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

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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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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 Data

Our main empirical exercises examine the trade off between labor leverage and financial leverage for three types of contingent claims on firms: assets, equity and bonds. We describe the data sources and how we construct the main variables.

2.1 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.[7] 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

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

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.

2.2 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:

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

where E_t, B_t,and L_t are the market values of equity, bonds, and loans, and R^E_t,R^B_t, and R^L_t 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 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:

$$LS_t = \begin{cases} \frac{XLR_t}{OIBDP_t + XLR_t + \Delta INVFG_{t-1}} & \text{if XLR is non-missing} \\ \frac{LABEX_t}{OIBDP_t + LABEX_t + \Delta INVFG_{t-1}} & \text{if XLR is missing} \end{cases} \tag{2}$$

where XLR is the Compustat item Staff Expense âĂŞ 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 âĂŞFinished 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.

2.3 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 1 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 1 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.

3 Empirical Evidence

3.1 Leverage, Asset Risk, and Expected Returns

3.1.1 Validating the Standard Tradeoff Theory: Financial Leverage and Asset Risk

In Table 2, we investigate the link between asset risk and financial leverage. The standard tradeoff theory of capital structure predicts a negative relation between asset risk and financial leverage, since firms with high asset risk will have high present value of distress, thereby reducing the usage of debt to balance distress costs and tax benefits.

We begin by estimating the following Fama-MacBeth regressions:

$$Leverage_{i,t} = \alpha + \beta_t Asset\ Risk_{i,t-1} + \epsilon_{i,t} \tag{3}$$

As the dependent variable, we consider both book and market leverage. The explanatory variables are several measure of asset risk including asset volatility, asset beta, and cash flow volatility which are lagged by one year.[8]

<< Table 2 here >>

Panel A of Table 2 reports the estimation results. We find a strong negative relationship between leverage and asset risk, as shown by negative coefficients on the measures of asset

[8] Asset volatility is the standard deviation of asset returns over the year. Asset beta is estimated from the regression of excess asset returns on excess market portfolio returns. Cash flow volatility is the standard deviation of quarterly operating income to assets ratio over the year

risk that we consider. The coefficient estimates are highly statistically significant and their economic magnitudes are also sizable. For example, a one-standard-deviation increase in asset volatility, asset beta, and cash flow volatility reduces book leverage by 9.1%, 4.2%, and 4.2%, respectively. In the multiple regressions with all the measures (the last columns of each leverage measure), the effect of asset beta is mostly subsumed by other two measures, suggesting that total risk is more important than systematic risk. We find very similar results when market leverage is used as the dependent variable.

In Panel B of Table 2, we further examine the relationship between asset risk and financial leverage, using quintile portfolios sorted on asset risk measured in previous year. We report both equal- and value-weighted averages of leverage of these portfolios.[9] Similar to Panel A, there is a clear negative relationship between asset risk and financial leverage across these portfolios. For example, the differences in asset volatility between the highest and lowest quintile portfolios are –0.385 and –0.425 for the equal- and value-weighted portfolios, respectively, both of which are highly statistically significant. The overall results show a strong negative link between asset risk and leverage.

3.1.2 Financial Leverage and Expected Returns

The negative between financial leverage and asset risk has a rather non-straightforward implications for expected returns on equity and bonds. There are two offsetting mechanisms through which leverage affects equity and bond returns. On the one hand, financial leverage will have negative effects on equity and bond returns, because high asset risk translates to high asset returns. On the other hand, leverage will also have positive effects on equity and bond returns either through the standard leverage effect or through increased default risk. Our analyses in this section can help explain the empirical relationship between equity and financial leverage, a long standing puzzling question in the literature, as well summarized by

[9] We calculate value-weighted average using the market value of firms' assets of the previous months.

Gomes and Schmid (2010).

To examine the relationships between financial leverage and asset, bond, and equity returns, we estimate the following Fama-MacBeth regressions:

$$Returns_{i,t} = \alpha + \beta_t Leverage_{i,t-1} + \epsilon_{i,t}. \tag{4}$$

Panel A of Table 3 provides the estimation results of Eq. (4). Starting with asset returns, we find that financial leverage negatively predicts asset returns in the cross section, consistent with the asset risk results reported in Table 2. The coefficient estimates show that a one-standard-deviation increase in leverage is associated with –2.6% and –2.1% decrease in asset returns for $BLev$ and $MLev$, respectively, with t-statistics of –4.02 and –3.43.

<< Table 3 here >>

Panel A also shows that the relation between bond return and leverage is significantly positive, as shown by positive on $BLev$ and $MLev$, which are all statistically significant at the 5% level. As discussed, there are two opposing mechanisms through which financial leverage is related to bond returns. Our results suggest that the distress risk effect of leverage dominates the asset risk effect, so that the overall effect of financial leverage on bond returns is positive. These results are somewhat expected, given that distress risk is one of the most important factor in corporate bonds, as documented by many previous studies (e.g., Bali, Bai, and Wen, 2017 JFE)

The results regarding equity returns in Panel A show that financial leverage does not positively predict equity returns. Rather, the relationship tends to be negative; the estimated coefficient on book leverage is negative and also statistically significan at the 10% level. The coefficient estimate on market leverage is also negative, although it is not statsitically significant. These results, although they look puzzling, are actually consistent with the results in Table 2. Firm with high asset risk (or distressed firms) endogenously choose low level of financial leverage, resulting in a flat, or negative, relation between levered returns and financial leverage.

In Panel B of Table 3, we sort firms into quintile portfolios based on leverage to further examine how financial leverage is associated with asset, bond, and equity returns.[10] Overall, we find very similar patterns as in Panel A. High-minus-low return spreads for asset (bond) returns are significantly negative (positive), while those are mostly insignificant for equity returns.

3.1.3 Validation of Labor Share as a Measure of Operating Leverage: Asset Risk and Returns

In Table 4, we examine how labor share is related to asset risk and asset returns in our data. In Table 4 Panel A, we examine the link between asset risk and labor share by employing the following Fama-MacBeth regressions:

$$Y_{i,t} = \alpha + \beta_t LS_{i,t-1} + \epsilon_{i,t} \tag{5}$$

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 4 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

[10] 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.

beta and cash flow volatility as well.

<< Table 4 here >>

This positive association between LS and asset risk, 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.[11] 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.

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

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

In this section, we study the trade off between operating leverage, measured by labor share, and financial leverage. Even though Table 1 already presents a preliminary evidence, we formally test this relation. In Panel A of Table 5, 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 and negative.

<< Table 5 here >>

Having documented that LS a proxy for business risk drives the inverse relation between operational and financial leverage, we investigate the leverage-return association through the lens of LS in Table 6. Specifically, we estimate the following Fama-MacBeth regressions of asset, equity, and bond returns on lagged financial leverage and LS:

$$Returns_{i,t} = \alpha + \beta_{1,t} LS_{i,t-1} + \beta_{2,t} Leverage_{i,t-1} + \beta_{3,t}(LS_{i,t-1} * Leverage_{i,t-1}) + \epsilon_{i,t} \quad (6)$$

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 6 here >>

Panel A of Table 6 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 (6). 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 6 provide supportive evidence of amplification mechanism driven by LS. 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 6, 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.

3.3 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:

$$Leverage_{i,t} = \alpha + \beta_{1,t} LS_{i,t-1} + \beta_{2,t} Asset\ Risk_{i,t-1} + \beta_{3,t}(LS_{i,t-1} * Asset\ Risk_{i,t-1}) + \epsilon_{i,t} \quad (7)$$

LS and asset risk variables are standardized in each year. Panel A of Table 7 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 7 here >>

The results in Panel A of Table 7 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 7, we document the results based on market leverage, which yields same conclusion as in Panel A.

4 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.

4.1 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

$$\frac{d\Lambda_t}{\Lambda_t} = -r dt - \eta dZ_t^{\Lambda}, \tag{8}$$

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

$$\frac{dW_t}{W_t} = \mu_{\mathrm{W}} dt + \sigma_{\mathrm{W}} \rho_{\mathrm{W}} dZ_t^{\Lambda} + \sigma_{\mathrm{W}} \sqrt{1 - \rho_{\mathrm{W}}^2} dZ_t^{\mathrm{W}}, \tag{9}$$

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:

$$Y_t = \left(\alpha(X_t L_t)^{\rho} + (1-\alpha)K^{\rho}\right)^{\frac{1}{\rho}}, \tag{10}$$

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.[12]

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 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

$$\frac{dX_t}{X_t} = \mu_{\mathrm{X}} dt + \sigma_{\mathrm{X}} \rho_{\mathrm{X}} dZ_t^{\Lambda} + \sigma_{\mathrm{X}} \sqrt{1-\rho_{\mathrm{X}}^2} dZ_t^{\mathrm{X}}, \tag{11}$$

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 ex-

[12] 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 (10) 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.

penses, as given by:

$$\Pi_t \equiv Y_t - W_t L_t. \tag{12}$$

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.

