t amount of labor employed in production and level of labor-augmenting productivity, respectively. The parameters $\alpha \in (0, 1)$ and $\rho \in (-\infty, 1)$ represent the weight of labor in the productive technology and the labor–capital substitutability in the productive technology, respectively.[7]

Finally, the firm is affected by a process $M_t \in \{0, 1\}$ that represents the marketability of the good produced by the firm. The firm starts producing a marketable good $M_{t=0} = 1$ until a stochastic time T, at which date the good becomes permanently non-marketable $M_{t \geq T} = 0$ (e.g.., obsolete). The date T is determined by a shock that follows a Poisson

[7] The labor–capital substitutability ρ is directly related to the the labor–capital elasticity of substitution, which is given by $\frac{1}{1-\rho}$. If $\rho \to 0$, the production function in Equation (3) represents the Cobb–Douglas production function, in which labor and capital are not complements nor substitutes. The cases $\rho > 0$ and $\rho < 0$ represent the cases in which labor and capital are substitutes and complements, respectively. León-Ledesma et al. (2010) and Klump et al. (2012) present evidence for the case $\rho < 0$, which is the one used in our analysis.

process with instantaneous intensity $\lambda_m dt$. In the discussion what follows, I assume that the firm is operating in the period $t < T$ and thus producing a marketable product unless explicitly stated otherwise.

The dynamics of the firm's productivity X are given by

$$\frac{dX_t}{X_t} = \mu_{\mathrm{X}} dt + \sigma_{\mathrm{X}} \rho_{\mathrm{X}} dZ_t^{\Lambda} + \sigma_{\mathrm{X}} \sqrt{1 - \rho_{\mathrm{X}}^2} dZ_t^{\mathrm{X}}, \tag{4}$$

where Z^{X} is a Wiener process orthogonal to the systematic shock Z^{Λ} and to the wage-specific shock Z^{W}. The parameters μ_{X}, σ_{X}, and ρ_{X} represent the instantaneous drift, volatility, and systematic risk loading of productivity growth, respectively.

The firm's instantaneous operating income is defined as revenues net of operating expenses, as given by:

$$\Pi_t \equiv Y_t - W_t L_t. \tag{5}$$

The firm is able to temporarily suspend operations and become inactive by instantaneously laying off its workforce. Similarly, an inactive firm can resume operations. Absence of labor adjustment costs implies that the firm will have an active operational status as long as it generates positive operating income ($\Pi \leq 0$) and have an inactive operational status otherwise.

2.2 Operating Income, Labor Share, and Labor Leverage

The active firm sets its labor demand (L) to maximize operating income. The optimal labor demand is such that the marginal contribution to income equals the marginal cost of labor and is given by

$$L_t = \begin{cases} \frac{K}{X_t}\left(\frac{S_t}{1-S_t}\right)^{\frac{1}{\rho}}\left(\frac{1-\alpha}{\alpha}\right)^{\frac{1}{\rho}}, & 0 < S_t < 1, \\ 0, & S_t \geq 1, \end{cases} \tag{6}$$

and the instantaneous labor-optimized operating income rate Π are given by

$$\Pi_t = \begin{cases} K\left(1-S_t\right)^{1-1/\rho}\left(1-\alpha\right)^{\frac{1}{\rho}}, & 0 < S_t < 1, \\ 0, & S_t \geq 1, \end{cases} \tag{7}$$

where

$$S_t \equiv \alpha^{\frac{1}{1-\rho}}\left(\frac{W_t}{X_t}\right)^{\frac{\rho}{\rho-1}}. \tag{8}$$

The ranges $S_t < 1$ and $S_t \geq 1$ represent the active and inactive operational regions. Labor share $\frac{L_t W_t}{Y_t}$ is only well defined for an active firm (i.e., a firm with positive output Y). In the active operational region (i.e., region $S_t < 1$) the $S_t = \frac{L_t W_t}{Y_t}$. For this reason, we refer to the variable S_t simply as *labor share* in what follows.

Figure 1 presents the comparative statics of operating income Π. The figure shows that operating income Π is decreasing in labor share S (Panel A), and is increasing in the weight of labor in the productive technology α (Panel B), and the labor–capital substitutability in the productive technology (ρ) (Panel C).

<< Figure 1 here >>

Operating leverage is the operating cash flow risk amplification that results from the properties of operating costs. In this paper we focus on operating leverage induced by labor, since labor costs are the most important type operating costs for firms (Donangelo et al.

(2018)). We denote the labor-induced form of operating leverage by labor leverage. Figure 2 illustrates the relation between the cash flow risk amplification from labor leverage and labor share. The figure shows that the volatility operating income growth is increasing with labor share.

<< Figure 2 here >>

2.3 Value of Unlevered Assets

Here we derive the value of the firm's assets when fully financed by equity. We later introduce financial leverage and analyze how it affects the value of the firm. The value of an unlevered firm V_{U} is defined as the present value of the discounted stream of cash flows to the firm owners, as given by

$$V_{\text{U}}[s_t] \equiv \text{E}_t \left[\int_t^\infty \frac{\Lambda_s}{\Lambda_t} \Pi_s (1-\tau) ds \right], \tag{9}$$

where $\tau \in [0,1]$ is the corporate tax rate. The solution for the value of the unlevered firm in Equation (29) is presented in the Appendix and illustrated in Figure 3. The figure shows comparative statics of the value of the unlevered firm V_{U}. Panel A shows that the value of the unlevered firm V_{U} declines with labor share S, since operating income is decreasing in S. The effects of the weight of labor in the productive technology α and of the labor–capital substitutability in the productive technology ρ on the unlevered firm value V_{U} are positive and mild, akin to the effects of these parameters on operating income. Panel D shows the negative effect of the volatility of productivity growth σ_{X} on firm value due to the positive relation between σ_{X} and the discount rates associated with the firms' cash flows.

<< *Figure 3 here* >>

2.4 Value of Financial Claims of a Levered Firm

We first consider a firm that previously issued a bond with a fixed-coupon rate $c > 0$. At the end of the section, we consider the bond issuance decision. Specifically, the firm is subject to tax payments $(\Pi_t - c)\tau$ per unit of time, where $c > 0$ is the coupon stream of debt, which is introduced later in this section. The firm's instantaneous net income rate Π^{NI} is defined as operating income net of coupon payments and corporate taxes, as given by:

$$\Pi_t^{\text{NI}} \equiv (\Pi_t - c)(1 - \tau). \tag{10}$$

The existence of debt implies that the firm is subject to bankruptcy, which is triggered by a default event. The firm enters into default when it is unable to make coupon payments. The default threshold is implicitly define by the condition given by

$$\Pi[\bar{S}] - c = 0. \tag{11}$$

Figure 4 illustrates the determinants of the default event. Panel A shows that net income Π^{NI} defined in Equation (10) is decreasing in labor share and that the default event occurs when it reaches zero. Panels B, C, and D show the comparative statics of default threshold $\bar{S}$ defined in Equation (11). Panel B shows how higher coupon rates c of previously issued corporate bonds are associated with lower default threshold $\bar{S}$. The intuition for this last result is that the default event is triggered at higher levels of operating income Π (i.e., lower levels of labor share S) when coupon rates are higher. Panels C and D show a relatively mild effect of the weight of labor in the productive technology α and of the labor–capital substitutability in the productive technology ρ on the default threshold $\bar{S}$.

<< Figure 4 here >>

The default event triggers bankruptcy and thus the transfer of the firm's ownership from shareholders to bondholders. At default, the defaulted bonds are written off and the bondholders effectively become the shareholders of the now unlevered firm. Bankruptcy costs BC are a fraction $\theta \in [0,1]$ of the firm's unlevered value, as given by

$$BC = \begin{cases} \theta V_{\mathrm{U}}[\bar{s}], & s_t = \bar{s}, \\ 0, & s_t \neq \bar{s}, \end{cases} \tag{12}$$

where $\bar{s} \equiv \mathrm{Log}\left[\bar{S}\right]$. The present value of expected bankruptcy costs V^{BC} are given by

$$V_{\mathrm{BC}}[s_t] = \theta V_{\mathrm{U}}[\bar{s}] e^{\beta_2 s} \left(1 - (1-\alpha)^{\frac{1}{1-\rho}} \left(\frac{K}{c}\right)^{\frac{\rho}{1-\rho}}\right)^{-\beta_2} \tag{13}$$

See Appendix for details.

Figure 5 shows the comparative statics of Equation (13). Panels A and B show that the present value of bankruptcy costs V_{BC} increases with labor share S and the coupon rate of previously issued bonds c, both of which are increasing in the likelihood of the default event. Panel C shows that the present value of bankruptcy costs V_{BC} are decreasing in the corporate tax rate τ. The reason for this last result is that the losses associated with bankruptcy are defined in terms of the unlevered firm value at default V_{U}, which is decreasing in the tax rate. Panel D shows the linear relation between the present value of bankruptcy costs V_{BC} and the percentage firm value loss conditional on default θ.

<< Figure 5 here >>

The fact that coupon payments are made on a before-tax basis implies that debt offers a stream of tax savings for the firm. The present value of the tax benefits (TB) are given by

$$V_{\text{TB}}[s_t] \equiv \mathrm{E}_t\left[\int_t^T \frac{\Lambda_s}{\Lambda_t} c\tau ds\right], \tag{14}$$

where $T > t$ is the date of default. Equation (14) shows that the tax benefits of debt are lost at default. The solution for the value of the tax benefits in Equation (14) is presented in the Appendix.

Figure 6 shows the comparative statics of Equation (14). Panel A shows that the present value of the expected tax benefits from debt V_{TB} decreases with labor share S. The intuition for this result is that the likelihood of the default event, in which the tax benefits of debt are lost, is increasing in labor share. Panel B shows that V_{TB} increases with the coupon rate c. The concave curve in Panel B reflects the fact that the likelihood of the default event increases with the coupon rate, which partially offsets the positive relation between c and V_{TB}. Panel C shows that V_{TB} is, as expected, increasing in the corporate tax rate τ.

<< Figure 6 here >>

The value of the debt issued by the firm V_{D} is defined as the present value of the discounted stream of cash flows paid to the current bondholders and is given by

$$V_{\text{D}}[s_t] \equiv \mathrm{E}_t\left[\int_t^T \frac{\Lambda_s}{\Lambda_t} c ds + \int_T^\infty \frac{\Lambda_s}{\Lambda_t} \Pi_s (1-\tau)(1-\theta) ds\right], \tag{15}$$

where $T > t$ is the date of default. The solution for the value of debt in Equation (15) is presented in the Appendix.

Figure 7 shows the comparative statics of Equation (15). Panel A shows that the present value of debt V_{D} decreases with labor share S, which is increasing in the likelihood of bankruptcy losses incurred by the bond holders. The figure shows that the value of debt converges to the value of the unlevered firm net of bankruptcy losses, $V_{\mathrm{U}}(1-\theta)$ once the default threshold $\bar{S}$ is reached. Panel B shows that V_{D} increases with the coupon rate c. Panels C and D show that V_{D} is decreasing in the corporate tax rate τ and the percentage firm value loss conditional on default θ, although the effect is mild. Panel E shows that the value of debt V_{D} decreases with the volatility of productivity growth σ_{X}.

<< *Figure 7 here* >>

The value of the levered firm V_{L} is the sum of the value of the unlevered firm V_{U} and the present value of the expected tax benefit from holding debt V_{TB} net of the expected bankruptcy costs V_{BC}. The value of equity of a levered firm is the difference between the value of the levered firm and the value of debt, as given by

$$V_{\mathrm{E}}[s_t] = V_{\mathrm{U}}[s_t] + V_{\mathrm{TB}}[s_t] - V_{\mathrm{BC}}[s_t] - V_{\mathrm{D}}[s_t]. \tag{16}$$

Figure 8 shows the comparative statics of Equation (16). Panel A shows that the present value of equity V_{E} decreases with labor share S. In particular, the panel shows that the value of equity converges to zero as the labor share S approaches the default threshold $\bar{S}$ is reached. Panels B and C show that V_{E} decreases with the coupon rate c of existing debt, and decreases with the corporate tax rate τ, given that these reduce the net income that is paid as dividends to the firm's shareholders. Panel D highlights the fact that, *after* bond issuance, the value of equity V_{E} is unaffected by the percentage firm value loss conditional on default θ. Panel E shows that the value of equity V_{E} decreases with the volatility of productivity growth σ_{X}.

<< *Figure 8 here* >>

Financial leverage ℓ is defined as the ratio of the value of debt V_{D} and the value of the levered firm V_{L}, as given by

$$\ell[s_t] = \frac{V_{\text{D}}[s_t]}{V_{\text{D}}[s_t] + V_{\text{E}}[s_t]}. \tag{17}$$

Figure 9 shows the comparative statics of the leverage ratio ℓ at a date after the bond issuance. Panel A shows that the leverage ratio ℓ increases with labor share S. The reason for this results is that although both the value of debt V_{D} and the value of equity V_{E} decline as the default threshold is approached, the latter is more affected given that equity holders lose the firm ownership at default. Panel B shows that the leverage ratio ℓ increases with the coupon rate c of existing debt. These last result is due to both the increase of V_{D} and decrease of V_{E} with c, as shown in Figures 7 and 8. Panels C and D show that financial leverage ℓ increases with the corporate tax rate τ while it decreases with the percentage firm value loss conditional on default θ. Panel E shows that financial leverage ℓ increases with the volatility of productivity growth σ_{X}. The intuition behind this last result is that the value of equity V_{E} is more sensitive to σ_{X} than the value of debt V_{D}.

<< *Figure 9 here* >>

Debt offers tax savings but makes the firm prone to costly bankruptcy. The owners of an unlevered firm consider this tradeoff when determining the firm's capital structure. At time t=0, the owners of an unlevered firm set the bond coupon level to maximize the net benefit of debt as given by

$$c^* = \text{argmax}_c \{V_{\text{TB}}[s_0, c] - V_{\text{BC}}[s_0, c]\}. \tag{18}$$

Finally, the optimal bond issuance decision $I^* = \text{sign}[V_{\text{TB}}[s_0, c^*] - V_{\text{BC}}[s_0, c^*]]$ is determined by the relative values of the firm with and without financial leverage. When $I^* = 1$, the value of the levered firm $V_L[s_0]$ exceeds the value of the unlevered firm $V_U[s_0]$ so the equity holders issue a bond with a coupon rate equal to c^*. When $I^* = -1$, the value of the levered firm $V_L[s_0]$ is less or equal than the value of the unlevered firm $V_U[s_0]$ so the equity holders are better off by not issuing a bond.