4.2 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

$$L_t = \begin{cases} \frac{K}{X_t}\left(\frac{S_t}{1-S_t}\right)^{\frac{1}{\rho}}\left(\frac{1-\alpha}{\alpha}\right)^{\frac{1}{\rho}}, & 0 < S_t < 1, \\ 0, & S_t \geq 1, \end{cases} \tag{13}$$

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

$$\Pi_t = \begin{cases} K\left(1 - S_t\right)^{1-1/\rho}\left(1-\alpha\right)^{\frac{1}{\rho}}, & 0 < S_t < 1, \\ 0, & S_t \geq 1, \end{cases} \tag{14}$$

where

$$S_t \equiv \alpha^{\frac{1}{1-\rho}}\left(\frac{W_t}{X_t}\right)^{\frac{\rho}{\rho-1}}. \tag{15}$$

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* >>

4.3 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

$$V_{\mathrm{U}}[S_t] \equiv \mathrm{E}_t\left[\int_t^{\infty} \frac{\Lambda_s}{\Lambda_t}\Pi_s(1-\tau)ds\right], \tag{16}$$

where $\tau \in [0,1]$ is the corporate tax rate. The solution for the value of the unlevered firm in Equation (16) is given by

$$V_{\mathrm{U}}[S_t] = \frac{(1-\tau)(1-\alpha)^{\frac{1}{\rho}}K}{(\beta_1-\beta_2)c_2}\left(\frac{(\rho-1)S_t^{\beta_1}B_{\frac{\rho-1}{\rho}}^{-\beta_1}[S_t]}{(\beta_1-1)\rho+1} - \frac{(\rho-1)S_t^{\beta_2}B_{\frac{\rho-1}{\rho}}^{-\beta_2}[S_t]}{(\beta_2-1)\rho+1} - \frac{G[-\beta_2]\,G\left[2-\frac{1}{\rho}\right]S_t^{\beta_2}}{G\left[-\beta_2-\frac{1}{\rho}+2\right]} - \frac{(\beta_1-\beta_2)c_2(1-S_t)^{1-\frac{1}{\rho}}}{(\beta_1-1+\frac{1}{\rho})(\beta_2-1+\frac{1}{\rho})}\right), \tag{17}$$

where $\beta_1 \equiv \frac{-c_1-\sqrt{c_1^2-4c_0\cdot c_2}}{2c_2}$, $\beta_2 \equiv \frac{-c_1+\sqrt{c_1^2-4c_0\cdot c_2}}{2c_2}$, $B_b^a[.]$ is the Beta function, and $G[.]$ is the Gamma function, and where

$$c_0 \equiv \mu_{\mathrm{X}} - r - \lambda_{\mathrm{m}} - \eta\cdot\rho_{\mathrm{X}}\cdot\sigma_{\mathrm{X}}, \tag{18a}$$

$$c_1 \equiv \left(\frac{\rho}{1-\rho}\right)\left(\eta(\rho_{\mathrm{W}}\cdot\sigma_{\mathrm{W}}-\rho_{\mathrm{X}}\cdot\sigma_{\mathrm{X}}) + \mu_{\mathrm{X}} - \mu_{\mathrm{W}} - \rho_{\mathrm{X}}\cdot\rho_{\mathrm{W}}\cdot\sigma_{\mathrm{X}}\cdot\sigma_{\mathrm{W}} + \frac{\sigma_{\mathrm{X}}^2+\sigma_{\mathrm{W}}^2}{2}\right), \tag{18b}$$

$$c_2 \equiv \left(\frac{\rho}{1-\rho}\right)^2\left(\frac{\sigma_{\mathrm{W}}^2+\sigma_{\mathrm{X}}^2}{2} - \rho_{\mathrm{W}}\cdot\rho_{\mathrm{X}}\cdot\sigma_{\mathrm{W}}\cdot\sigma_{\mathrm{X}}\right). \tag{18c}$$

See appendix for details.

The solution for the value of the unlevered firm in Equation (17) is 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 >>

4.4 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:

$$\Pi_t^{NI} \equiv (\Pi_t - c)(1 - \tau). \tag{19}$$

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 defined by the condition $\Pi[\bar{S}] - c = 0$ and is given by

$$\bar{S} = 1 - \left(\frac{K}{c}\right)^{\frac{\rho}{1-\rho}} (1 - \alpha)^{\frac{1}{1-\rho}}. \tag{20}$$

Figure 4 illustrates the determinants of the default event. Panel A shows that net income Π^{NI} defined in Equation (19) 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 (20). 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

$$BC = \begin{cases} \theta \cdot V_{\mathrm{U}}[\bar{S}], & S_t = \bar{S} \wedge t \leq T_{\mathrm{m}}, \\ 0, & S_t \neq \bar{S} \vee t > T_{\mathrm{m}}, \end{cases} \tag{21}$$

where T_{m} is the date of the debt maturity. The present value of expected bankruptcy costs V^{BC} is given by

$$V_{\mathrm{BC}}[S_t] = \theta \cdot V_{\mathrm{U}}[\bar{S}] \left(\frac{S}{\bar{S}} \right)^{\beta_4}, \tag{22}$$

where $\beta_4 \equiv \frac{-c_1 + \sqrt{c_1^2 - 4(c_0 - \delta)c_2}}{2c_2}$. See Appendix for details.

Figure 5 shows the comparative statics of Equation (22). 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

$$V_{\mathrm{TB}}[S_t] \equiv \mathrm{E}_t\left[\int_t^{\min[T_{\mathrm{d}},T_{\mathrm{m}}]} \frac{\Lambda_s}{\Lambda_t} \cdot c \cdot \tau \cdot dS\right], \tag{23}$$

where $T_{\mathrm{d}} > t$ is the date of default. Equation (23) shows that the tax benefits of debt are lost at default and at debt maturity. The solution for the value of the tax benefits in Equation (23) is presented in the Appendix.

Figure 6 shows the comparative statics of Equation (23). 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

$$V_{\mathrm{D}}[S_t] \equiv \mathrm{E}_t\left[\int_t^{\min[T_{\mathrm{d}},T_{\mathrm{m}}]} \frac{\Lambda_s}{\Lambda_t} \cdot \mathrm{c} \cdot dS + \mathbf{1}_{\{\mathrm{T}<\mathrm{T_m}\}} \int_T^{\infty} \frac{\Lambda_s}{\Lambda_t} \cdot \Pi_s(1-\tau)(1-\theta)dS + \mathbf{1}_{\{\mathrm{T}\geq\mathrm{T_m}\}} \cdot \frac{\Lambda_{T_{\mathrm{m}}}}{\Lambda_t} \cdot \mathrm{F}\right], \tag{24}$$

where $F > 0$ is the face value of debt. The solution for the value of debt in Equation (24) is presented in the Appendix.

Figure 7 shows the comparative statics of Equation (24). 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

$$V_{\mathrm{E}}[S_t] = V_{\mathrm{U}}[S_t] + V_{\mathrm{TB}}[S_t] - V_{\mathrm{BC}}[S_t] - V_{\mathrm{D}}[S_t]. \tag{25}$$

Figure 8 shows the comparative statics of Equation (25). 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

$$\ell[S_t] = \frac{V_{\text{D}}[S_t]}{V_{\text{D}}[S_t] + V_{\text{E}}[S_t]}. \tag{26}$$

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

$$c^* = \text{argmax}_c\{V_{\text{TB}}[S_0, c] - V_{\text{BC}}[S_0, c]\}. \tag{27}$$

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 $V_{\text{L}}[s_0]$ exceeds the value of the unlevered firm $V_{\text{U}}[s_0]$ so the equity holders issue a bond with a coupon rate equal to c^*. When $I^* = -1$, the value of the levered firm $V_{\text{L}}[S_0]$ is less or equal than the value of the unlevered firm $V_{\text{U}}[S_0]$ 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* >>

4.5 Model Calibration

This section presents the results of a numerical exercise based on model-generated data from a large number of simulations, each of which represents a large panel of firms. The model is calibrated to minimize the distance between the moments constructed from data generated by the model and the moments constructed from real-world data. In particular, the main goal of the calibration presented in this section is to verify that the model can, under reasonable parameter values, produce point estimates that are close to those presented in the next section.

4.5.1 Calibration Procedure

Each simulation consists of the simulation of 100 panels of 780 firms over 86 years at a monthly frequency. The initial levels of productivity, wages, and labor share are identical for all firm at the start of the simulation and for new firms that replace firms hit by an obsolescence shock. Firms issue debt when they are born and subsequently after they are hit by a stochastic debt maturity shock. The first 50 years of each panel are used to generate the cross-sectional distributions of firm-level productivity, wages, labor share, and financial leverage. The last 36 years of each simulated panel, which we denote years t =0, ..., 36, are then used to generate the synthetic moments.