Figure 10 shows how the optimal coupon rate and issuance decisions are affected by labor share S and some key model parameters. Panel A shows that the optimal coupon rate is decreasing in labor share. The reason is that the value of bankruptcy costs V_{BC} increase while the value of the expected tax benefits of debt V_{TB} decrease with labor share, which make a higher coupon rate c less advantageous closer to the default threshold $\bar{S}$. The shaded area in Panel A indicates the region in which labor share is high enough so that the firm's equity holders are better off not issuing a bond. Panel B shows that, conditional on bond issuance, the optimal coupon rate c^* is decreasing in the volatility of productivity growth σ_X. Panel C shows that the optimal coupon rate c^* is increasing in the corporate tax rate τ, which in turn implies greater value of the expected tax benefits of debt V_{TB}. The shaded are in the panel indicates the minimum level of corporate tax rates in which the firm is better off issuing bonds. Panel D shows that the optimal coupon rate c^* is decreasing in the percentage firm value loss conditional on default θ, which in turn implies greater value of the expected losses due to bankruptcy V_{BC}.

<< Figure 10 here >>

Figure 11 shows the comparative statics of the firm's optimal financial leverage at the date of bond issuance, as well as the optimal bond issuance regions. The patterns in the figure are similar to those of 10.

<< *Figure 11 here* >>

2.5 Labor Leverage, Financial Leverage, and Expected Returns

This section defines expected returns for the firms' asset, equity, and debt and discusses the relation between these, labor leverage, and financial leverage.

2.5.1 Definition of Expected Returns

We consider the returns on three different contingent claims on the firm: assets (i.e., claims on the unlevered firm), bonds (i.e., claims on the debt issued by the firm), and stocks (i.e., claims on the equity of the firm). Expected returns of the assets (R_{A}), bonds (R_{B}), and stocks (R_{E}) are defined as

$$\mathrm{E}_t\left[R_{\text{A,t+1}}\right] = \frac{\mathrm{E}_t\left[V_{\text{U,t+1}}\right] + \mathrm{E}_t\left[\int_t^{t+1} \Pi_s(1-\tau)ds\right]}{V_{\text{U,t}}} - 1, \tag{19a}$$

$$\mathrm{E}_t\left[R_{\text{B,t+1}}\right] = \frac{\mathrm{E}_t\left[V_{\text{D,t+1}}\right] + \mathrm{E}_t\left[\int_t^{\min[t+1,T]} c ds + \int_{\min[t+1,T]}^{t+1} \Pi_s(1-\tau)(1-\theta)ds\right]}{V_{\text{D,t}}} - 1, \tag{19b}$$

$$\mathrm{E}_t\left[R_{\text{E,t+1}}\right] = \frac{\mathrm{E}_t\left[V_{\text{E,t+1}}\right] + \mathrm{E}_t\left[\int_t^{\min[t+1,T]} \Pi_s^{\text{NI}} ds\right]}{V_{\text{E,t}}} - 1. \tag{19c}$$

2.5.2 Comparative Statics on Expected Returns

The expressions for expected returns in Equations (19a), (19b), and (19c) cannot be solved analytically. To address this challenge, we conduct numerical comparative statistics to investigate the relative contributions of these two types of leverage on the expected asset, bond, and stock returns. We start by investigating the unconditional relation between financial leverage and expected returns and the unconditional relation between labor leverage and expected returns.

The numerical comparative statics are based on the simulation a panel of 1,000,000 firms over six years. Firms are randomly assigned firm-specific productivity levels so that the initial cross-sectional distribution of labor share has a mean (0.49) and standard deviation (0.10) that match those found in the data. Firms issue debt on the year $t = 1$ according to the maximization problem discussed in Section 2.4. One year later (i.e., year $t = 2$) we form portfolios of firms sorted on labor leverage (i.e., labor share), financial leverage, or both. We then compute equal- and value-weighted one-year asset, bond, and equity returns for the portfolios at year $t = 3$. The parameters values used in the model simulation used in the construction of the table are $K = 1.00$, $r = 0.01$, $\eta = 0.80$, $\alpha = 0.50$, $\rho = -1.50$, $\lambda_{\mathrm{m}} = 0.01$, $\mu_{\mathrm{X}} = 0.01$, $\rho_{\mathrm{X}} = 0.50$, $\sigma_{\mathrm{X}} = 0.10$, $\mu_{\mathrm{W}} = 0.00$, $\rho_{\mathrm{W}} = 0.50$, $\sigma_{\mathrm{W}} = 0.01$, $\tau = 0.23$, and $\theta = 0.77$.

The univariate comparative statics of expected returns on labor leverage and financial leverage are shown in Table 1. The table shows the average asset, bond, and equity returns of portfolios sorted on either labor leverage (Panel A) or financial leverage (Panel B). Panel A of Table 1 show that the returns of the three corporate securities considered (i.e., asset , bonds, and equity) are increasing in labor share. This result is expected and confirms the validity of labor share as a proxy for labor-induced operating leverage.

Panel B of Table 1 presents the comparative statics of expected returns on financial leverage. The first two rows of Panel B of Table 1 show that asset returns are negatively related to financial leverage. This result highlights the idea that financial leverage is an endogenous firm characteristic that negatively responds to asset risk. The middle two rows of Panel B of Table 1 show that bond returns are increasing in financial leverage. The intuition for this last result is that, all else equal, the bonds of firms with greater financial leverage are closer to bankruptcy, in which debt holders become shareholders, and are therefore more exposed to equity risk. The last two columns of Panel B of Table 1 shows no clear relation between financial leverage and stock returns. This result shows that the indirect effect on equity risk of the negative relation between asset risk and financial leverage is offset by the positive effect of financial leverage on equity risk.

<< *Table 1 here* >>

The multivariate comparative statics of expected returns on financial leverage and labor leverage jointly are shown in Table 2. The table presents the average asset returns (Panel A), bond returns (Panel B), and equity returns (Panel C) of portfolios first sorted into labor leverage terciles and then on financial leverage quintiles. The sequential double sorting exercise can be interpreted as an analysis of the effect of the second sorting variable (i.e., financial leverage) on expected returns *controlling* for the first sorting variable (i.e., labor leverage).

Panel A of Table 2 show that the negative relation between expected asset returns and financial leverage is robust to controlling for labor leverage. Panel B of Table 2 shows that, the relation between financial leverage and bond returns is positive and increasing in labor leverage. Panel C of Table 2 shows a positive relation between financial leverage and equity returns once we control for labor shares.

<< *Table 2 here* >>

3 Data

Our main empirical exercises examine three types of contingent claims on firms: assets, equity and bonds. Using returns on these claims on firms, we test the predictions from our model based on optimal investment and leverage choices. We describe the data sources and how we construct the main variables.

3.1 Data Sources

We draw on a firm's stock price and accounting information from the CRSP and Compustat. The bond price information from the Reuters Fixed Income Database. We also add the Mergent Fixed Income Security Database (FISD) for information on detailed terms and conditions of bonds.

The Reuters data collects daily quotes provided by major dealers in the U.S. corporate bond market, covering more than 500,000 corporate bonds.[8] The database spans from 1991 through 2012. For the period before 1991, the Lehman Brothers Fixed Income database is utilized. Observations with matrix prices are removed because matrix prices are calculated using other bonds having similar characteristics. Note that the price data used in the analysis are not actual transaction data, which can be stale. However, price staleness is not a major concern based on the in-depth analysis by Choi (2013) and Choi and Richardson (2016). Following these studies, we obtain month-end prices for our study.

The last step is to match corresponding corporate bonds to a firm's stock. Basically, we identify same issuers by utilizing issuer-level six-digit CUSIPS in each stock. We also track bonds issued by subsidiaries, and by surviving firms in the case of mergers and acquisitions.

3.2 Variable Construction

After matching aforementioned databases, we construct the return on a firm's assets by value-weighting equity, bond, and loan returns on the firm as following:

$$R^A_{t+1} = \frac{E_t}{E_t + B_t + L_t} R^E_{t+1} + \frac{B_t}{E_t + B_t + L_t} R^B_{t+1} + \frac{L_t}{E_t + B_t + L_t} R^L_{t+1} \tag{20}$$

[8]For a detailed description of the database, see Choi (2013) and Choi and Richardson (2016)

where E_t, B_t,and L_t are the market values of equity, bonds, and loans, and R_t^E,R_t^B, and R_t^L are the returns on equity, bonds, and loans, respectively. We use firm-level bond returns by value-weighting individual bond returns issued by the same firms to circumvent illiquidity issues of small bonds. The loan amounts are assumed to be the remaining portion of the book debt net of corporate bonds. Since we do not utilize the detailed information on corporate loans, the loan returns are measured as proportional to corporate bond returns following Choi (2013).

Our key variable from the model is the labor share, the ratio of labor expenses to value added, which is a sufficient statistic for asset risk. Specifically, we use the extended version of labor share (LS) of Donangelo et al. (2018) for empirical analysis. The measure is defined as following:

$$LS_t = \begin{cases} \frac{XLR_t}{OIBDP_t + XLR_t + \Delta INVFG_{t-1}} & \text{if XLR is non-missing} \\ \frac{LABEX_t}{OIBDP_t + LABEX_t + \Delta INVFG_{t-1}} & \text{if XLR is missing} \end{cases} \tag{21}$$

where XLR is the Compustat item Staff Expense – Total (which we use as a proxy for labor costs), $OIBDP$ is the Compustat item Operating Income Before Depreciation, and $\Delta INVFG$ is the change in the Compustat item Inventories –Finished Goods. For firms missing XLR, we instead use $LABEX$, which is defined as the product of the Compustat item EMP (Number of Employees) and the average annual labor compensation per employee in the industry during that year. We estimate the average labor compensation per employee as the average ratio of XLR and EMP in the industry, calculated using the firms that do report XLR.

3.3 Summary Statistics

We construct our main sample by merging the CRSP/EJV/Compustat databases. The sample spans the period from 1976 to 2011 covering 3,757 firms after excluding financial firms. Panel A of Table 3 provides summary statistics for the firm-level sample across issuer-level ratings. We consider both book (BLev) and market leverage (MLev). In our sample, firms with relatively low ratings are smaller, and tend to have high level of labor share, leverage, and book-to-market ratio than firms rated higher.

<< *Table 3 here* >>

In Panel B, we report time-series average of median characteristics for tercile portfolios of firms sorted either on lagged financial leverage or LS. When firms are sorted by financial leverage, we find that firms with high leverage are larger (in terms of both assets and market value of equity), are more value firm like (i.e., higher B/M and E/P ratios), and are less labor intensive (high EMP/PPENT). More importantly, highly levered firms also tend to have low labor share, implying the tradeoff between operating and financial leverages. On the other hand, when firms are sorted based on LS, we find that firms with higher LS are smaller. The negative relation between LS and firm size suggest the greater riskiness of high labor share firms. High LS firms are also slightly more value firm like (although B/M and E/P ratios diverge), and are more labor intensive.

4 Empirical Evidence

4.1 Validating the Standard Capital Structure Theory

Our theory describes the role of the interaction between operating and financial leverage in driving the risk and return of security returns. In this section, we begin by investigating the link between asset risk and financial leverage. As in the standard tradeoff theory of capital structure, our model also predicts a negative relation between asset risk and financial leverage, since firms with high asset risk will have high present value of distress, thereby reduce the usage of debt due to to balance distress costs and tax benefits.

In Table 4, we investigate the relation between asset risk and financial leverage. We begin by estimating the following Fama-MacBeth regressions:

$$Leverage_{i,t} = \alpha + \beta_t Asset\ Risk_{i,t-1} + \epsilon_{i,t} \tag{22}$$

As the dependent variable, we consider book and market leverages. The explanatory variable is a measure of asset risk including asset volatility, asset beta, and cash flow volatility which are lagged by one year. Asset volatility is the standard deviation of asset returns over the year. Asset beta is estimated by regressing firm-level asset returns on the market risk factor of Fama and French (1993). Cash flow volatility is the standard deviation of operating income to assets ratio over the year.[9] All independent variables are standardized to have a mean of 0 and a standard deviation of 1 in every year. This allows us to directly interpret the economic meaning of regression slopes.

<< Table 4 here >>

In Panel A of Table 4 we report the time-series average of coefficients estimates in Equation (22). Starting with BLev, we find a negative relation between leverage and asset risk, suggesting that risky firms reduce the level of financial leverage. For example, a one-standard-deviation increase in asset volatility, asset beta, and cash flow volatility reduces the level of book leverage by 9.1%, 4.2%, and 4.2%, respectively. In the last columns of each leverage proxy, we run multiple regressions with all of the three proxies. As it turns out, the effect

[9] We use quarterly Compustat file to calculate cash flow volatility.

of asset beta is mostly subsumed by other two proxies. We find very similar patterns in market leverage. For example, the coefficient estimates on asset risk proxies are -0.122 (Asset Volatility), -0.061 (Asset Beta), and -0.055 (Cash Flow Volatility), which are larger than estimates for book leverage in terms of absolute magnitude.

In Panel B of Table 4, we further examine the relationship between asset risk and financial leverage by forming quintile portfolios based on asset risk measured in previous year. We report both equal and value weighted average leverage across these portfolios.[10] Similar to Panel A, there is a clear negative relation between asset risk and financial leverage for both equal and value weighted portfolios. For example of MLev, the difference between highest and lowest asset volatility quiltile is -0.385 when portfolios are equal-weighted. Similarly, high-minus-low MLev spreads are -0.165 (Asset Beta), and -0.111 (Cash Flow Volatility) which are all significant at the 1% level. Overall, the results in Table 4 show evidence consistent with the theory of capital structure.

The results reported in Table 4 show that firms with high asset risk tend to maintain low leverage. As shown in our theory, this negative link implies a rather non-straightforward relationship among financial leverage and returns on corporate securities including equity and bonds as well as returns on firms' entire assets. In particular, to the extent that high asset risk firms also have high asset returns, we would expect a similar link between asset returns and financial leverage. That is, high financial leverage firms will have low asset returns. More importantly, this negative link can shed light on the link between equity and financial leverage as well, a long standing puzzling question in the literature, as well summarized by Gomes and Schmid (2010).