The model simulation requires the definition of the 14 parameters values shown in Table 8. The risk free rate is set to r=0.016 and the market price of risk is set to η= 0.623. The productivity growth drift μ_X=0.027, the wage growth drift μ_W=0.009, and the weight of labor in the production function α=0.224 , jointly determine the average level of labor share. The parameters that are related to the second moments of productivity growth (σ_X=0.051 and ρ_X=0.813) and of wage growth (σ_W=0.009 and ρ_W=0.584) jointly determine the moments related to macroeconomic variables shown in Table 9. The labor–capital elasticity of substitution is set to $\frac{1}{1-\rho}$=0.483 , which is consistent with the estimates reported in the literature (e.g., León-Ledesma et al. (2010) and Klump et al. (2012)). The technological obsolescence rate is set to λ_d=0.025, a value consistent with the literature (e.g., Carlson, Fisher, and Giammarino (2004)). The final three parameters defined the level of financial leverage. The share of the firm value lost at bankruptcy is set to θ=0.951, the corporate tax rate is set to τ=0.201, and the intensity of debt maturity is set to δ=0.063.

<< Table 8 here >>

Table 9 presents statistics of model generated moments along with corresponding moments from the data. The first four moments are related to aggregate macroeconomic variables: the volatilities of aggregate output growth, aggregate wage growth, aggregate productivity growth, and profit growth. We follow Donangelo et al. (2018) and construct our synthetic aggregate productivity as that in the data, $Y/(L^{(1-.594)})$, where L represents aggregate labor. The model generates macroeconomic moments that are comparable although not identical to those in the data. For instance, the model generates output (i.e., GDP) growth and productivity growth that are more volatile than their data counterparts. Conversely, the model generates wage growth and profit growth that are smoother than their counterparts in the data. The table also presents the average firm-level financial leverage ratio and labor share from the model and from the data. These moments are consistent with those from the data.

<< Table 9 here >>

Table 10 presents average asset, debt, and equity returns of firms sorted on lagged financial leverage from the model calibration, along with the corresponding moments from the data. Panel A of Table 10 shows 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. Panel B of Table 10 shows 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. Panel C of Table 10 shows a weakly positive relation between financial leverage and stock returns, in particular for equal-weighted 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. Overall, the the results in Table 10 show that the calibrated model is able to generate moments that are not only qualitatively but also quantitatively consistent with those from the data.

<< Table 10 here >>

Table 11 presents results of portfolio sorts similar to those presented in Table 10 but in which the sorting variable is a our proxy for operating leverage (i.e., labor share) instead of financial leverage. Panel A of Table 11 shows that asset returns are positively related to labor share. This result is consistent with moments from the data. Panel B of Table 11 shows that the relation between bond returns and labor share is negative for equally-weighted bond returns and positive for value-weighted bond returns. The former result is in contrast with the positive, albeit relatively weak, relation between bond returns and labor share observed in the data. Panel C of Table 11 shows a positive relation between labor share and stock returns, which is consistent with the moments from the data and with the labor leverage literature.

<< Table 11 here >>

Table 12 presents the results of the following Fama-MacBeth regressions:

$$Returns_{i,t} = \alpha + \beta_{1,t} LS_{i,t-1} + \beta_{2,t} Leverage_{i,t-1} + \beta_{3,t}(LS_{i,t-1} * Leverage_{i,t-1}) + \epsilon_{i,t}. \quad (28)$$

Table 12 shows that the model is able to produce results consistent with those from the data. In particular, the table shows that asset returns are positively related to operating leverage and negatively related to financial leverage. The table also shows that bond returns are positively related to both types of leverage. Finally, the table shows that equity returns are positively related to operating leverage but not strongly related to financial leverage as can be seen in the univariate specification.

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 (16) satisfies the ordinary differential equation (ODE) given by

$$\Pi_t(1-\tau) + c_0 V_{\mathrm{U}}[s_{\mathrm{t}}] + c_1 V_{\mathrm{U}}'[s_{\mathrm{t}}] + c_2 V_{\mathrm{U}}''[s_{\mathrm{t}}] = 0, \tag{29}$$

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 (29) is given by

$$V_{\mathrm{U}}[s_t] = \frac{(1-\tau)(1-\alpha)^{\frac{1}{\rho}}K}{(\beta_1-\beta_2)c_2}\left(\frac{(\rho-1)e^{s_t\beta_1}B^{-\beta_1}_{\frac{\rho-1}{\rho}}[e^{s_t}]}{(\beta_1-1)\rho+1} - \frac{(\rho-1)e^{s_t\beta_2}B^{-\beta_2}_{\frac{\rho-1}{\rho}}[e^{s_t}]}{(\beta_2-1)\rho+1} - \frac{G[-\beta_2]\,G\left[2-\frac{1}{\rho}\right]e^{s_t\beta_2}}{G\left[-\beta_2-\frac{1}{\rho}+2\right]} - \frac{(\beta_1-\beta_2)c_2(1-e^{s_t})^{1-1/\rho}}{(\beta_1-1+1/\rho)(\beta_2-1+1/\rho)}\right), \tag{31}$$

where $\beta_1 \equiv \frac{-c_1-\sqrt{c_1^2-4c_0c_2}}{2c_2}$ and $\beta_2 \equiv \frac{-c_1+\sqrt{c_1^2-4c_0c_2}}{2c_2}$ are the negative and positive roots of the fundamental polynomial of the ODE in Equation (29), $B_b^a[.]$ 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

$$c_0 V_{\text{BC}}[s_{\text{t}}] - \delta V_{\text{BC}}[s_{\text{t}}] + c_1 V'_{\text{BC}}[s_{\text{t}}] + c_2 V''_{\text{BC}}[s_{\text{t}}] = 0, \tag{32}$$

subject to the boundary conditions $\lim_{s \to \bar{s}} V_{\text{BC}}[s] = V_{\text{U}}[\bar{s}]$ and $\lim_{s \to \infty} V_{\text{BC}}[s] = 0$. The solution to the ODE in Equation is known and is given in Equation (22).

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

The value of the tax benefits of debt in Equation (23) satisfies the ordinary differential equation (ODE) given by

$$c\tau + c_0 V_{\text{TB}}[s_{\text{t}}] - \delta V_{\text{TB}}[s_{\text{t}}] + c_1 V'_{\text{TB}}[s_{\text{t}}] + c_2 V''_{\text{TB}}[s_{\text{t}}] = 0, \tag{33}$$

subject to the boundary conditions $\lim_{s \to -\infty} V_{\text{TB}}[s] = \frac{c\tau}{r + \lambda_{\text{d}}}$ and $\lim_{s \to \bar{s}} V_{\text{TB}}[s] = 0$. 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 (24) satisfies the ordinary differential equation (ODE) given by

$$c + c_0 V_{\mathrm{D}}[s_{\mathrm{t}}] - \delta \left(V_{\mathrm{D}}[s_{\mathrm{t}}] - F \right) + c_1 V'_{\mathrm{D}}[s_{\mathrm{t}}] + c_2 V''_{\mathrm{D}}[s_{\mathrm{t}}] = 0, \tag{34}$$

where F is the face (i.e., issuance) value of debt, 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)
Parameter values used in the figures are presented in Table 8.

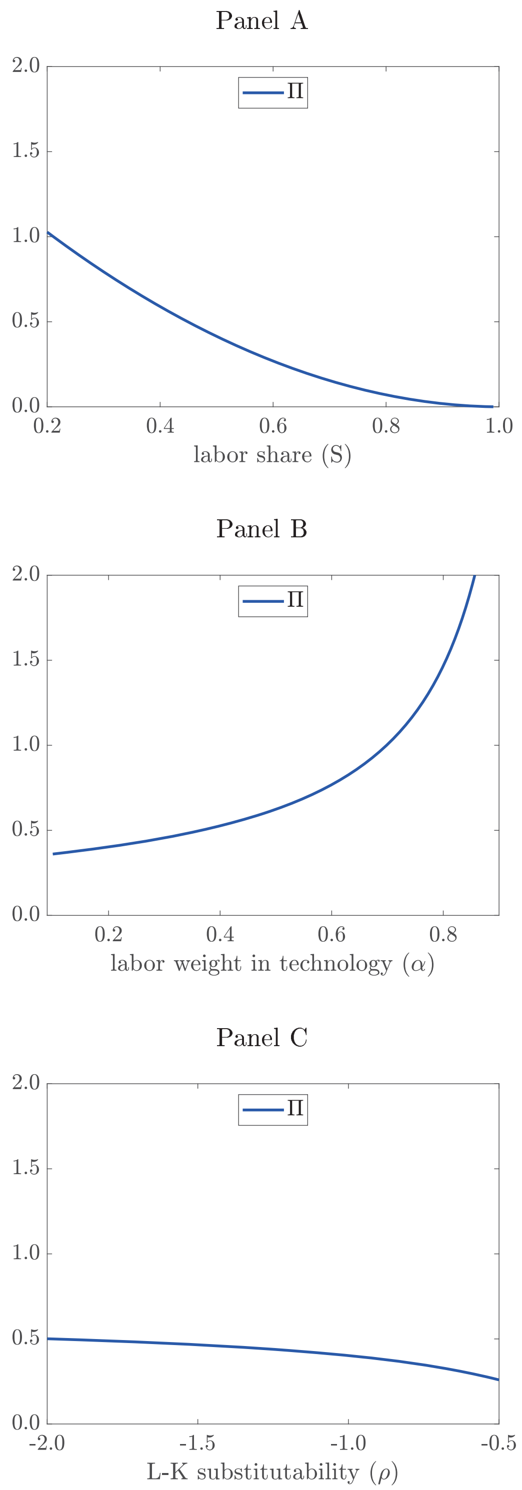

Figure 2
Model: Labor Share and Labor Leverage
Parameter values used in the figures are presented in Table 8.

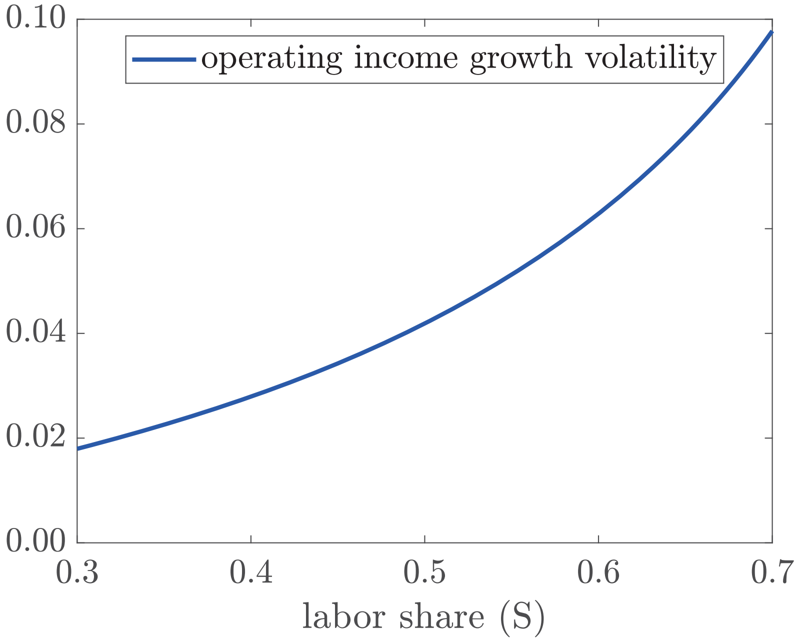

Figure 3

Model: Value of Unlevered Firm (V_U)

Parameter values used in the figures are presented in Table 8.

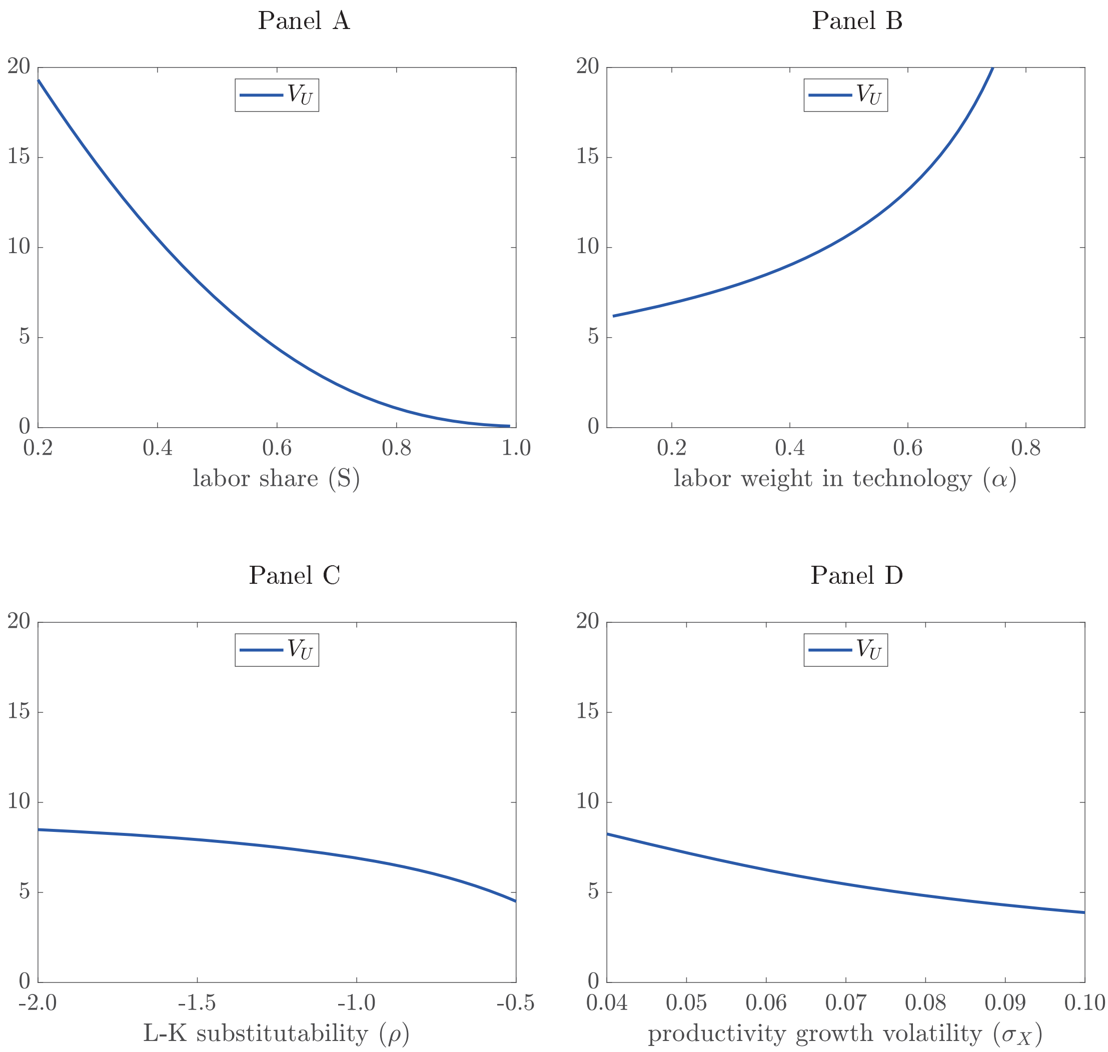

Figure 4

Model: Net Profits (Π^{NI}) and Bankruptcy Threshold ($\bar{S}$)

Parameter values used in the figures are presented in Table 8.