To answer this question, in Table 5 Panel A, we examine asset, equity, and bond returns on firms in our sample. Specifically, we implement the following Fama-MacBeth regressions

[10] We form value-weighted portfolios using the market value of firm's assets known at the beginning of portfolio formation month.

each year:

$$Returns_{i,t} = \alpha + \beta_t Leverage_{i,t-1} + \epsilon_{i,t} \tag{23}$$

The leverage variables are standardized in each year. In Panel A of Table 5 we report the time-series average of coefficients estimates in Equation (5). The results show diverging patterns across securities. Starting with asset return results, we find a strong negative correlation between asset return and four measure of financial leverages, which is consistent with asset risk evidence reported in Table 4. For example, the coefficient estimates imply that a one-standard-deviation increase in leverage is associated with -2.6% (BLev) and -2.1% (MLev) decrease in financial leverage. On the other hand, the relation between bond return and leverage is significantly positive, as distress costs enhanced by leverage directly affect bondholders. We find the estimates are significant at least at the 5% level, ranging from 0.008 to 0.012 depending on specifications.

<< Table 5 here >>

For equity returns, we find a rather vague association between returns and financial leverage. The estimated coefficient is significant and negative when book leverage is used, whereas it is insignificant for market leverage. However, this pattern is actually consistent with evidence in Table 4. Firm with high asset risk (or distressed firms) endogenously choose low level of financial leverage, resulting in a flat relation between levered returns and financial leverage.

In Panel B of Table 5, we sort firms into quintile portfolios (both equal and value weighted) using lagged leverage to further examine the link between corporate security returns and financial leverage.[11] Overall, we find very similar patterns as in Panel A. High-

[11] We form value-weighted asset, bond, and equity portfolios using the market value of firm's assets, the market value of firm's bonds, and the market value of firm's equity, respectively, known at the beginning of portfolio formation month.

minus-low return spreads for asset (bond) returns are significantly negative (positive), while those are mostly insignificant for equity returns.

4.2 Validation of Labor Share as a Measure of Operating Leverage

In the model, the value of firm is a function of labor share, implying labor share as fundamental source of asset risk. We validate this assumption by showing how labor share is related to asset risk proxies and asset returns in the data.

In Table 6 Panel A, we examine the link between asset risk and labor share by employing the following Fama-MacBeth regressions:

$$Y_{i,t} = \alpha + \beta_t LS_{i,t-1} + \epsilon_{i,t} \tag{24}$$

where Y indicates dependent variables used including three asset risk proxies (asset volatility, asset beta, and cash flow volatility) and three types of security returns (asset, bond, and equity). LS is the labor share lagged by one year, which is standardized in each year. The estimation results reported in Panel A of Table 6 show that LS is indeed positively related to asset risk proxies. For example, the coefficient estimates of 0.010 for asset volatility suggest that a one-standard-deviation increase in labor share is associated with 1% increase in asset volatility. We also find significant and positive coefficients on labor share for asset beta and cash flow volatility as well.

<< Table 6 here >>

This positive association between LS and asset risk proxies, as reported in Panel A, also implies that high LS should have high subsequent returns as well. To examine this risk-return implication of security returns, in Panel B we estimate Fama-MacBeth regressions of asset, bond, and equity returns on lagged LS. Panel B indeed shows that firms with high labor share tend to have high subsequent corporate security returns. In other words, the coefficient estimates on LS are all positive and significant at least 5% level. For example, a one-standard-deviation increase in labor share leads to an increase in annualized returns of 1.4% (asset return), 0.4% (bond return), and 1.4% (equity return).

In Panel C and D, we form quintile portfolios sorted on lagged LS to further examine the link between labor share and asset risk and returns. Similar to Panel A and B, the high-minus-low spreads are all significantly positive, corroborating the Fama-MacBeth results. In Panel C for example, when returns are equal-weighted, high-minus-low portfolio spreads are 0.030 (Asset Volatility), 0.252 (Asset Beta), and 0.003 (Cash Flow Volatility). We find very similar results for value-weighted results.[12] In Panel D of security return results, the LS return spreads are all significant and positive both for equal and value weighted portfolios. For example, high-minus-low annual return spreads are 4% (Asset Return), 1.1% (Bond Return), and 4.1% (Equity Return) when returns are equal-weighted.

4.3 Tradeoff between Operating Leverage and Financial Leverage: Implication for Returns

Our model predicts the trade off between operating leverage, measured by labor share, and financial leverage. Even though Table 3 already presents a preliminary evidence, we formally test this relation. In Panel A of Table 7, we report correlations between LS and financial leverage measures. As anticipated, we find a negative correlation between LS and leverages (both book and market). In Panel B, we report the time-series average of median leverage of portfolios sorted on LS. Clearly, there is a decreasing pattern of leverages across quintiles. In Panel C, we run a Fama-MacBeth regressions of leverages on LS and report the time-series average of LS coefficients. Again, the coefficient estimates on LS are all significant

[12] We form value-weighted portfolios using market value of firm's assets known at the beginning of portfolio formation month.

and negative.

<< Table 7 here >>

In so far, we have documented that LS a proxy for business risk drives the inverse relation between operational and financial leverage. Based on these findings, we investigate the leverage-return association through the lens of LS. In Table 8, we implement the Fama-MacBeth regressions (Panel A and B) and the portfolio sorts (Panel C) by considering both leverage dimensions.

Specifically, we estimate the following Fama-MacBeth regressions of asset, equity, and bond returns on lagged financial leverage and LS:

$$Returns_{i,t} = \alpha + \beta_{1,t} LS_{i,t-1} + \beta_{2,t} Leverage_{i,t-1} + \beta_{3,t}(LS_{i,t-1} * Leverage_{i,t-1}) + \epsilon_{i,t} \quad (25)$$

LS and leverage measures are standardized in each year. In the specification, we include the product between LS and financial leverage to examine the interaction effect of operating and financial leverage in returns.

<< Table 8 here >>

Panel A of Table 8 provides the results from Fama-MacBeth regressions of returns on LS and book leverage. In each security return result, we consider three different specifications in addition to (25). From the column 1 to 3, we include univariate regressions of returns either on LS or leverage, and multiple regressions of returns on LS and leverage, without interaction between two. The results in Panel A of Table 8 provide supportive evidence of amplification mechanism driven by LS, consistent with the prediction from our model. For example of asset returns, the coefficients on interaction term (LS*Lev) is -0.007 which is statistically significant at conventional level. This implies that the negative return-leverage sensitivity becomes more stronger for firms having high labor share. We also find this amplification mechanism in bond returns as well. The coefficient estimate on the interaction term (LS*Lev) is 0.005 which is positive at 1% level.

The inverse relation between asset risk and financial leverage can explain why there is almost no relation between financial leverage and equity returns. Firms with low operating leverage endogenously chooses high level of financial leverage, suggesting two offsetting forces in equity returns. Our evidence supports this intuition as shown in the last four columns of Panel A. Overall, we do not find any notable effects of financial leverage for equity returns after LS has been included in the specification. In Panel B of Table 8, we document the results from the Fama-MacBeth regressions of returns on LS and market leverage. We find the estimation results very similar to those of Panel A.

In Panel C of Table 8, we report average portfolio returns double sorted on lagged LS and Lev. Because LS is more exogenous in our framework, we first sort firms into three portfolios based on LS, and then form tercile portfolios within each LS tercile. The results corroborate the relation documented in Panel A and B. For example, the negative financial leverage-asset return relation is more pronounced for firms with high asset risks or high LS. When market leverage is used as sorting variable, the equal-weighted leverage spread is -8.9% for the highest LS portfolio which is significant at 1% level. At the same time, the estimated spread is -3.1% for the lowest LS portfolio, which is significant at 10% level. The positive leverage-bond return relation is also larger for firms with high LS. Lastly, we find significant and negative equity return spreads especially for firms in the highest LS tercile when book leverage is used as sorting variable, while the relation between financial leverage and equity returns are flat in other cases.

4.4 What Drives Financial Leverage? Fundamental Risk or Labor Leverage

Our final investigation is on the driving force of financial leverage. The previous results show that both fundamental asset risk and LS drive a firm's leverage choice. We go into more deeper to examine which force dominates the other. To see this, we consider the following Fama-MacBeth regressions of leverage on lagged LS and asset risk variables:

$$Leverage_{i,t} = \alpha + \beta_{1,t} LS_{i,t-1} + \beta_{2,t} Asset\ Risk_{i,t-1} + \beta_{3,t}(LS_{i,t-1} * Asset\ Risk_{i,t-1}) + \epsilon_{i,t} \tag{26}$$

LS and asset risk variables are standardized in each year. Panel A of Table 9 provides the results from Fama-MacBeth regressions of book leverage on LS and asset risk. The proxies for fundamental risk are asset volatility, asset beta, and cash flow volatility. In each asset risk variable result, we also implement univariate regressions of leverage either on LS or asset risk, and multiple regressions of leverage on LS and asset risk, without interaction between two.

<< Table 9 here >>

The results in Panel A of Table 9 generally show that asset risk variables (asset volatility, asset beta, and cash flow volatility) better explain the variations of leverage across firms, from the incremental R-squared values. For example, when asset volatility is used as proxy for fundamental risk, the R-squared value increases from 0.04 to 0.26 compared to univariate regressions on labor share. We find similar but weak (in terms of magnitude) results for asset beta and cash flow volatility results. In addition, the interaction terms of asset risk and LS are estimated to be significantly positive. Our interpretation is that the influence of labor share on leverage diminishes especially for firms with high asset risk, suggesting the fundamental asset risk as main driver of financial leverage. In Panel B of Table 9, we document the results based on market leverage, which yields same conclusion as in Panel A.

5 Conclusion

We study the implications of the interaction between operating leverage and financial leverage for the risk and returns of the different corporate securities. We present a novel production-based asset-pricing model of labor leverage that embeds endogenous capital structure decisions. The model suggests that labor leverage amplifies the risk of firms' assets, bonds, and equity. The model shows that financial leverage tends to offset the relation between labor leverage and the returns of the corporate securities because firms optimally choose lower levels of debt in response to higher asset risk. On the one hand, the financial leverage amplifies bond returns by increasing bond holders exposure to priced default risk. On the other hand, the flipped relations between asset and bond returns and financial leverage represent offsetting drivers of the relation between financial leverage and equity returns. We find supporting evidence for the predictions of our model using a unique dataset of asset and bond returns. Overall, our paper highlights the importance of considering the interaction between the two main sources of leverage to study the risk and return characteristics of the different corporate securities.

6 Appendix

6.1 Value of the Unlevered Firm (V_{U})

The value of the unlevered firms in Equation (29) satisfies the ordinary differential equation (ODE) given by

$$\Pi_t(1-\tau) + c_0 V_{\mathrm{U}}[s_t] + c_1 V_{\mathrm{U}}'[s_t] + c_2 V_{\mathrm{U}}''[s_t] = 0, \tag{27}$$

where $s_t \equiv \mathrm{Log}\,[S_t]$ and

$$\begin{aligned}
c_0 &\equiv \mu_{\mathrm{X}} - r - \lambda_{\mathrm{m}} - \eta\rho_{\mathrm{X}}\sigma_{\mathrm{X}}, \\
c_1 &\equiv \left(\frac{\rho}{1-\rho}\right)\left(\eta(\rho_{\mathrm{W}}\sigma_{\mathrm{W}} - \rho_{\mathrm{X}}\sigma_{\mathrm{X}}) + \mu_{\mathrm{X}} - \mu_{\mathrm{W}} - \rho_{\mathrm{X}}\rho_{\mathrm{W}}\sigma_{\mathrm{X}}\sigma_{\mathrm{W}} + \frac{\sigma_{\mathrm{X}}^2 + \sigma_{\mathrm{W}}^2}{2}\right), \\
c_2 &\equiv \left(\frac{\rho}{1-\rho}\right)^2 \left(\frac{\sigma_{\mathrm{W}}^2 + \sigma_{\mathrm{X}}^2}{2} - \rho_{\mathrm{W}}\rho_{\mathrm{X}}\sigma_{\mathrm{W}}\sigma_{\mathrm{X}}\right),
\end{aligned}$$

subject to the transversality conditions $\lim_{s\to-\infty} V_{\mathrm{U}}[s] = \frac{(1-\alpha)^{1/\rho}}{\lambda+r}$ and $\lim_{s\to\infty} V_{\mathrm{U}}[s] = 0$. The solution to the ODE in Equation (27) is given by

$$V_{\mathrm{U}}[s_t] = \frac{(1-\tau)(1-\alpha)^{\frac{1}{\rho}} K}{(\beta_1-\beta_2)c_2}\left(\frac{(\rho-1)e^{s_t\beta_1} B^{-\beta_1}_{\frac{\rho-1}{\rho}}[e^{s_t}]}{(\beta_1-1)\rho+1} - \frac{(\rho-1)e^{s_t\beta_2} B^{-\beta_2}_{\frac{\rho-1}{\rho}}[e^{s_t}]}{(\beta_2-1)\rho+1} - \frac{G[-\beta_2]\, G\left[2-\frac{1}{\rho}\right] e^{s_t\beta_2}}{G\left[-\beta_2-\frac{1}{\rho}+2\right]} - \frac{(\beta_1-\beta_2)c_2(1-e^{s_t})^{1-1/\rho}}{(\beta_1-1+1/\rho)(\beta_2-1+1/\rho)}\right), \tag{29}$$

where β_1 and β_2 are the negative and positive roots of the fundamental polynomial of the ODE in Equation (27), $B_b^a[.]$ is the Beta function, and $G[.]$ is the Gamma function.

6.2 Value of the Expected Bankruptcy Costs (V_{BC})

The present value of the expected bankruptcy costs satisfies the ordinary differential equation (ODE) given by

$$c_0 V_{\mathrm{BC}}[s_{\mathrm{t}}] + c_1 V'_{\mathrm{BC}}[s_{\mathrm{t}}] + c_2 V''_{\mathrm{BC}}[s_{\mathrm{t}}] = 0, \tag{30}$$

subject to the boundary conditions $\lim_{s \to \bar{s}} V_{\mathrm{BC}}[s] = V_{\mathrm{U}}[\bar{s}]$ and $\lim_{s \to \infty} V_{\mathrm{BC}}[s] = 0$. The solution to the ODE in Equation is known and is given in Equation (30).