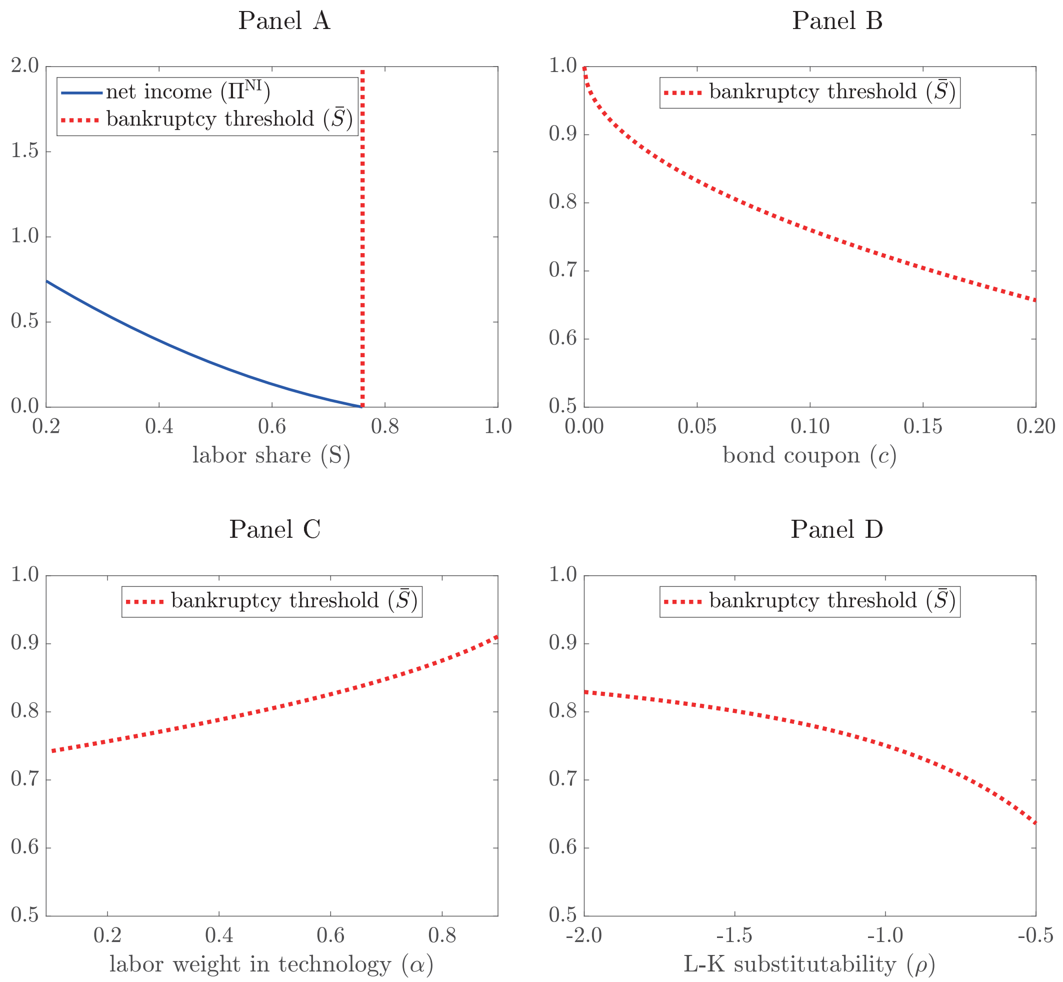

Figure 5

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

Parameter values used in the figures are presented in Table 8.

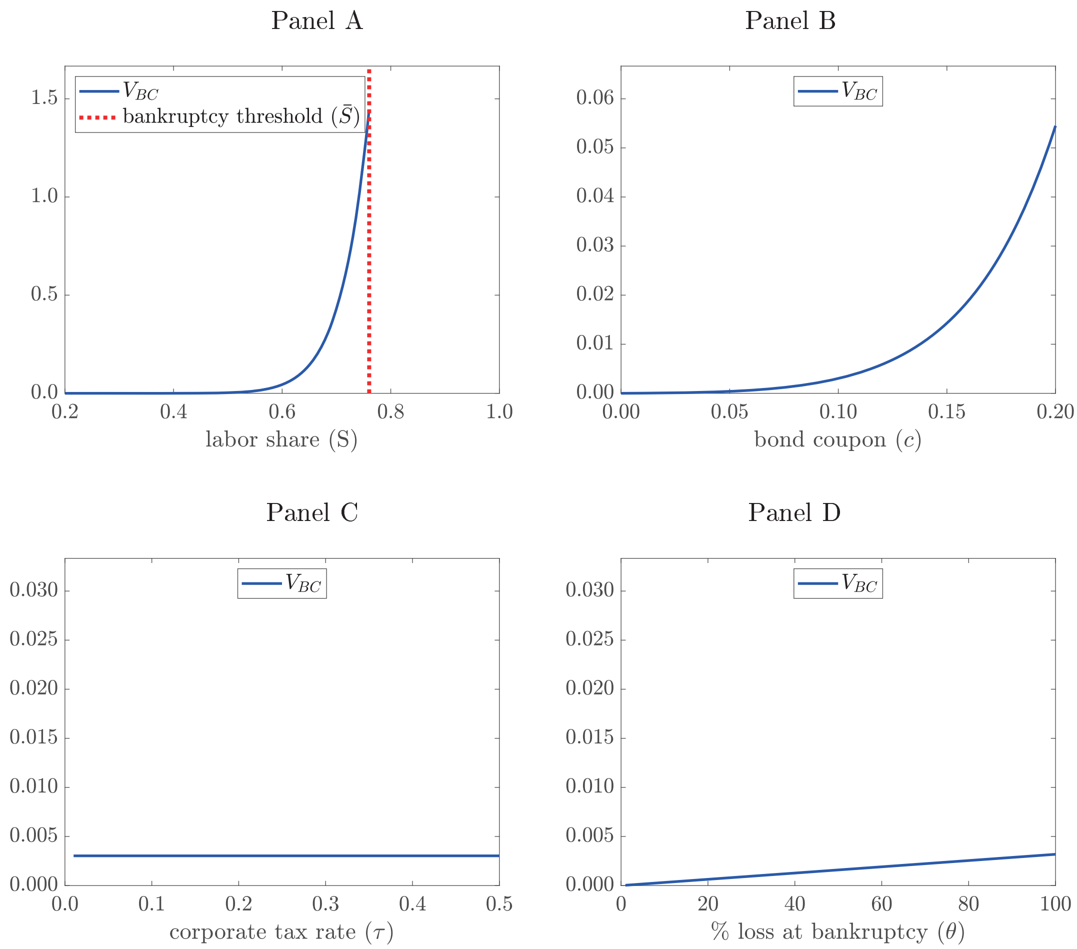

Figure 6

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

Parameter values used in the figures are presented in Table 8.

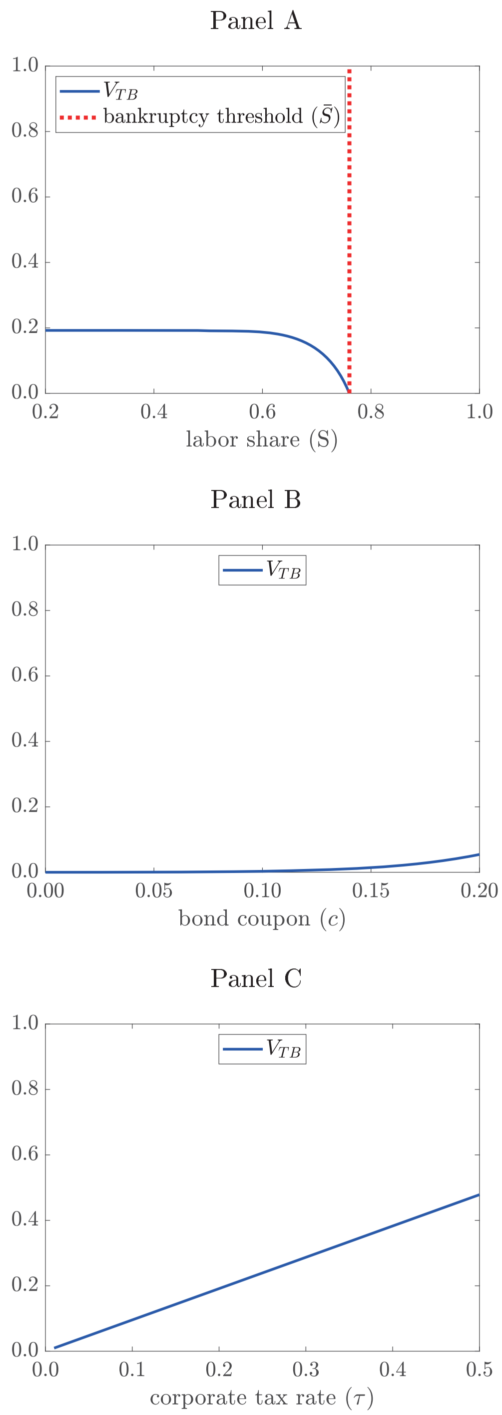

Figure 7

Model: Value of Debt (V_D)

Parameter values used in the figures are presented in Table 8.

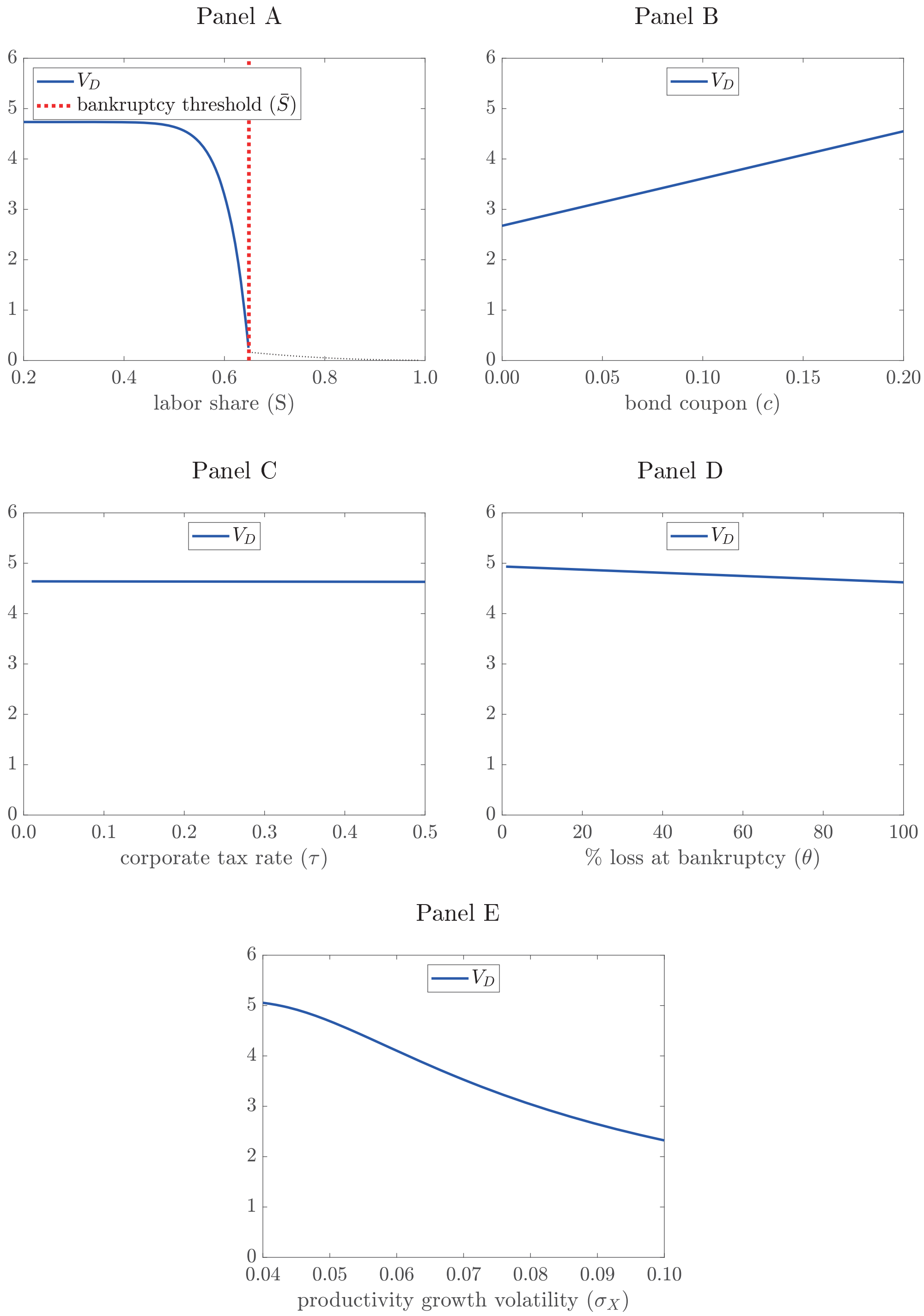

Figure 8

Model: Value of Equity (V_E)

Parameter values used in the figures are presented in Table 8.

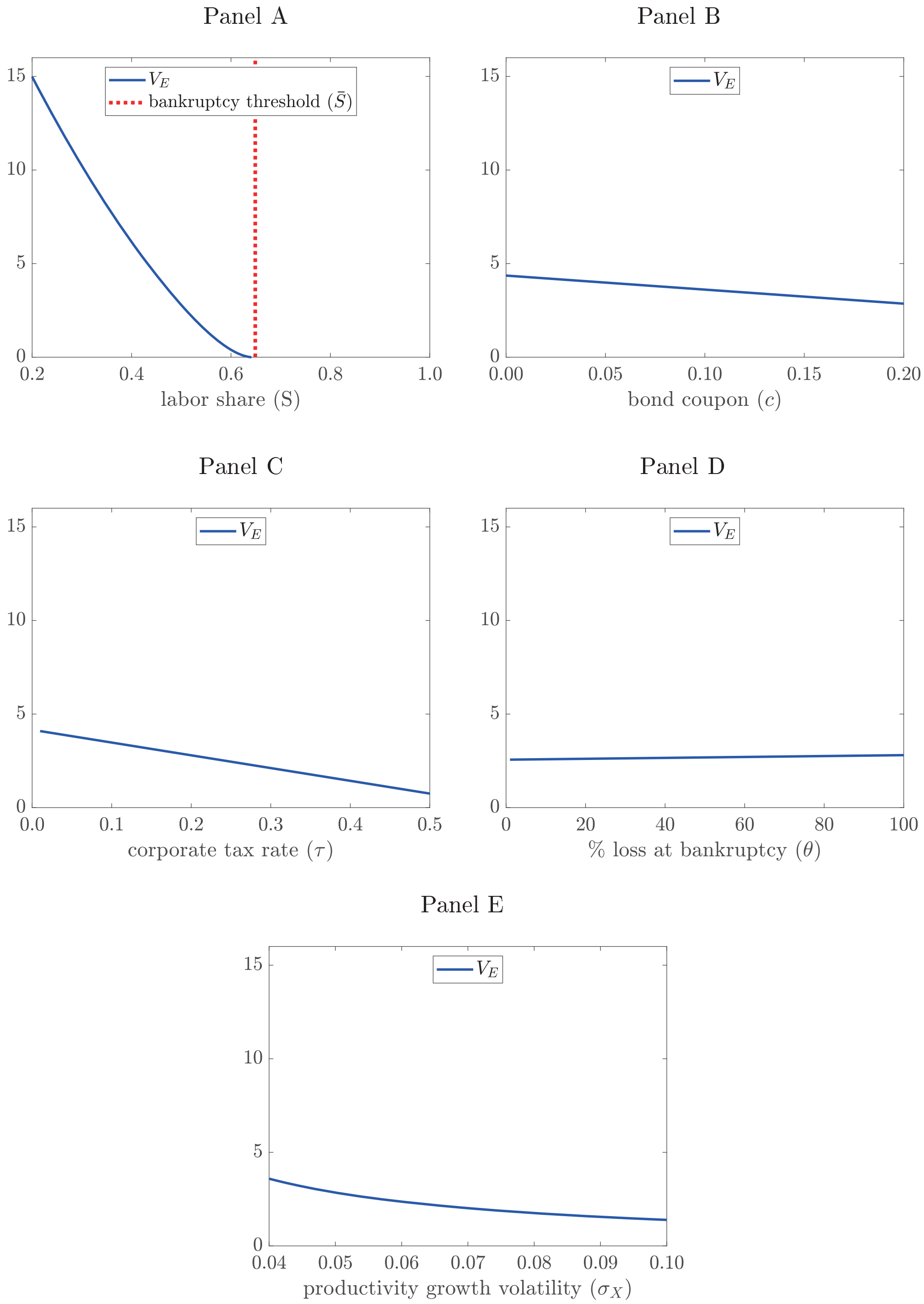

Figure 9

Model: Financial Leverage Ratio (ℓ)

Parameter values used in the figures are presented in Table 8.