6.3 Value of Expected Tax Benefits of Debt (V_{TB})

The value of the tax benefits of debt in Equation (14) satisfies the ordinary differential equation (ODE) given by

$$c\tau + c_0 V_{\mathrm{TB}}[s_{\mathrm{t}}] + c_1 V'_{\mathrm{TB}}[s_{\mathrm{t}}] + c_2 V''_{\mathrm{TB}}[s_{\mathrm{t}}] = 0, \tag{31}$$

subject to the boundary conditions $\lim_{s \to -\infty} V_{\mathrm{TB}}[s] = \frac{c\tau}{r+\lambda_{\mathrm{d}}}$ and $\lim_{s \to \bar{s}} V_{\mathrm{TB}}[s] = 0$. The first boundary condition represents the fact that the value of the tab benefits of debt converges to the value of a risk free bond that pays a stream of tax savings $c\tau$ as the firm moves away from the bankruptcy threshold. The second boundary condition represents the fact that the tax benefits of debt are lost at the time of default.

6.4 Value of Debt (V_{D})

The value of the debt in Equation (15) satisfies the ordinary differential equation (ODE) given by

$$c + c_0 V_{\mathrm{D}}[s_{\mathrm{t}}] + c_1 V'_{\mathrm{D}}[s_{\mathrm{t}}] + c_2 V''_{\mathrm{D}}[s_{\mathrm{t}}] = 0, \tag{32}$$

subject to the boundary conditions $\lim_{s \to -\infty} V_{\mathrm{D}}[s] = \frac{c}{r+\lambda_{\mathrm{d}}}$ and $\lim_{s \to \bar{s}} V_{\mathrm{D}}[s] = V_{\mathrm{U}}[\bar{s}](1-\theta)$. The first boundary condition represents the fact that the value of the debt converges to the value of a risk free bond as the firm moves away from the bankruptcy threshold. The second boundary condition represents the fact that, at time of default, the bondholders become the owners of the firm so that the value of debt at default equals the value of unlevered assets net of bankruptcy costs.

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Figure 1
Model: Operating Income (Π)

The parameters values used in the plots are $K = 1.00$, $S = 0.60$, $\alpha = 0.67$, and $\rho = -1.50$.

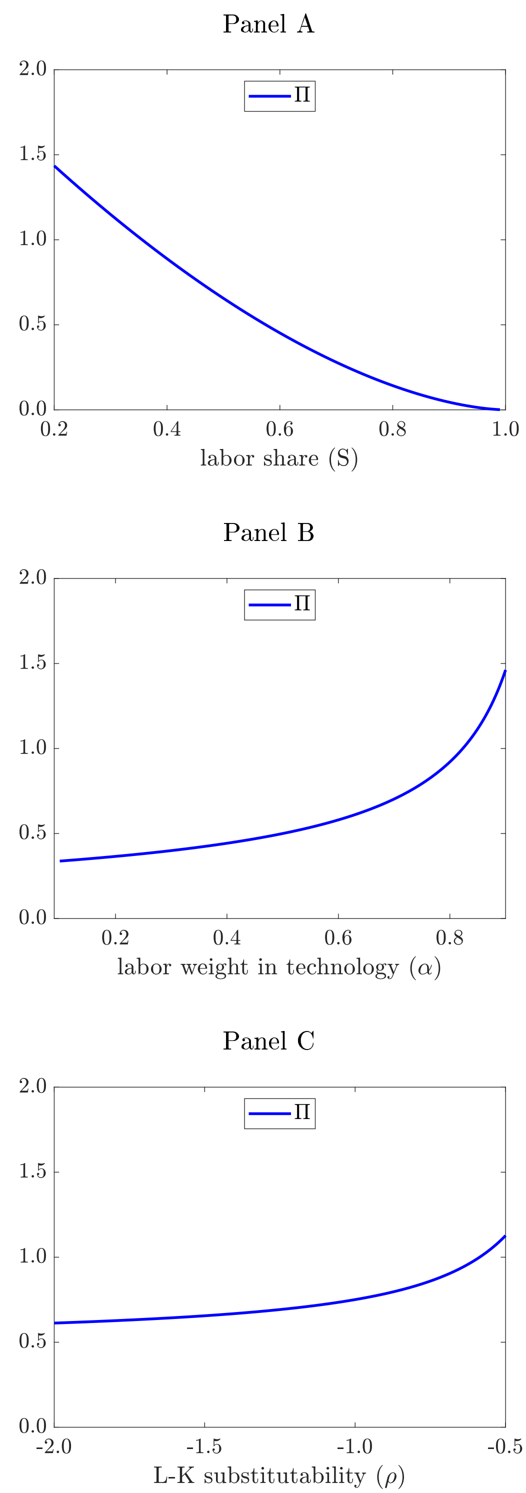


Figure 2
Model: Labor Share and Labor Leverage
The parameters values used in the plots are $K = 1.00$, $S = 0.60$, $\alpha = 0.67$, and $\rho = -1.50$.

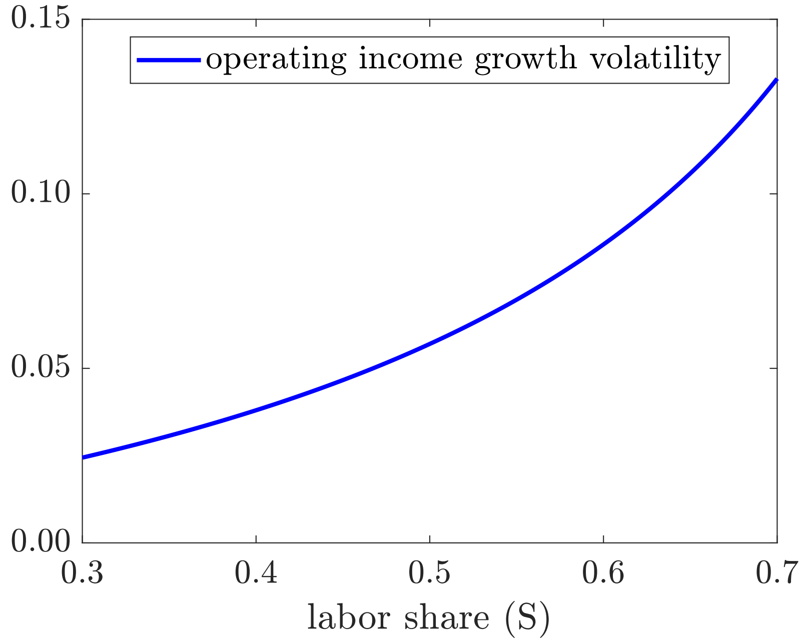


Figure 3

Model: Value of Unlevered Firm (V_U)

The parameters values used in the plots are $K = 1.00$, $S = 0.60$, $r = 0.02$, $\eta = 0.60$, $\alpha = 0.67$, $\rho = -1.50$, $\lambda_m = 0.02$, $\mu_x = 0.03$, $\rho_x = 0.65$, $\sigma_x = 0.07$, $\mu_w = 0.01$, $\rho_w = 0.35$, $\sigma_w = 0.01$, and $\tau = 0.50$.

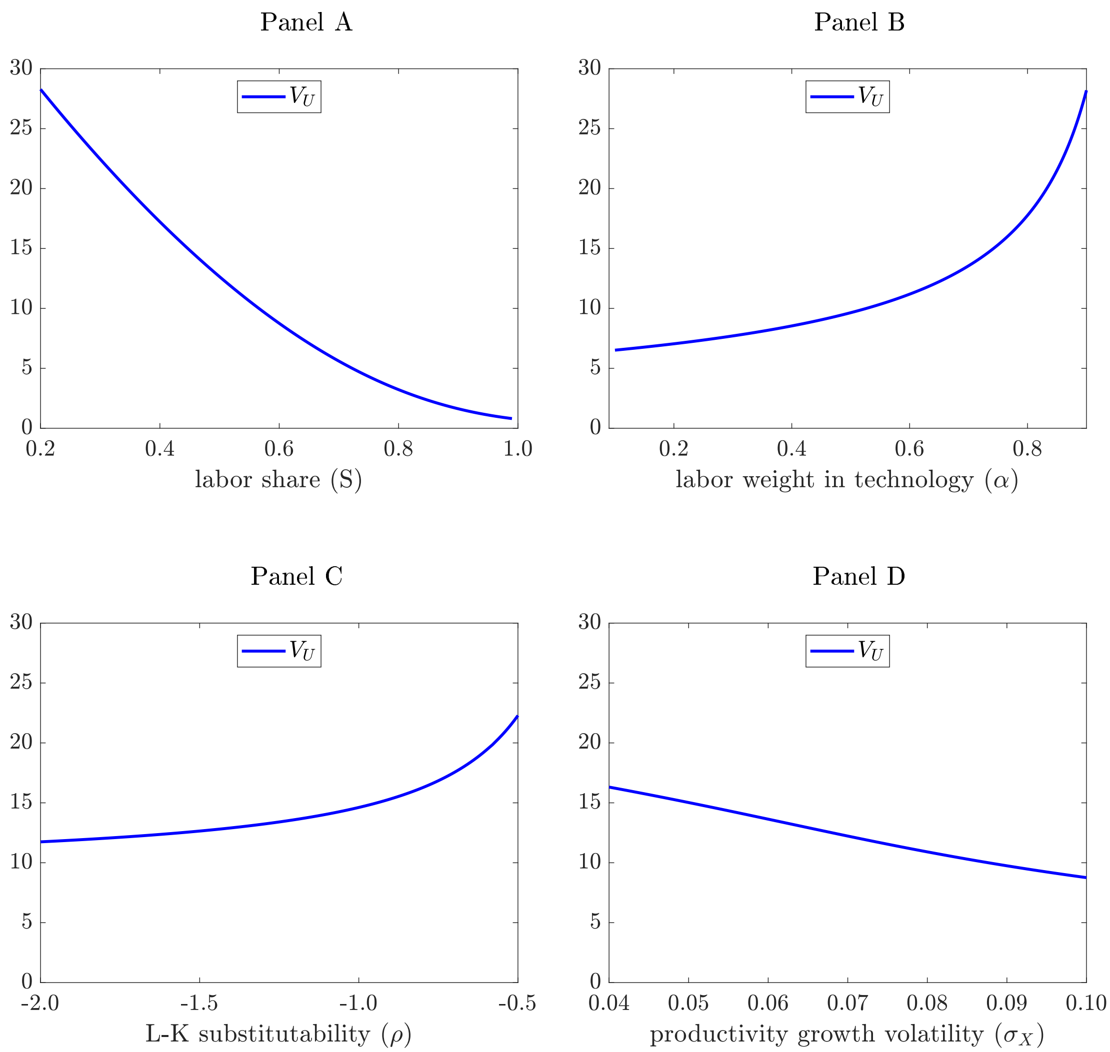


Figure 4
Model: Net Profits (Π^{NI}) and Bankruptcy Threshold ($\bar{S}$)
The parameters values used in the plots are $K = 1.00$, $\alpha = 0.67$, $\rho = -1.50$, $c = 0.10$.

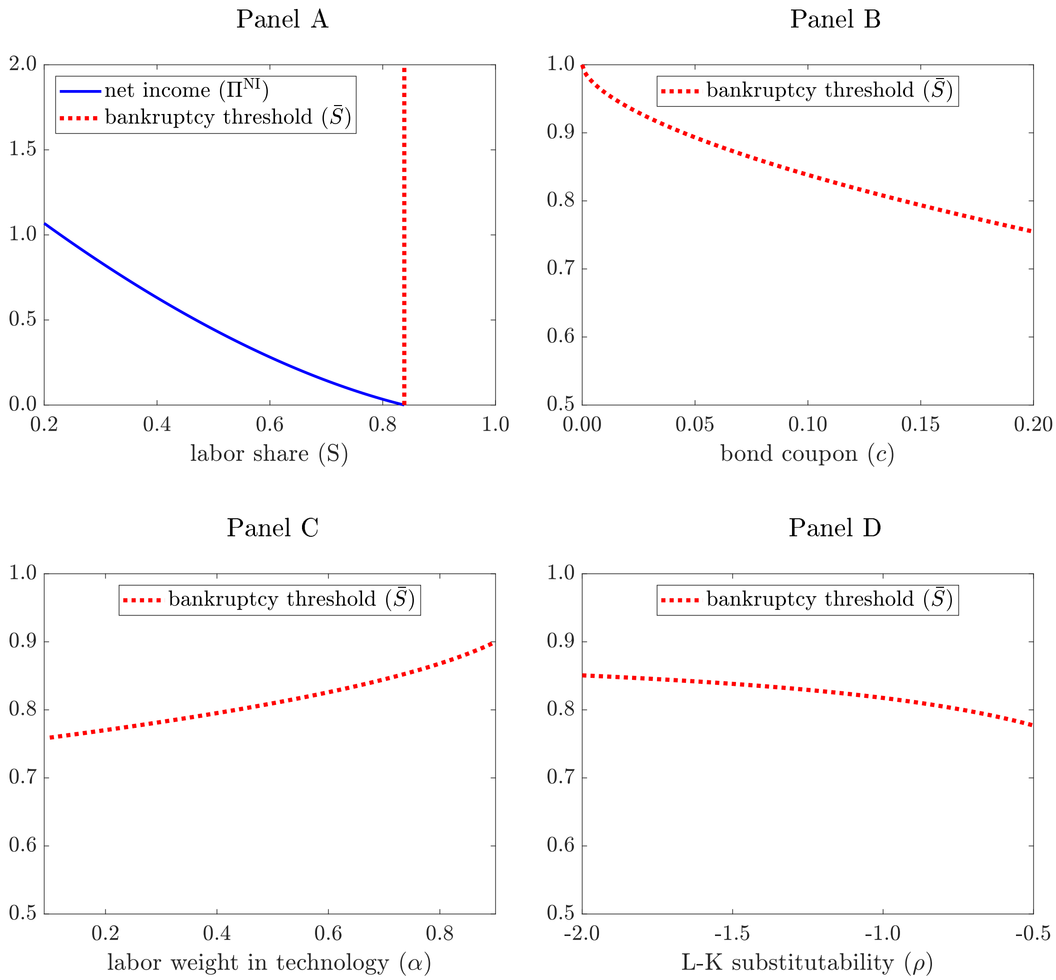


Figure 5
Model: Value of Bankruptcy Costs (V_{BC})

The parameters values used in the plots are $K = 1.00$, $S = 0.60$, $r = 0.02$, $\eta = 0.60$, $\alpha = 0.67$, $\rho = -1.50$, $\lambda_{\mathrm{m}} = 0.02$, $\mu_{\mathrm{X}} = 0.03$, $\rho_{\mathrm{X}} = 0.65$, $\sigma_{\mathrm{X}} = 0.07$, $\mu_{\mathrm{W}} = 0.01$, $\rho_{\mathrm{W}} = 0.35$, $\sigma_{\mathrm{W}} = 0.01$, $\tau = 0.50$, $\theta = 0.50$, and $c = 0.10$.

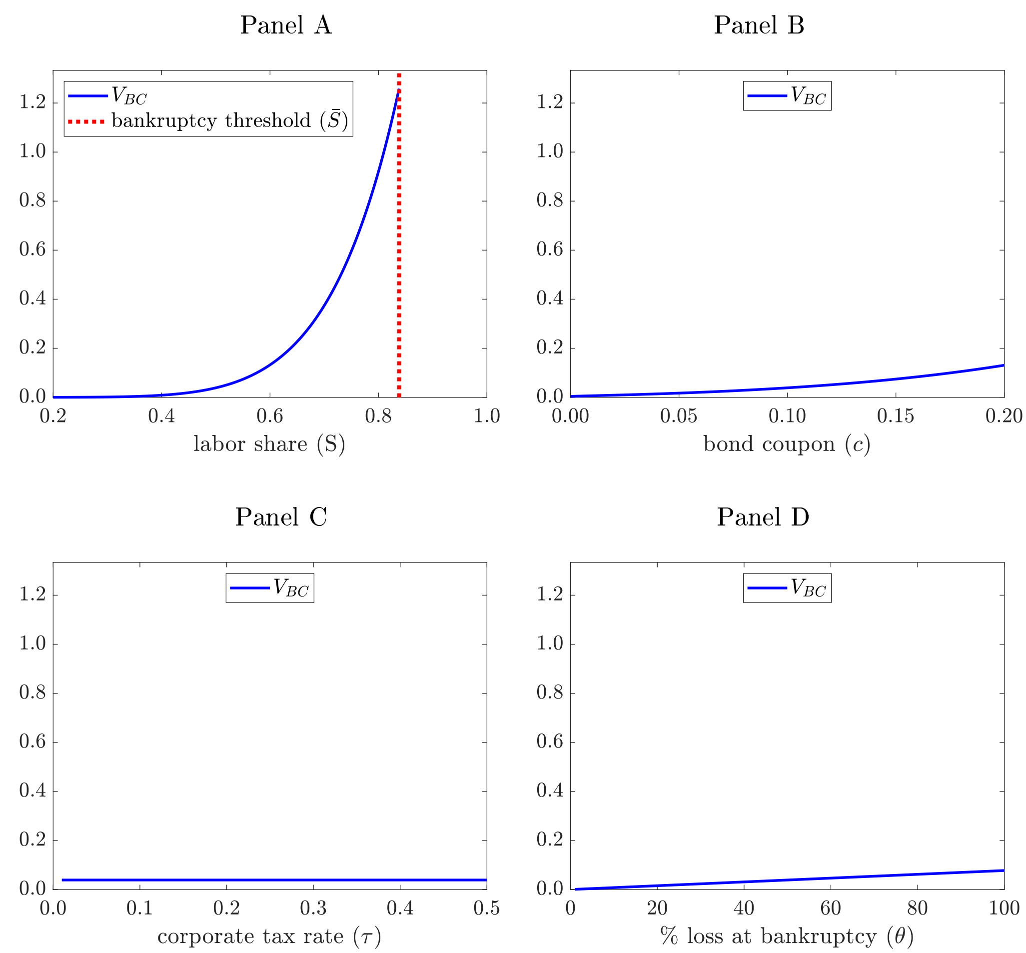
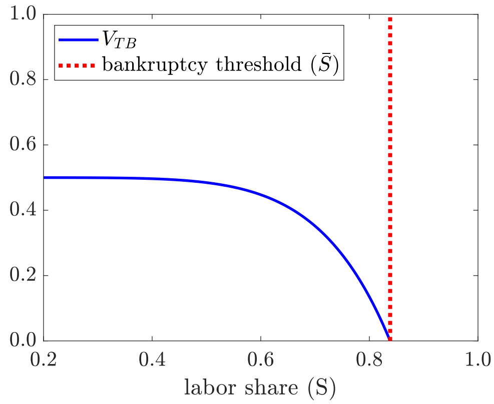


Figure 6

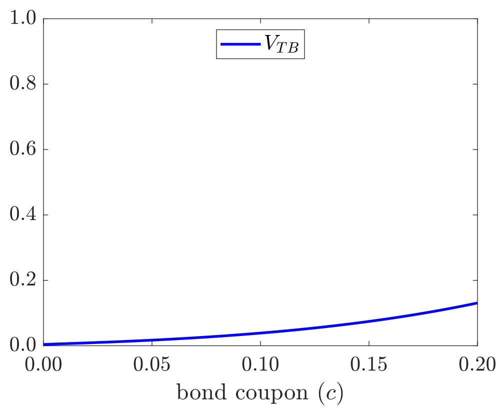
Model: Value of the Expected Tax Benefits of Debt (V_{TB})

The parameters values used in the plots are $K = 1.00$, $S = 0.60$, $r = 0.02$, $\eta = 0.60$, $\alpha = 0.67$, $\rho = -1.50$, $\lambda_{\text{m}} = 0.02$, $\mu_{\text{X}} = 0.03$, $\rho_{\text{X}} = 0.65$, $\sigma_{\text{X}} = 0.07$, $\mu_{\text{W}} = 0.01$, $\rho_{\text{W}} = 0.35$, $\sigma_{\text{W}} = 0.01$, $\tau = 0.50$, $\theta = 0.50$, and $c = 0.10$.

Panel A



Panel B



Panel C

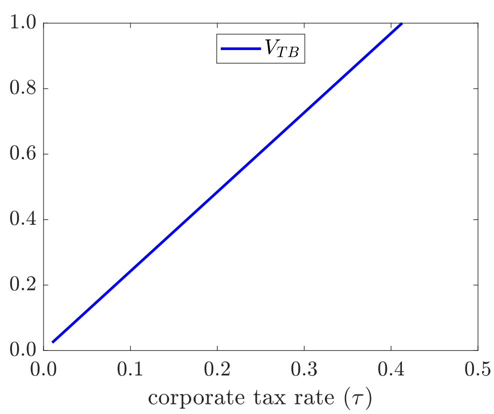


Figure 7
Model: Value of Debt (V_{D})

The parameters values used in the plots are $K = 1.00$, $S = 0.60$, $r = 0.02$, $\eta = 0.60$, $\alpha = 0.67$, $\rho = -1.50$, $\lambda_{\mathrm{m}} = 0.02$, $\mu_{\mathrm{X}} = 0.03$, $\rho_{\mathrm{X}} = 0.65$, $\sigma_{\mathrm{X}} = 0.07$, $\mu_{\mathrm{W}} = 0.01$, $\rho_{\mathrm{W}} = 0.35$, $\sigma_{\mathrm{W}} = 0.01$, $\tau = 0.50$, $\theta = 0.50$, and $c = 0.10$.

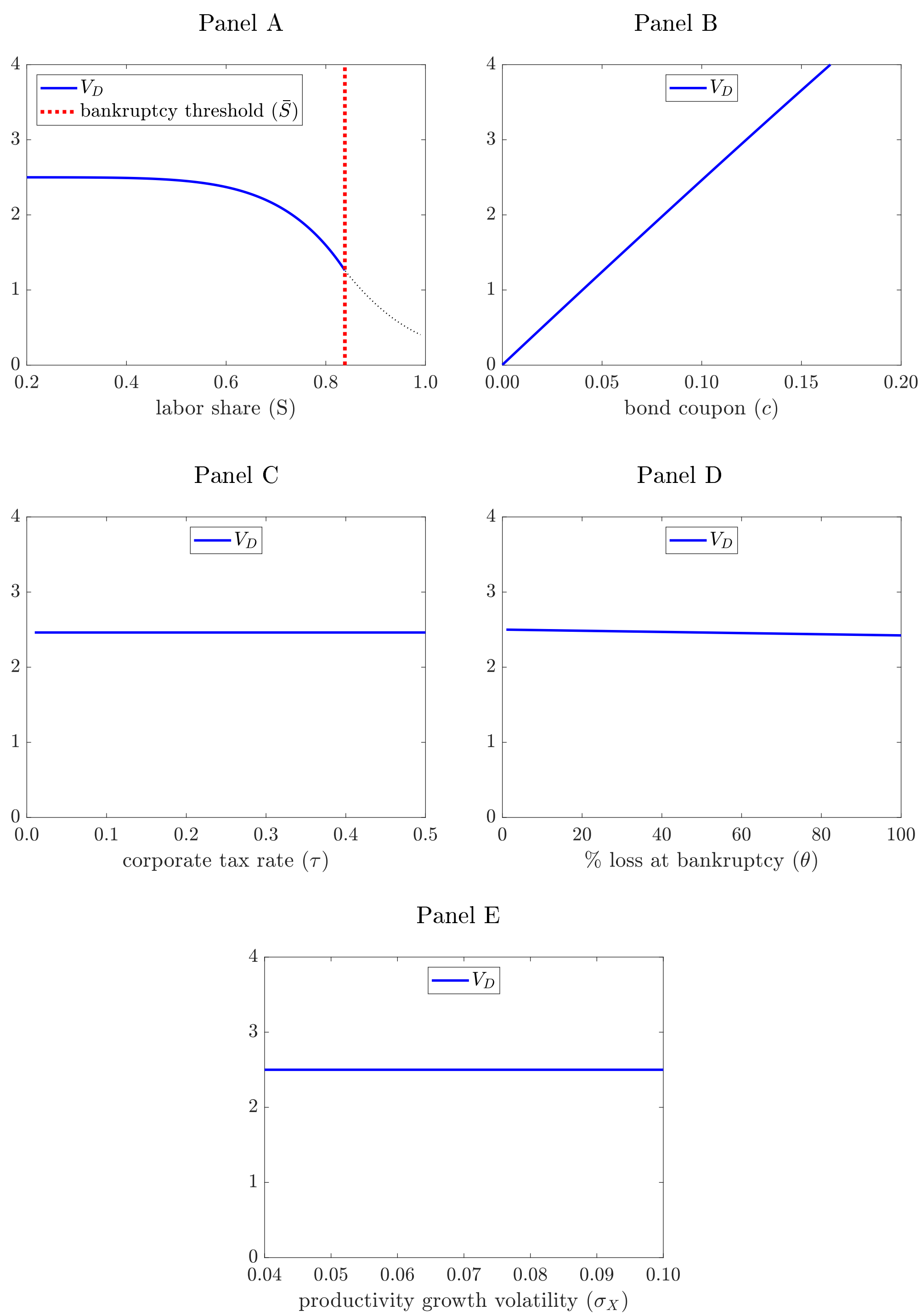


Figure 8
Model: Value of Equity (V_E)

The parameters values used in the plots are $K = 1.00$, $S = 0.60$, $r = 0.02$, $\eta = 0.60$, $\alpha = 0.67$, $\rho = -1.50$, $\lambda_m = 0.02$, $\mu_X = 0.03$, $\rho_X = 0.65$, $\sigma_X = 0.07$, $\mu_W = 0.01$, $\rho_W = 0.35$, $\sigma_W = 0.01$, $\tau = 0.50$, $\theta = 0.50$, and $c = 0.10$.

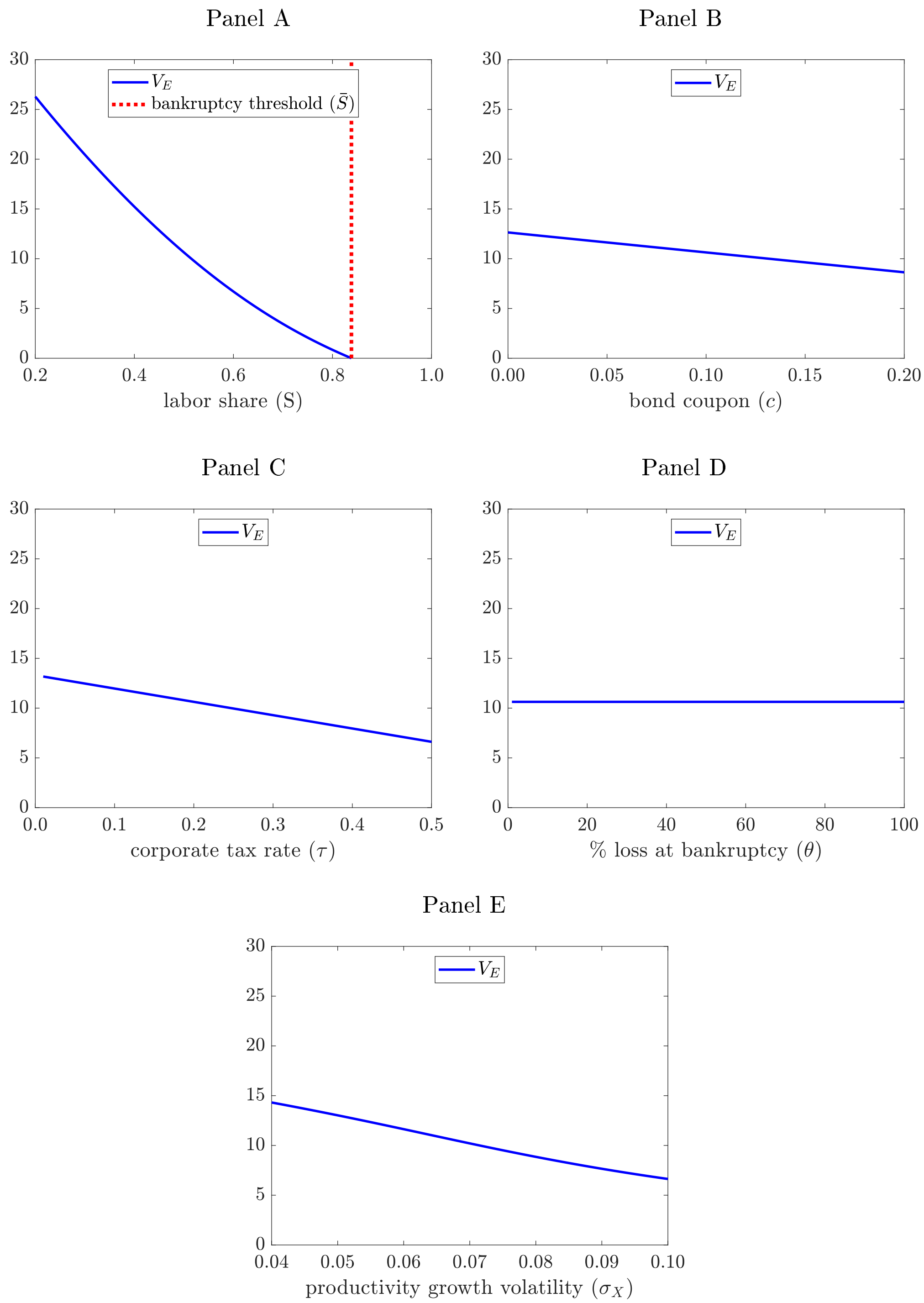


Figure 9

Model: Financial Leverage Ratio (ℓ)

The parameters values used in the plots are $K = 1.00$, $r = 0.01$, $\eta = 0.80$, $\alpha = 0.50$, $\rho = -1.50$, $\lambda_{\mathrm{m}} = 0.01$, $\mu_{\mathrm{X}} = 0.01$, $\rho_{\mathrm{X}} = 0.50$, $\sigma_{\mathrm{X}} = 0.10$, $\mu_{\mathrm{W}} = 0.00$, $\rho_{\mathrm{W}} = 0.50$, $\sigma_{\mathrm{W}} = 0.01$, $\tau = 0.23$, and $\theta = 0.77$.