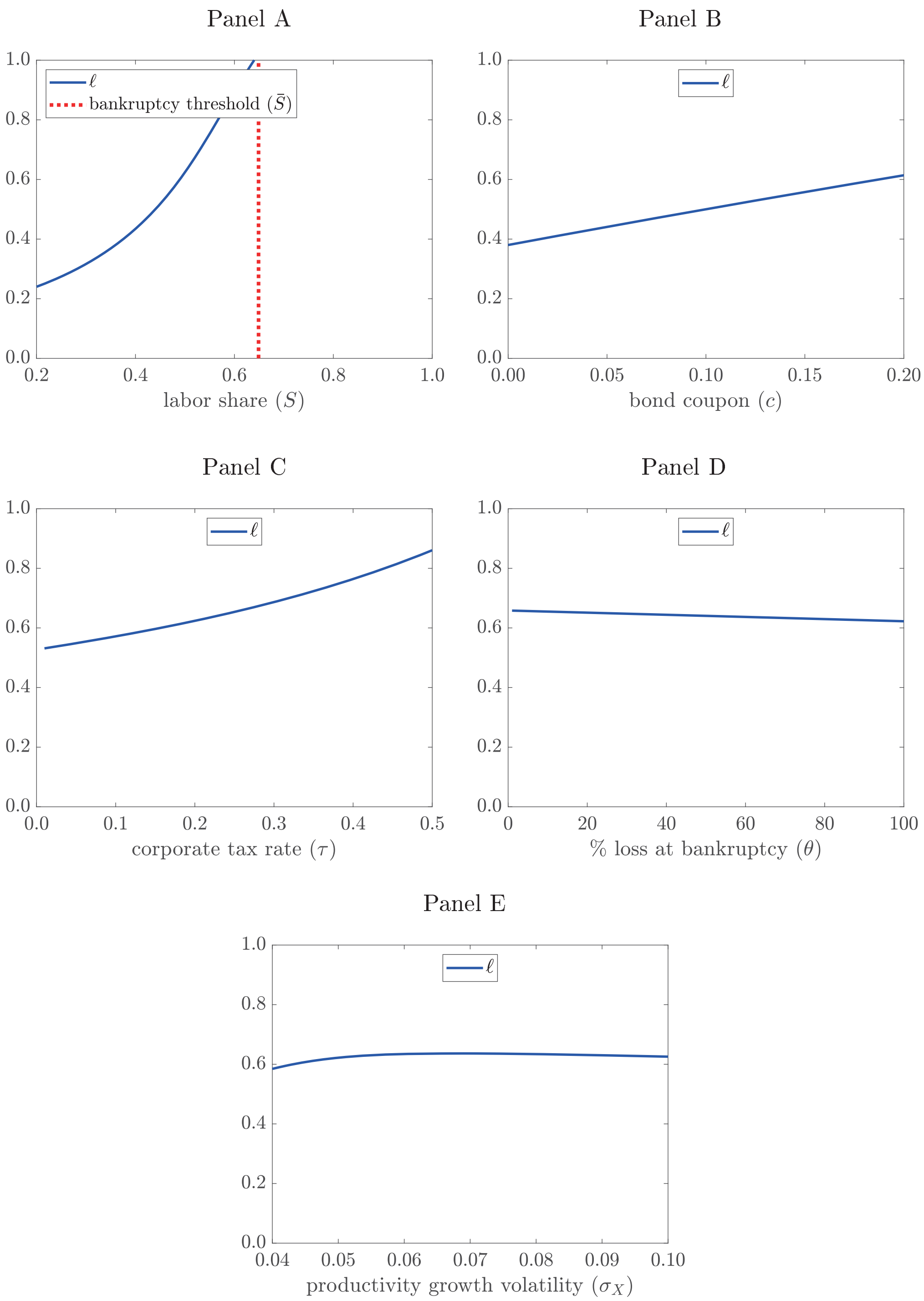

Figure 10

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

The shaded area in the plots below indicates the region with no bond issuance ($I^* = \text{sign}[V_{\text{TB}}[s_0, c^*] - V_{\text{BC}}[s_0, c^*]] = -1$). Parameter values used in the figures are presented in Table 8.

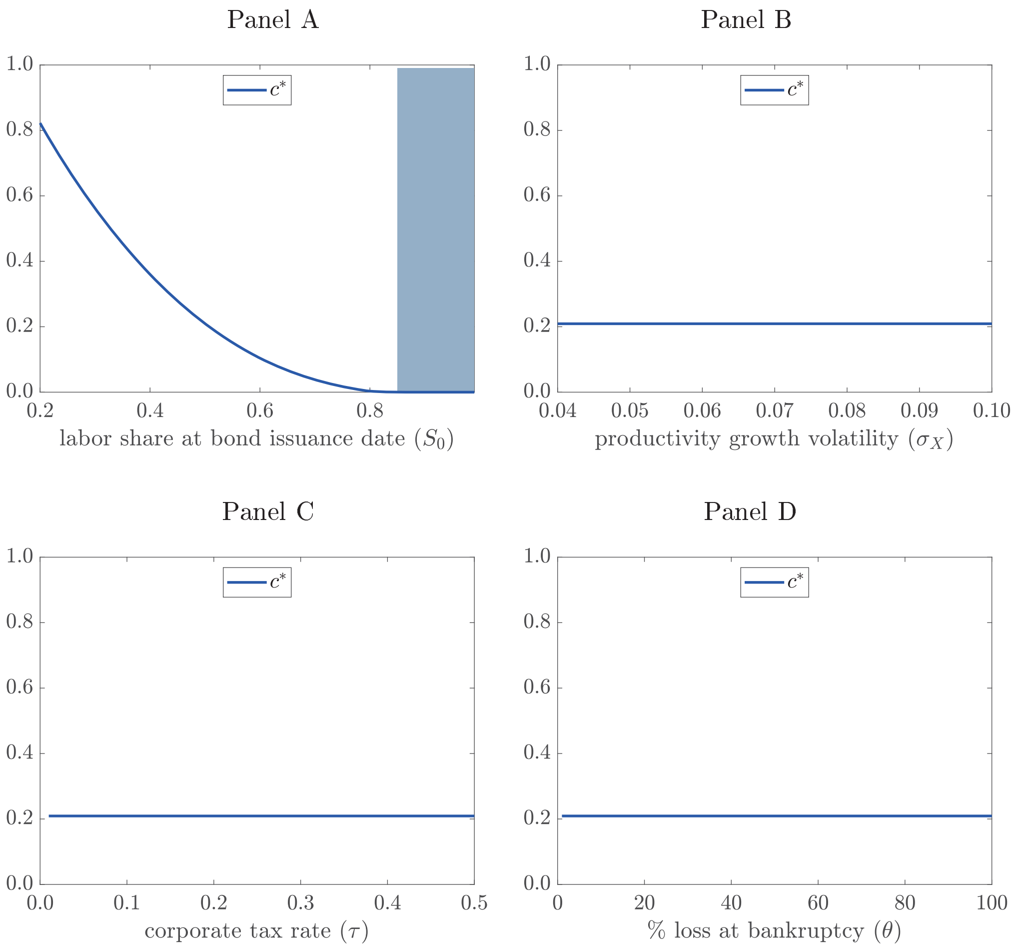

Figure 11

Model: Bond Issuance Decision and Optimal Financial Leverage Ratio (ℓ^*)

The shaded area in the plots below indicates the region with no bond issuance ($I^* = \text{sign}[V_{\text{TB}}[s_0, c^*] - V_{\text{BC}}[s_0, c^*]] = -1$). Parameter values used in the figures are presented in Table 8.

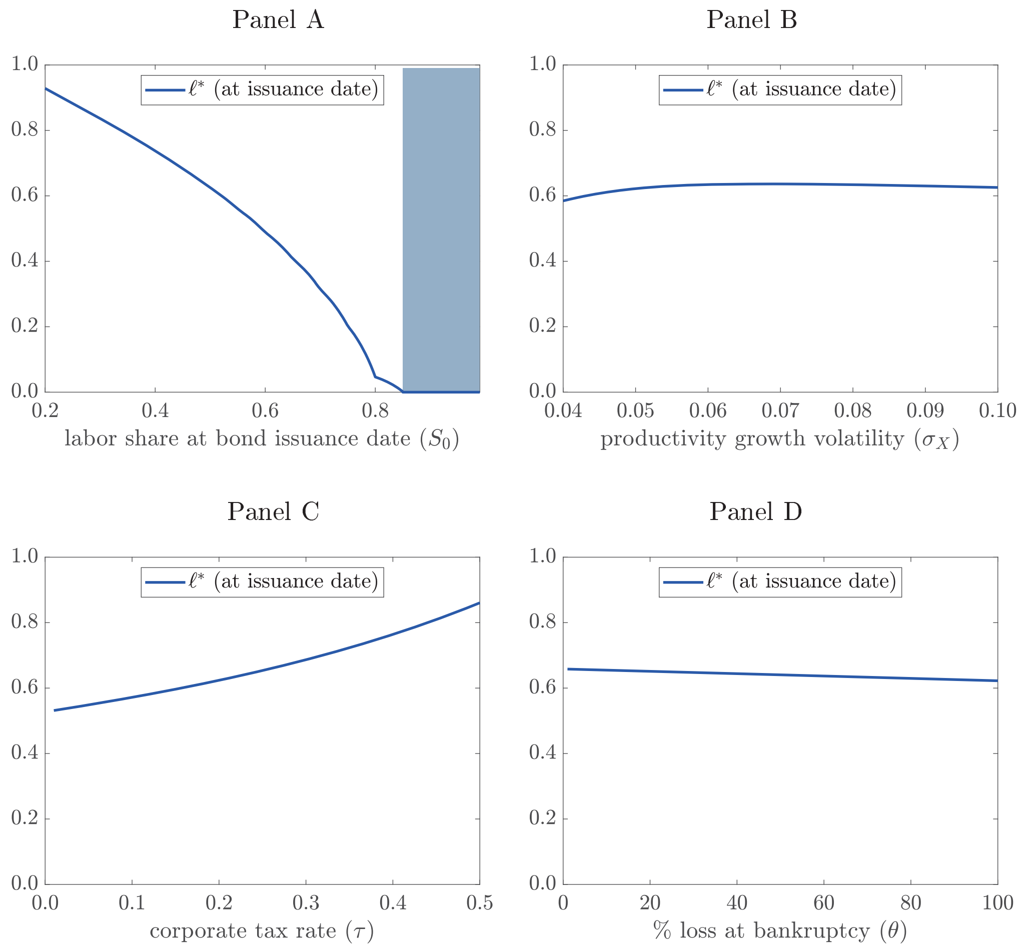

Table 1
Summary Statistics

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
	First	0.68	0.00	0.00	−0.21	−0.24	4.75	5.16	0.62	0.07	4.06	225
BLev	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
	First	0.68	0.00	0.00	−0.20	−0.24	4.74	5.19	0.56	0.06	4.04	225
MLev	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
	First	0.33	0.30	0.32	0.03	0.01	7.94	7.37	0.77	0.09	1.56	224
LS	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 2
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 their cross-sectional means and standard deviations are 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 3
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 4
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 5
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 6

Tradeoff between Operating Leverage and Financial Leverage: Implication for Returns

The table 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, book leverage (Panel A) and market leverage (Panel B). 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 7
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

Table 8
Model Calibration: Parameters Values

This table shows the parameter values used in the calibrated model.