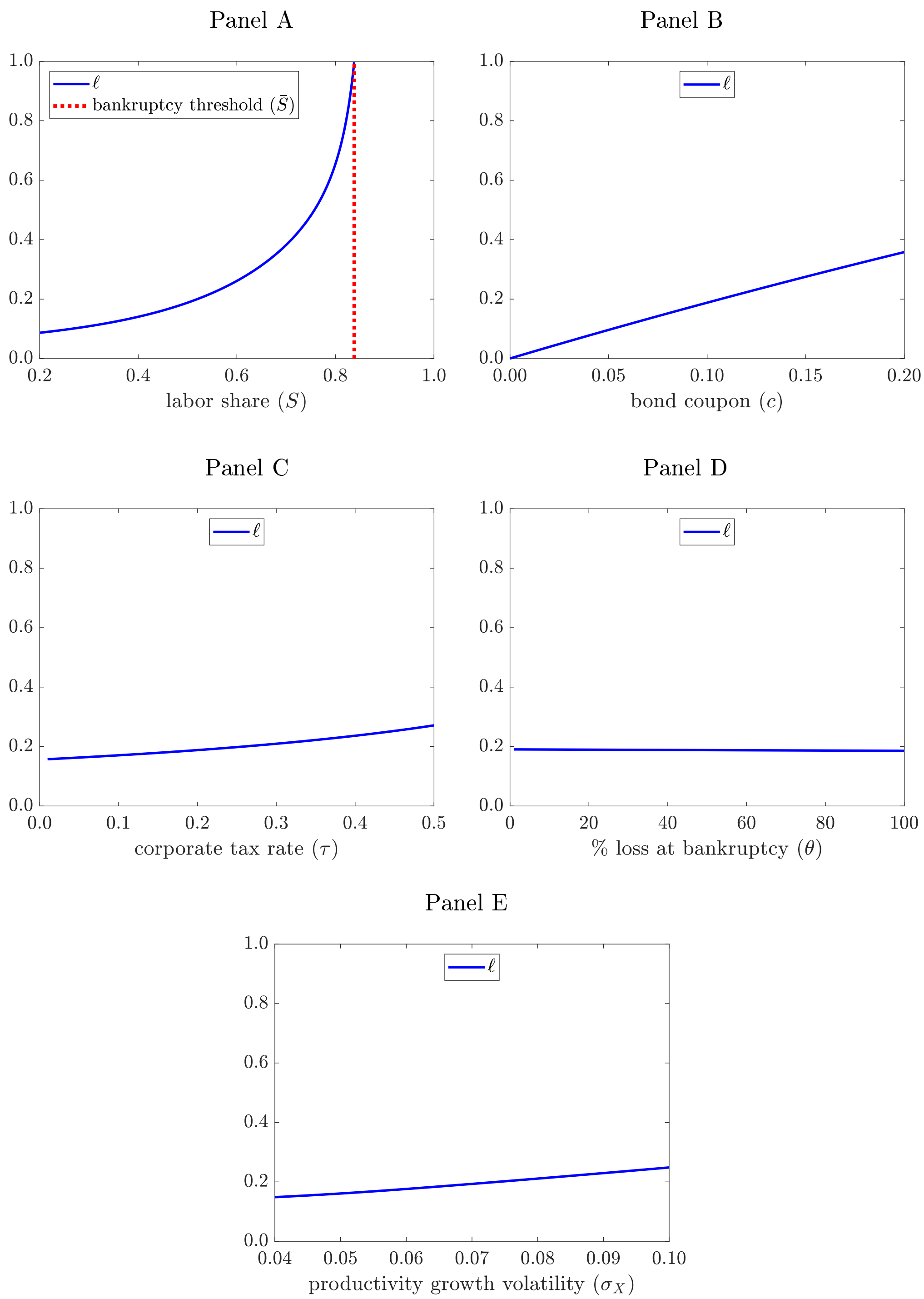


Figure 10
Model: Bond Issuance Decision and Optimal Coupon Rate (c^*)

The shaded area in the plots below indicates the region with no bond issuance ($I^* = \text{sign}[V_{\text{TB}}[s_0, c^*] - V_{\text{BC}}[s_0, c^*]] = -1$). The parameters values used in the plots are $K = 1.00$, $r = 0.01$, $\eta = 0.80$, $\alpha = 0.50$, $\rho = -1.50$, $\lambda_{\text{m}} = 0.01$, $\mu_{\text{X}} = 0.01$, $\rho_{\text{X}} = 0.50$, $\sigma_{\text{X}} = 0.10$, $\mu_{\text{W}} = 0.00$, $\rho_{\text{W}} = 0.50$, $\sigma_{\text{W}} = 0.01$, $\tau = 0.23$, and $\theta = 0.77$.

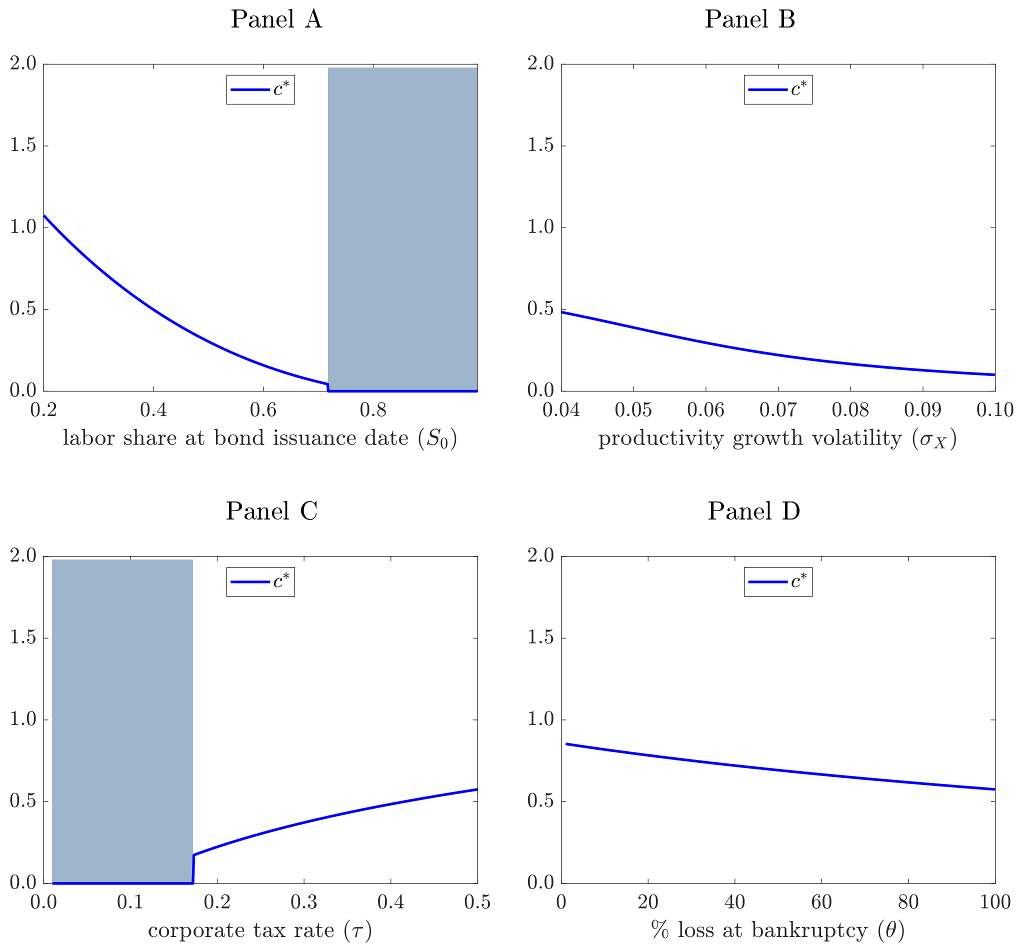


Figure 11
Model: Bond Issuance Decision and Optimal Financial Leverage Ratio (ℓ^*)
The shaded area in the plots below indicates the region with no bond issuance ($I^* = \text{sign}[V_{\text{TB}}[s_0, c^*] - V_{\text{BC}}[s_0, c^*]] = -1$). The parameters values used in the plots are $K = 1.00$, $r = 0.01$, $\eta = 0.80$, $\alpha = 0.50$, $\rho = -1.50$, $\lambda_{\text{m}} = 0.01$, $\mu_{\text{X}} = 0.01$, $\rho_{\text{X}} = 0.50$, $\sigma_{\text{X}} = 0.10$, $\mu_{\text{W}} = 0.00$, $\rho_{\text{W}} = 0.50$, $\sigma_{\text{W}} = 0.01$, $\tau = 0.23$, and $\theta = 0.77$.

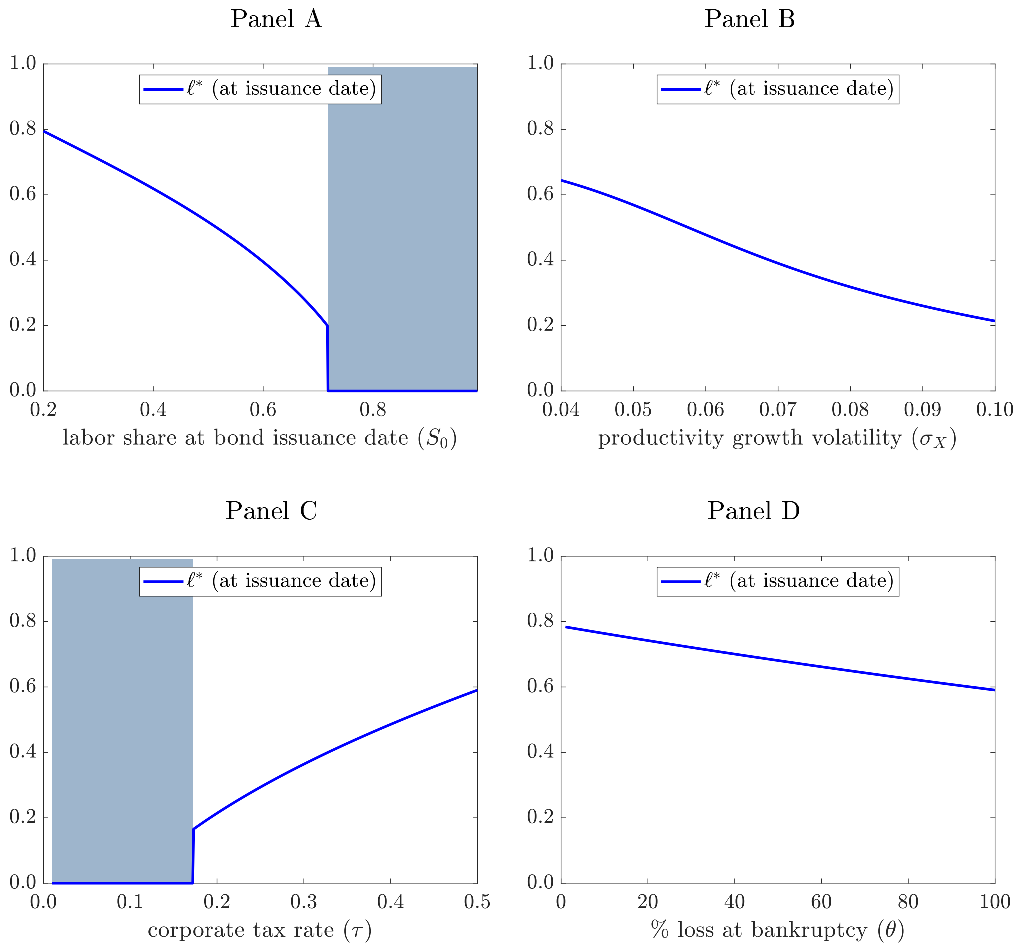


Table 1
Model: Univariate Comparative Statics

The table below reports estimates of portfolio of firms sorted on lagged financial leverage ℓ and portfolios of firms sorted on lagged labor share S using simulated data from the model. The simulated data is based on a synthetic panel of 1,000,000 firms over 6 years. Debt is issued at the end of year $t = 1$, portfolios are formed at year $t = 5$, and one-year asset, bond, and equity returns are computed at year $t = 6$. The parameters values used in the model simulation used in the construction of the table are $K = 1.00$, $r = 0.01$, $\eta = 0.80$, $\alpha = 0.50$, $\rho = -1.50$, $\lambda_{\mathrm{m}} = 0.01$, $\mu_{\mathrm{X}} = 0.01$, $\rho_{\mathrm{X}} = 0.50$, $\sigma_{\mathrm{X}} = 0.10$, $\mu_{\mathrm{W}} = 0.00$, $\rho_{\mathrm{W}} = 0.50$, $\sigma_{\mathrm{W}} = 0.01$, $\tau = 0.23$, and $\theta = 0.77$.

portfolio	Portfolio					
weights	L	2	3	4	H	H-L
Panel A: Portfolios sorted on labor share (S)						
Asset Returns (%)						
equal	6.20	7.25	8.19	9.35	11.40	5.20
value	6.16	7.23	8.17	9.32	11.32	5.16
Bond Returns (%)						
equal	4.10	4.57	4.88	4.99	4.45	0.35
value	4.13	4.72	5.24	5.83	6.95	2.83
Equity Returns (%)						
equal	7.15	8.32	9.35	10.57	12.63	5.48
value	7.15	8.37	9.42	10.68	12.74	5.59
Panel B: Portfolios sorted on financial leverage (ℓ)						
Asset Returns (%)						
equal	10.15	8.00	7.92	7.92	8.40	-1.76
value	9.96	7.81	7.68	7.63	8.03	-1.93
Bond Returns (%)						
equal	2.38	4.80	4.97	5.13	5.73	3.35
value	3.86	4.64	4.76	4.87	5.38	1.52
Equity Returns (%)						
equal	10.43	8.91	9.07	9.30	10.30	-0.13
value	10.29	8.75	8.85	9.02	9.95	-0.34

Table 2
Model: Multivariate Comparative Statics

The table below reports estimates of portfolio of firms sorted on lagged financial leverage ℓ controlling for the level of labor share S using simulated data from the model. The simulated data is based on a synthetic panel of 1,000,000 firms over 6 years. Debt is issued at the end of year $t = 1$, portfolios are formed at year $t = 5$, and one-year asset, bond, and equity returns are computed at year $t = 6$.The parameters values used in the model simulation used in the construction of the table are $K = 1.00$, $r = 0.01$, $\eta = 0.80$, $\alpha = 0.50$, $\rho = -1.50$, $\lambda_{\mathrm{m}} = 0.01$, $\mu_{\mathrm{x}} = 0.01$, $\rho_{\mathrm{x}} = 0.50$, $\sigma_{\mathrm{x}} = 0.10$, $\mu_{\mathrm{w}} = 0.00$, $\rho_{\mathrm{w}} = 0.50$, $\sigma_{\mathrm{w}} = 0.01$, $\tau = 0.23$, and $\theta = 0.77$.

labor share	Portfolios sorted on financial leverage (ℓ)					
(S) tercile	L	2	3	4	H	H-L
			Panel A: Asset Returns (%)			
			Equal-weighted returns			
first	6.74	6.61	6.55	6.46	6.47	-0.27
second	8.30	8.22	8.11	8.08	8.15	-0.15
third	11.10	11.04	10.33	10.19	10.82	-0.28
			Value-weighted returns			
first	6.70	6.56	6.49	6.40	6.42	-0.27
second	8.28	8.20	8.08	8.06	8.14	-0.14
third	10.91	11.04	10.22	10.11	10.71	-0.20
			Panel B: Bond Returns (%)			
			Equal-weighted returns			
first	3.98	4.23	4.29	4.34	4.50	0.52
second	3.44	4.97	5.09	5.24	5.53	2.09
third	0.72	3.21	5.86	6.30	7.28	6.56
			Value-weighted returns			
first	4.09	4.19	4.24	4.29	4.47	0.38
second	4.49	4.95	5.07	5.22	5.54	1.06
third	1.68	3.94	5.85	6.24	7.20	5.52
			Panel C: Stock Returns (%)			
			Equal-weighted returns			
first	7.35	7.47	7.54	7.58	7.85	0.50
second	8.70	9.19	9.28	9.48	9.95	1.25
third	11.22	11.45	11.63	11.96	13.40	2.19
			Value-weighted returns			
first	7.33	7.43	7.49	7.53	7.82	0.49
second	8.70	9.18	9.26	9.46	9.96	1.26
third	11.03	11.45	11.54	11.89	13.33	2.29

Table 3
Summary Statistics

This table reports sample summary statistics. The sample includes non-financial firms with asset return data available from 1976 through 2011. We report time-series average of median characteristics of eight issuer-level rating buckets (Panel A), and of tercile portfolios sorted either on lagged leverage or labor share (Panel B). LS is ratio of labor expenses over the sum of labor expenses, operating profits, and the change in inventories of final goods. For firms missing labor expenses, we proxy them by the product of the number of employees in the firm and the average wage in the industry. $BLev$ is book leverage, and is defined as the ratio of book value of debt over the book value of assets. $MLev$ is market leverage, and is defined as the ratio of book value of debt over the sum of book value of debt and market value of equity. $LogAssets$ is the logarithm of the book value of assets. $LogSize$ is the logarithm of market value of equity. B/M is the shareholders' book value of equity divided by the market value of equity. E/P is the earnings to price ratio. $EMP/PPENT$ is the number of employees per unit of plant, property, and equipment.

Sample		LS	BLev	MLev	OBLev	OMLev	Log Assets	Log Size	B/M	E/P	EMP/ PPENT	Obs
Panel A: Average Median Firm Characteristics Sorted on Ratings												
AAA		0.43	0.15	0.08	−0.10	−0.18	10.40	10.94	0.36	0.06	2.24	216
AA		0.51	0.25	0.17	0.00	−0.10	9.17	9.11	0.45	0.07	2.57	924
A		0.54	0.27	0.23	0.03	−0.02	8.61	8.52	0.55	0.07	2.78	3456
BBB		0.57	0.31	0.31	0.07	0.06	8.40	8.00	0.63	0.07	2.70	4126
BB		0.66	0.37	0.39	0.14	0.16	7.51	7.01	0.65	0.06	2.97	2686
B		0.73	0.47	0.56	0.25	0.32	6.73	5.92	0.74	0.05	2.88	1490
CCC		0.73	0.54	0.82	0.30	0.56	6.59	4.48	0.75	−0.05	2.61	101
Unrated		0.67	0.00	0.00	−0.18	−0.20	5.48	5.73	0.65	0.06	3.78	10582
Panel B: Average Median Portfolio Characteristics Sorted on Operating/Financial Leverage Terciles												
All Firms		0.63	0.23	0.24	0.00	−0.03	7.31	6.85	0.73	0.08	3.39	672
BLev	First	0.68	0.00	0.00	−0.21	−0.24	4.75	5.16	0.62	0.07	4.06	225
	Second	0.64	0.24	0.25	0.00	−0.02	8.04	7.73	0.71	0.08	3.21	223
	Third	0.54	0.42	0.51	0.18	0.22	7.72	6.98	0.85	0.08	2.38	224
MLev	First	0.68	0.00	0.00	−0.20	−0.24	4.74	5.19	0.56	0.06	4.04	225
	Second	0.63	0.25	0.24	0.01	−0.03	8.00	7.82	0.61	0.08	3.21	223
	Third	0.56	0.41	0.53	0.16	0.25	7.85	6.83	1.02	0.09	2.40	224
LS	First	0.33	0.30	0.32	0.03	0.01	7.94	7.37	0.77	0.09	1.56	224
	Second	0.63	0.22	0.20	−0.01	−0.06	7.39	7.09	0.63	0.08	3.38	224
	Third	0.83	0.18	0.18	−0.02	−0.05	6.36	5.87	0.79	0.07	4.03	224

Table 4
Validating the Standard Capital Structure Theory: Asset Risk and Financial Leverage

The table provides the tradeoff between asset risk and leverage. Panel A reports results from the Fama-MacBeth regressions of leverage on asset risk variables lagged by one year. The dependent variables are measures of leverage ($BLev$ and $MLev$). We consider three variables for asset risk proxies: $Asset\ Vol.$ is the standard deviation of asset returns over next year; $Asset\ Beta$ is estimated by regressing firm-level asset returns on the market excess returns; $Cash\ Vol.$ is the standard deviation of operating income to assets ratio over next year. All independent variables are standardized so that the cross-sectional standard deviation is one in every year. Panel B reports average leverage of quintile portfolios sorted on lagged asset risk variables. We form value-weighted portfolios using market value of firm's assets. The sample period is from 1976 through 2011. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively. Newey-West t-statistics estimated with five lags are shown in parentheses.

Panel A: Fama-MacBeth Regressions of Financial Leverage on Asset Risk

	BLev				MLev			
Asset Vol.	-0.091***			-0.094***	-0.122***			-0.126***
	(-16.35)			(-14.65)	(-18.14)			(-16.30)
Asset Beta		-0.042***		0.007		-0.061***		0.006
		(-13.02)		(1.06)		(-8.90)		(0.78)
Cash Vol.			-0.042***	-0.013***			-0.055***	-0.016***
			(-10.58)	(-4.52)			(-8.26)	(-4.60)
R^2	0.247	0.060	0.065	0.285	0.261	0.074	0.064	0.290
Obs	22452	22452	20139	20139	22452	22452	20139	20139

Panel B: Average Financial Leverage of Firms Sorted on Asset Risk

	BLev Quintiles						MLev Quintiles					
	L	2	3	4	H	H-L	L	2	3	4	H	H-L
	Asset Vol.						Asset Vol.					
EW	0.387	0.311	0.264	0.225	0.119	-0.268***	0.505	0.380	0.303	0.243	0.120	-0.385***
	(33.80)	(31.28)	(30.03)	(23.57)	(14.39)	(-16.91)	(25.36)	(17.47)	(19.64)	(25.03)	(12.74)	(-18.15)
VW	0.429	0.268	0.238	0.220	0.171	-0.258***	0.580	0.294	0.235	0.200	0.154	-0.425***
	(11.75)	(15.50)	(12.49)	(15.14)	(16.33)	(-7.39)	(13.54)	(11.91)	(12.39)	(12.60)	(9.17)	(-8.53)
	Asset Beta						Asset Beta					
EW	0.259	0.302	0.268	0.228	0.149	-0.110***	0.320	0.378	0.313	0.257	0.154	-0.165***
	(23.86)	(34.18)	(27.11)	(23.14)	(22.38)	(-10.31)	(12.23)	(18.48)	(24.86)	(23.70)	(16.19)	(-7.56)
VW	0.366	0.334	0.275	0.236	0.194	-0.172***	0.456	0.409	0.307	0.242	0.179	-0.276***
	(14.50)	(11.62)	(11.52)	(12.84)	(16.86)	(-8.10)	(15.36)	(16.04)	(13.39)	(13.84)	(12.06)	(-9.65)
	Cash Vol.						Cash Vol.					
EW	0.252	0.278	0.257	0.226	0.175	-0.077***	0.306	0.329	0.307	0.260	0.195	-0.111***
	(33.25)	(37.60)	(29.60)	(28.34)	(18.36)	(-8.88)	(36.11)	(16.84)	(14.59)	(13.78)	(16.02)	(-8.70)
VW	0.340	0.275	0.273	0.251	0.220	-0.120***	0.429	0.307	0.297	0.252	0.220	-0.209***
	(9.97)	(15.13)	(14.61)	(16.95)	(13.64)	(-4.70)	(9.32)	(15.93)	(12.40)	(9.82)	(10.67)	(-3.63)

Table 5
Validating the Standard Capital Structure Theory: Returns and Financial Leverage

The table provides relation between security excess returns and leverage. Panel A reports results from the Fama-MacBeth regressions of annualized excess returns on lagged leverage. The dependent variables are firm-level asset, bond, and equity returns. Asset returns are obtained by value-weighting equity, bond, and loan returns for each firm; bond returns are from the Lehman Brothers Fixed Income database and Reuter's EJV databases; equity returns are from CRSP. The explanatory variables are book and market leverages ($BLev$ and $MLev$), which are standardized in each year. Panel B reports average annualized excess returns of quintile portfolios sorted on lagged leverage. EW and VW denote equal- and value-weighted portfolios, respectively. The sample period is from 1976 through 2011. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively. Newey-West t-statistics estimated with five lags are shown in parentheses.

Panel A: Fama-MacBeth Regressions of Returns on Financial Leverage

	Asset Return		Bond Return		Equity Return	
BLev	-0.026***		0.008**		-0.012*	
	(-4.02)		(2.65)		(-1.97)	
MLev		-0.021***		0.012***		-0.001
		(-3.43)		(2.99)		(-0.11)
R^2	0.016	0.013	0.024	0.050	0.014	0.017
Obs	23531	23531	16934	16934	23531	23531

Panel B: Average Returns of Firms Sorted on Financial Leverage

	BLev Quintiles						MLev Quintiles					
	L	2	3	4	H	H-L	L	2	3	4	H	H-L
	Asset Return						Asset Return					
EW	0.117	0.064	0.070	0.051	0.048	-0.070***	0.111	0.063	0.066	0.062	0.056	-0.056***
	(7.24)	(6.51)	(5.97)	(5.74)	(3.83)	(-4.61)	(6.61)	(5.98)	(5.84)	(5.60)	(4.53)	(-3.65)
VW	0.060	0.058	0.057	0.032	0.031	-0.029***	0.069	0.046	0.058	0.050	0.035	-0.034**
	(3.78)	(3.73)	(4.12)	(2.73)	(3.56)	(-3.08)	(4.90)	(2.24)	(6.05)	(4.84)	(3.41)	(-2.63)
	Bond Return						Bond Return					
EW	0.037	0.040	0.041	0.045	0.058	0.020**	0.032	0.035	0.040	0.048	0.064	0.032***
	(2.94)	(2.90)	(2.96)	(3.49)	(3.27)	(2.45)	(2.75)	(2.86)	(2.72)	(3.32)	(3.44)	(2.82)
VW	0.033	0.034	0.035	0.038	0.041	0.008**	0.032	0.035	0.039	0.043	0.046	0.013**
	(2.77)	(2.69)	(2.72)	(2.99)	(3.23)	(2.29)	(2.73)	(2.68)	(2.66)	(3.31)	(3.77)	(2.49)
	Equity Return						Equity Return					
EW	0.121	0.083	0.101	0.078	0.087	-0.033*	0.113	0.074	0.086	0.090	0.116	0.003
	(7.28)	(7.02)	(6.61)	(5.80)	(3.87)	(-1.89)	(6.58)	(5.92)	(6.22)	(5.99)	(4.64)	(0.17)
VW	0.068	0.075	0.092	0.039	0.068	0.000	0.049	0.083	0.075	0.072	0.082	0.033
	(3.77)	(3.14)	(3.88)	(1.56)	(1.95)	(0.01)	(2.23)	(4.73)	(5.95)	(4.94)	(1.97)	(0.92)

Table 6
Validation of Labor Share as a Measure of Operating Leverage

The table provides relation between labor share and asset risk/security excess returns. Panel A reports results from the Fama-MacBeth regressions of asset risk proxies (Asset Volatility, Asset Beta, and Cash Flow Volatility) on lagged LS. LS is standardized in each year. Panel B reports results from the Fama-MacBeth regressions of annualized security excess returns (asset, bond, and equity) on lagged LS. Panel C reports average asset risk of quintile portfolios sorted on lagged LS. Panel D reports average annualized security excess returns of quintile portfolios sorted on lagged LS. The sample period is from 1976 through 2011. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively. Newey-West t-statistics estimated with five lags are shown in parentheses.