Parameter	Symbol	Value
Stochastic Discount Factor		
Risk-free rate	r	0.016
Price of risk	η	0.623
Wages and Labor		
Drift of wage growth	μ_{W}	0.009
Volatility of wage growth	σ_{W}	0.009
Priced portion of wage growth	ρ_{W}	0.584
Productivity		
Drift of productivity growth	μ_{X}	0.027
Volatility of productivity growth	σ_{X}	0.051
Priced portion of productivity growth	ρ_{X}	0.813
Productive Technology		
L-K elasticity of substitution	$\frac{1}{1-\rho}$	0.483
Weight of labor in productive technology	α	0.224
Technological obsolescence rate	λ_{d}	0.025
Financial Leverage		
Bankruptcy costs (fraction of firm value)	θ	0.951
Corporate tax rate	τ	0.201
Intensity of debt maturity	δ	0.063

Table 9
Model Calibration: Summary Statistics

This table shows summary statistics from the model calibration. Parameter values used in the calibration are presented in Table 8.

Moment	Model	Data
Aggregate Moments		
GDP growth volatility	3.3	3.1
TFP growth volatility	2.7	1.9
Wage growth volatility	0.7	1.7
Profit growth volatility	6.7	10.4
Firm-Level Moments		
Financial leverage ratio	28.3	24.0
Labor share	58.0	63.0

Table 10
Model Calibration: Returns and Financial Leverage

The table presents average asset, bond, and equity returns of portfolios of simulated firms from the model calibration sorted on lagged financial leverage. Parameter values used in the calibration are presented in Table 8.

	Model						Data					
	L	2	3	4	H	H-L	L	2	3	4	H	H-L
	Asset Return						Asset Return					
EW	9.11	8.78	7.45	6.17	5.07	-4.04***	11.10	6.30	6.60	6.20	5.60	-5.60***
	(5.88)	(6.02)	(6.58)	(7.58)	(9.18)	(-4.00)	(6.61)	(5.98)	(5.84)	(5.60)	(4.53)	(3.65)
VW	8.04	7.53	6.51	5.70	4.90	-3.14***	6.90	4.60	5.80	5.00	3.50	-3.40***
	(6.39)	(6.69)	(7.37)	(8.24)	(9.57)	(-4.10)	(4.90)	(2.24)	(6.05)	(4.84)	(3.41)	(2.63)
	Bond Return						Bond Return					
EW	2.00	2.74	2.89	2.75	2.59	0.59***	3.20	3.50	4.00	4.80	6.40	3.20***
	(28.60)	(30.82)	(24.73)	(26.30)	(28.10)	(4.27)	(2.75)	(2.86)	(2.72)	(3.32)	(3.44)	(2.82)
VW	2.19	2.78	2.73	2.64	2.54	0.35***	3.20	3.50	3.90	4.30	4.60	1.30**
	(32.98)	(31.62)	(29.69)	(30.49)	(29.22)	(2.86)	(2.73)	(2.68)	(2.66)	(3.31)	(3.77)	(2.49)
	Equity Return						Equity Return					
EW	9.26	9.25	8.97	8.85	9.63	0.37	11.30	7.40	8.60	9.00	11.60	0.30
	(5.85)	(5.90)	(6.07)	(6.36)	(6.69)	(1.18)	(6.58)	(5.92)	(6.22)	(5.99)	(4.64)	(0.17)
VW	8.23	8.02	7.88	8.18	9.23	1.01***	4.90	8.30	7.50	7.20	8.20	3.30
	(6.33)	(6.50)	(6.68)	(6.75)	(6.83)	(3.73)	(2.23)	(4.73)	(5.95)	(4.94)	(1.97)	(0.92)

Table 11
Model Calibration: Returns and Operating Leverage

The table presents average asset, bond, and equity returns of portfolios of simulated firms from the model calibration sorted on lagged labor share. Parameter values used in the calibration are presented in Table 8.

	Model						Data					
	L	2	3	4	H	H-L	L	2	3	4	H	H-L
	Asset Return						Asset Return					
EW	4.72	5.64	6.95	8.59	10.69	5.97***	6.70	6.00	8.20	7.50	10.70	4.00***
	(10.38)	(8.46)	(6.99)	(6.08)	(5.40)	(3.89)	(5.10)	(5.99)	(5.87)	(5.46)	(8.21)	(3.35)
VW	4.69	5.59	6.88	8.50	10.49	5.80***	3.80	4.70	5.30	4.40	6.70	2.90***
	(10.46)	(8.54)	(7.05)	(6.11)	(5.44)	(3.90)	(3.61)	(3.73)	(3.66)	(2.93)	(6.14)	(3.02)
	Bond Return						Bond Return					
EW	2.49	2.61	2.69	2.69	2.49	0.00	4.20	4.00	4.20	4.40	5.30	1.10**
	(35.72)	(33.91)	(29.15)	(25.69)	(24.98)	(0.02)	(2.88)	(2.93)	(3.00)	(3.27)	(3.61)	(2.13)
VW	2.48	2.63	2.84	3.10	3.39	0.90***	3.20	4.10	2.90	4.40	4.80	1.60***
	(32.19)	(28.85)	(22.46)	(16.41)	(11.99)	(3.31)	(2.46)	(2.76)	(2.63)	(2.87)	(3.61)	(2.87)
	Equity Return						Equity Return					
EW	8.08	8.24	8.75	9.68	11.22	3.13***	8.90	7.80	10.20	9.10	13.00	4.10**
	(7.48)	(6.84)	(6.26)	(5.80)	(5.32)	(2.99)	(4.97)	(5.83)	(6.14)	(5.33)	(7.41)	(2.36)
VW	7.33	7.74	8.40	9.46	10.97	3.64***	6.80	7.20	5.30	6.80	9.60	2.70**
	(7.87)	(7.07)	(6.40)	(5.87)	(5.38)	(3.24)	(2.26)	(4.01)	(1.41)	(2.53)	(5.54)	(2.17)

Table 12
Model Calibration: Tradeoff between Operating Leverage and Financial Leverage

The table presents results from the Fama-MacBeth regressions of simulated asset, debt, and equity returns on lagged LS, leverage (Lev), and interaction between LS and leverage (LS*Lev). LS and leverage are standardized in each year. Parameter values used in the calibration are presented in Table 8.

	Model				Data			
	Asset Return				Asset Return			
LS	2.24***		2.03***	1.97***	1.40***		1.10***	1.20***
	(3.93)		(3.74)	(3.75)	(4.08)		(3.24)	(3.35)
Lev		-1.74***	-0.30***	-0.44***		-2.10***	-2.00***	-1.90***
		(-4.04)	(-3.04)	(-3.36)		(-3.43)	(-3.16)	(-2.91)
LS*Lev				-0.34***				-0.60**
				(-2.89)				(-2.00)
R^2	13.35	7.81	13.52	13.76	1.00	1.30	2.20	2.80
Obs	24123	24123	24103	24103	23531	23531	23531	23531
	Bond Return				Bond Return			
LS	0.03		0.24***	0.28***	0.40**		0.30**	0.30**
	(0.63)		(2.68)	(2.96)	(2.17)		(2.31)	(2.33)
Lev		0.13***	0.30***	0.42***		1.20***	1.30***	1.20***
		(2.63)	(3.16)	(3.74)		(2.99)	(3.15)	(3.11)
LS*Lev				0.30***				0.40**
				(4.34)				(2.10)
R^2	0.48	0.60	2.54	4.65	1.70	5.00	6.60	7.80
Obs	24123	24123	24103	24103	16934	16934	16934	16934
	Equity Return				Equity Return			
LS	1.11***		2.41***	2.36***	1.40***		1.30**	1.30***
	(2.95)		(3.64)	(3.60)	(2.83)		(2.47)	(2.61)
Lev		0.10	1.82***	1.66***		-0.10	0.10	0.20
		(0.81)	(4.40)	(4.19)		(-0.11)	(0.17)	(0.35)
LS*Lev				-0.38***				-0.30
				(-3.42)				(-0.64)
R^2	4.17	0.29	7.01	7.19	0.90	1.70	2.70	3.40
Obs	24123	24123	24103	24103	23531	23531	23531	23531