Panel A: Fama-MacBeth Regressions of Asset Risk on Labor Share

	Asset Vol.	Asset Beta	Cash Vol.
LS	0.010***	0.088***	0.001***
	(10.47)	(8.31)	(3.10)
R^2	0.045	0.013	0.019
Obs	23531	23531	20703

Panel B: Fama-MacBeth Regressions of Returns on Labor Share

	Asset Return	Bond Return	Equity Return
LS	0.014***	0.004**	0.014***
	(4.08)	(2.17)	(2.83)
R^2	0.010	0.017	0.009
Obs	23531	16934	23531

Panel C: Average Asset Risk of Firms Sorted on Labor Share

	L	2	3	4	H	H-L
			Asset Vol.			
EW	0.061	0.070	0.077	0.079	0.091	0.030***
	(13.38)	(16.07)	(17.97)	(17.02)	(18.80)	(10.78)
VW	0.042	0.050	0.052	0.060	0.065	0.023***
	(9.72)	(13.94)	(13.21)	(15.69)	(13.82)	(5.06)
			Asset Beta			
EW	0.574	0.731	0.815	0.839	0.826	0.252***
	(8.70)	(14.29)	(22.85)	(16.88)	(13.11)	(9.02)
VW	0.482	0.583	0.678	0.779	0.789	0.306***
	(11.98)	(32.43)	(32.64)	(27.40)	(15.75)	(4.39)
			Cash Vol.			
EW	0.012	0.012	0.012	0.011	0.015	0.003***
	(14.88)	(23.97)	(23.54)	(31.57)	(29.29)	(2.90)
VW	0.008	0.008	0.008	0.009	0.012	0.004***
	(18.10)	(15.79)	(9.63)	(10.49)	(32.03)	(9.88)

Panel D: Average Returns of Firms Sorted on Labor Share

	L	2	3	4	H	H-L
			Asset Return			
EW	0.067	0.060	0.082	0.075	0.107	0.040***
	(5.10)	(5.99)	(5.87)	(5.46)	(8.21)	(3.35)
VW	0.038	0.047	0.053	0.044	0.067	0.029***
	(3.61)	(3.73)	(3.66)	(2.93)	(6.14)	(3.02)
			Bond Return			
EW	0.042	0.040	0.042	0.044	0.053	0.011**
	(2.88)	(2.93)	(3.00)	(3.27)	(3.61)	(2.13)
VW	0.032	0.041	0.029	0.044	0.048	0.016***
	(2.46)	(2.76)	(2.63)	(2.87)	(3.61)	(2.87)
			Equity Return			
EW	0.089	0.078	0.102	0.091	0.130	0.041**
	(4.97)	(5.83)	(6.14)	(5.33)	(7.41)	(2.36)
VW	0.068	0.072	0.053	0.068	0.096	0.027**
	(2.26)	(4.01)	(1.41)	(2.53)	(5.54)	(2.17)

Table 7
Tradeoff between Operating Leverage and Financial Leverage

The table provides the tradeoff between labor share and leverage. Panel A reports the correlation coefficients between LS and two measures of leverage ($BLev$ and $MLev$). Panel B reports the time-series average of median leverage of quintile portfolios sorted on LS. Panel C reports results from the Fama-MacBeth regressions of leverage on LS. LS is standardized in each year. The sample period is from 1976 through 2011. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively. Newey-West t-statistics estimated with five lags are shown in parentheses.

Panel A: Correlation Martrix Between Labor Share and Leverages

	LS	BLev	MLev
LS	1		
BLev	-0.188	1	
MLev	-0.149	0.882	1

Panel B: Average Leverage of Firms Sorted on Labor Share

	LS Portfolio				
	L	2	3	4	H
BLev	0.329	0.261	0.221	0.218	0.163
MLev	0.378	0.256	0.196	0.212	0.183

Panel C: Fama-MacBeth Regressions of Leverage on Labor Share

	BLev	MLev
LS	-0.037***	-0.036***
	(-8.93)	(-4.80)
R^2	0.043	0.032
Obs	23519	23519

Table 8
Tradeoff between Operating Leverage and Financial Leverage: Implication for Returns

The table provides the interaction effects of labor share and leverage on security excess returns. Panel A reports results from the Fama-MacBeth regressions of annualized security excess returns (asset, bond, and equity) on lagged LS, leverage (Lev), and interaction between LS and leverage (LS*Lev). LS and leverage are standardized in each year. We consider two measures of leverage ($BLev$ and $MLev$). Panel B reports the average annualized security excess returns of portfolios double sorted on lagged LS and leverage. We first sort firms into tercile portfolios using lagged LS. Within each LS tercile, firms are grouped into tercile portfolios based on lagged leverage measures. The sample period is from 1976 through 2011. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively. Newey-West t-statistics estimated with five lags are shown in parentheses.

Panel A: Fama-MacBeth Regressions of Returns on Labor Share and Book Leverage

	Asset Return				Bond Return				Equity Return			
LS	0.014***		0.009***	0.010***	0.004**		0.004**	0.004**	0.014***		0.012**	0.012**
	(4.08)		(2.84)	(2.93)	(2.17)		(2.52)	(2.43)	(2.83)		(2.30)	(2.45)
Lev		-0.026***	-0.025***	-0.025***		0.008**	0.009***	0.009**		-0.012*	-0.010	-0.010
		(-4.02)	(-3.72)	(-3.82)		(2.65)	(2.86)	(2.71)		(-1.97)	(-1.61)	(-1.62)
LS*Lev				-0.007*				0.005***				-0.004
				(-1.94)				(2.73)				(-0.84)
R^2	0.010	0.016	0.024	0.029	0.017	0.024	0.044	0.055	0.009	0.014	0.023	0.028
Obs	23531	23531	23531	23531	16934	16934	16934	16934	23531	23531	23531	23531

Panel B: Fama-MacBeth Regressions of Returns on Labor Share and Market Leverage

	Asset Return				Bond Return				Equity Return			
LS	0.014***		0.011***	0.012***	0.004**		0.003**	0.003**	0.014***		0.013**	0.013**
	(4.08)		(3.24)	(3.35)	(2.17)		(2.31)	(2.33)	(2.83)		(2.47)	(2.61)
Lev		-0.021***	-0.020***	-0.019***		0.012***	0.013***	0.012***		-0.001	0.001	0.002
		(-3.43)	(-3.16)	(-2.91)		(2.99)	(3.15)	(3.11)		(-0.11)	(0.17)	(0.35)
LS*Lev				-0.006*				0.004**				-0.003
				(-2.00)				(2.10)				(-0.64)
R^2	0.010	0.013	0.022	0.028	0.017	0.050	0.066	0.078	0.009	0.017	0.027	0.034
Obs	23531	23531	23531	23531	16934	16934	16934	16934	23531	23531	23531	23531

Table 8
Tradeoff between Operating Leverage and Financial Leverage: Implication for Returns (Cont'd)

Panel C: Average Returns of Firms Sorted on Labor Share and Financial Leverage

		BLev Terciles				MLev Terciles			
	LS Terciles	First	Second	Third	Third-First	First	Second	Third	Third-First
					Asset Return				
	First	0.090	0.059	0.045	-0.044**	0.086	0.054	0.054	-0.031*
		(5.92)	(5.67)	(3.40)	(-2.60)	(5.37)	(4.10)	(4.70)	(-1.88)
EW	Second	0.102	0.071	0.050	-0.052***	0.098	0.067	0.057	-0.041**
		(5.01)	(5.99)	(4.88)	(-3.15)	(4.38)	(6.33)	(5.02)	(-2.03)
	Third	0.158	0.077	0.060	-0.098***	0.155	0.074	0.065	-0.089***
		(7.76)	(6.74)	(4.76)	(-5.18)	(7.53)	(6.94)	(4.71)	(-4.71)
	First	0.061	0.043	0.026	-0.034**	0.055	0.048	0.034	-0.021**
		(3.62)	(3.04)	(3.21)	(-2.10)	(2.90)	(4.20)	(3.69)	(-2.18)
VW	Second	0.077	0.062	0.031	-0.045**	0.079	0.066	0.036	-0.043*
		(3.53)	(4.60)	(2.03)	(-2.30)	(2.99)	(4.42)	(2.50)	(-1.87)
	Third	0.116	0.064	0.055	-0.062**	0.100	0.062	0.060	-0.041**
		(4.42)	(4.58)	(4.35)	(-2.29)	(3.50)	(5.16)	(4.53)	(-2.36)
					Bond Return				
	First	0.038	0.042	0.050	0.012***	0.032	0.043	0.053	0.021***
		(2.71)	(2.98)	(3.06)	(3.02)	(2.51)	(2.95)	(3.14)	(2.89)
EW	Second	0.038	0.040	0.046	0.008*	0.032	0.039	0.053	0.021**
		(3.09)	(2.73)	(3.22)	(1.77)	(2.81)	(2.78)	(3.14)	(2.17)
	Third	0.042	0.043	0.070	0.028**	0.036	0.042	0.076	0.040***
		(3.37)	(2.87)	(3.81)	(2.64)	(3.21)	(2.98)	(3.66)	(2.85)
	First	0.033	0.037	0.039	0.006**	0.032	0.039	0.040	0.008**
		(2.69)	(2.82)	(2.97)	(2.12)	(2.62)	(2.91)	(3.01)	(2.29)
VW	Second	0.032	0.034	0.039	0.007*	0.031	0.039	0.042	0.010***
		(2.72)	(2.52)	(2.94)	(1.70)	(2.64)	(2.79)	(2.98)	(2.83)
	Third	0.042	0.039	0.055	0.013***	0.040	0.040	0.073	0.032**
		(3.21)	(2.98)	(4.19)	(2.80)	(3.28)	(2.94)	(3.88)	(2.61)
					Equity Return				
	First	0.096	0.082	0.074	-0.022	0.104	0.061	0.089	-0.015
		(5.77)	(6.23)	(3.50)	(-1.07)	(4.48)	(3.73)	(5.56)	(-0.70)
EW	Second	0.105	0.090	0.085	-0.020	0.097	0.085	0.099	0.002
		(5.10)	(6.11)	(4.88)	(-1.06)	(4.16)	(7.33)	(5.78)	(0.11)
	Third	0.159	0.102	0.102	-0.057***	0.143	0.092	0.120	-0.023
		(7.72)	(7.61)	(4.75)	(-2.93)	(6.85)	(7.48)	(4.69)	(-1.50)
	First	0.071	0.068	0.058	-0.013	0.074	0.068	0.087	0.013
		(3.36)	(2.76)	(1.70)	(-0.48)	(3.60)	(4.10)	(2.49)	(0.41)
VW	Second	0.085	0.081	0.044	-0.041	0.060	0.081	0.056	-0.005
		(3.62)	(4.65)	(1.16)	(-1.10)	(2.46)	(4.82)	(1.61)	(-0.13)
	Third	0.117	0.084	0.087	-0.030**	0.116	0.072	0.101	-0.016
		(4.82)	(4.59)	(4.63)	(-2.21)	(3.85)	(6.24)	(4.39)	(-0.42)

Table 9
What Drives Financial Leverage? Fundamental Risk or Labor Leverage

The table report results from the Fama-MacBeth regressions of leverage on lagged asset risk, labor share, and interaction between asset risk and labor share. The dependent variables are measures of leverage ($BLev$ and $MLev$). The explanatory variables are asset risk proxies (Asset Volatility, Asset Beta, and Cash Flow Volatility), and labor share (LS). The sample period is from 1976 through 2011. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively. Newey-West t-statistics estimated with five lags are shown in parentheses.

Panel A: Fama-MacBeth Regressions of Book Leverage on Labor Share and Asset Risk

	Asset Vol.				Asset Beta				Cash Vol.			
LS	-0.034***		-0.017***	-0.016***	-0.034***		-0.030***	-0.029***	-0.034***		-0.033***	-0.033***
	(-8.98)		(-4.98)	(-5.04)	(-8.98)		(-8.80)	(-8.85)	(-8.98)		(-7.79)	(-7.36)
Asset Vol.		-0.091***	-0.088***	-0.091***								
		(-16.35)	(-15.47)	(-16.28)								
LS*Asset Vol.				0.011***								
				(4.15)								
Asset Beta						-0.042***	-0.039***	-0.042***				
						(-13.02)	(-12.57)	(-13.12)				
LS*Asset Beta								0.013***				
								(11.20)				
Cash Vol.										-0.042***	-0.039***	-0.043***
										(-10.58)	(-10.26)	(-9.87)
LS*Cash Vol.												0.008*
												(1.76)
R^2	0.04	0.247	0.26	0.272	0.04	0.06	0.091	0.103	0.04	0.065	0.108	0.118
Obs	22452	22452	22452	22452	22452	22452	22452	22452	20139	20139	20139	20139

Panel B: Fama-MacBeth Regressions of Market Leverage on Labor Share and Asset Risk

	Asset Vol.				Asset Beta				Cash Vol.			
LS	-0.035***		-0.013**	-0.012*	-0.035***		-0.029***	-0.027***	-0.035***		-0.030***	-0.030***
	(-4.89)		(-2.16)	(-1.86)	(-4.89)		(-4.30)	(-4.19)	(-4.89)		(-3.48)	(-3.26)
Asset Vol.		-0.122***	-0.120***	-0.124***								
		(-18.14)	(-16.96)	(-16.07)								
LS*Asset Vol.				0.016***								
				(4.43)								
Asset Beta						-0.061***	-0.058***	-0.062***				
						(-8.90)	(-8.50)	(-8.55)				
LS*Asset Beta								0.017***				
								(9.29)				
Cash Vol.										-0.055***	-0.053***	-0.058***
										(-8.26)	(-7.60)	(-7.33)
LS*Cash Vol.												0.010*
												(1.83)
R^2	0.033	0.261	0.272	0.285	0.033	0.074	0.099	0.109	0.033	0.064	0.103	0.112
Obs	22452	22452	22452	22452	22452	22431	22452	22452	20139	20139	20139	20139