The Elephant in the Room: the Impact of Labor Obligations on Credit Risk*

Jack Favilukis
University of British Columbia
Sauder School of Business

Xiaoji Lin
The Ohio State University
Fisher College of Business

Xiaofei Zhao
University of Texas at Dallas
Naveen Jindal School of Management

December 2, 2015

*thanks

Abstract

We study the impact of labor market frictions on credit risk. Our central finding is that labor market variables are first-order in accounting for both aggregate and firm-level variations in credit risk and capital structure. Labor market variables (wage growth or labor share) forecast the aggregate credit spread as well as or better than alternative predictors. Furthermore, firm-level labor expense growth rates and labor share can predict Moody-KMV expected default frequency (EDF) in the cross-section across a wide range of countries. These variables also explain firm-level capital structure decisions. A model with wage rigidity and risky long-term debt can explain these links as well as produce large credit spreads despite realistically low default probabilities. This is because pre-committed payments to labor make other committed payments (such as debt) riskier; this effect is amplified when debt is long-term.

1 Introduction

We study the impact of labor market frictions on credit risk. Our central finding is that labor market variables are first-order in accounting for both aggregate and firm-level variations in credit risk and in capital structure decisions. When wages are rigid, a negative economic shock leads to a rise in labor induced operating leverage, as wages fall too slowly and labor share rises. This labor leverage effect increases firms' credit risk because precommitted wage payments make other payments, such as interest, riskier. Adjustment happens both in prices and quantities: in response to a negative shock, bond prices fall (yields rise) and firms issue less debt. Firms with higher labor leverage tend to have higher credit risk and lower financial leverage.

We show that labor market variables (low wage growth or high labor share), which capture the strength of operating leverage when wages are sticky, significantly forecast the aggregate Baa-Aaa credit spread in the U.S. A 1 percentage point decrease in the wage growth (increase in labor share) is associated with an increase of 15 (11) basis points in credit spread, and the univariate R^2 of wage growth (labor share) is 0.28 (0.09). These findings are robust to inclusion of standard controls used in the literature. These same variables also forecast corporate debt growth with the opposite sign to the credit spread forecast. A 1 percentage point decrease in the wage growth (increase in labor share) is associated with 1.3 (0.4) percent reduction in the aggregate quantity of U.S. corporate debt.

In the cross section, we show that firm-level labor market variables are important predictors of credit risk, as measured by the Moody-KMV expected default frequency (EDF), across a wide range of countries, including U.S., Canada, and major European and Asian Pacific countries. Again, these findings are robust to standard controls. More specifically, firms with lower labor expense growth rates (higher labor share) have higher future EDFs. As with the aggregate data, these variables also forecast corporate debt growth, with the opposite sign to the EDF forecast. Additionally, firms with higher labor leverage tend to have lower financial leverage; the strikingly strong relationship between labor share and financial leverage is presented in Figure 2. Taken together, our results suggest that understanding labor markets is crucial for understanding both the aggregate and the cross sectional variation in credit risk and capital structure.

To that end, we solve a dynamic stochastic general equilibrium (DSGE) model with heterogeneous firms. Unlike many standard models, in our model the labor market is not frictionless. Wage contracts are staggered, which prevent firms from immediately adjusting their labor expenses in response to new shocks. This causes wages to be sticky and labor leverage to matter for asset prices. As in the data, the wage process in our model is smoother than output and imperfectly correlated with output. On the financing side, firms issue long-term debt to finance investment and labor expenses. Although the labor leverage channel will work with either short- or long-term debt, the interaction of sticky wages and long-term debt is quantitatively important.

In the model, the predictability of labor market variables for the credit spread arises endogenously due to the interaction between operating leverage and financial leverage. In economic downturns, productivity and output fall by more than wages, causing an increase in labor share and labor leverage. High expected payments to labor make equity more likely to default in bad times, especially when the wage bill is relatively high. Thus, the model implies that labor share (positively) and wage growth (negatively) are natural predictors of credit risk. Similarly, at the firm level, low (high) productivity firms have lower (higher) wage growth and higher (lower) labor share; because these firms have more labor leverage, they have a higher risk premium.

Notably, the model produces a realistically large credit spread, despite realistically low default probabilities, providing a novel explanation for the credit spread puzzle. In our model shocks to the growth rate of productivity are persistent, and households have Epstein and Zin (1989) utility, thus standard long run risk forces are present, as in Bansal and Yaron (2004), Kaltenbrunner and Lochstoer (2010), and Croce (2014). Because shocks are persistent, a negative shock today implies that consumption growth is likely to be low for many periods into the future; such a shock is especially unpleasant because the intertemporal elasticity of substitution (IES) is above one. In this world, safe long-term debt is an especially good hedge, because it promises a long-term, stable interest payment. On the other hand, long-term corporate debt is especially risky, because firms are likely to default exactly when a long sequence of negative shocks leaves their revenues low relative to promised interest payments. This effect is magnified by wage rigidity, since after such a long sequence of low growth, not only are interest payments high relative to revenues, but payments to labor are relatively high too.

The model also produces a quantitatively realistic leverage ratio, despite zero explicit bankruptcy costs. This happens because long-term debt exacerbates the debt-overhang, under-investment problem studied by Myers (1977). Hennessy (2004) and Moyen (2007) have previously pointed out that the debt-overhang may be more acute in the presence of long-term debt. The interactions of long-term debt, sticky wages, and long-run risk all strengthen the effect.

In addition to successfully replicating the observed predictability in credit spread, the model also produces a sizable equity premium and equity volatility. As shown in Favilukis and Lin (2015b), the equity premium and volatility are high in a model with wage rigidity, because in many models without labor frictions, profits are too smooth and dividends may be counter-cyclical. Wage rigidity, through operating leverage, makes profits and dividends behave more like the data. Thus the model with wage rigidity and corporate debt provides a coherent accounting of several major financial puzzles–the equity premium puzzle, the credit spread puzzle, and the under-leverage puzzle–in a unified framework.

Finally, in addition to the economic question, we believe that our ability to solve a general equilibrium, heterogenous firm model with long-term wage and long term-debt contracts is, in itself, an important methodological contribution. Models with defaultable long-term debt have only recently appeared in the sovereign default literature (Arellano and Ramanarayanan (2012), Chatterjee and Burcu (2012)), though doing this with heterogenous firms requires additional complexity.

Literature review The macroeconomic literature on wages and labor is quite large (e.g., Pissarides (1979), Calvo (1982), Taylor (1983), Taylor (1999), Shimer (2005), Hall (2005), Gertler and Trigari (2009)), although there has been little work done relating labor market frictions to credit risk. More recently, financial economists have began exploring links between labor and asset prices. Examples of structural models include Danthine and Donaldson (2002),Berk and Walden (2013),Petrosky-Nadeau, Zhang, and Kuehn (2013),Belo, Lin, and Bazdresch (2014),Donangelo (2014), Li and Palomino (2014),Favilukis and Lin (2015b) and Zhang (2015).

Operating leverage due to wages has also been explored empirically by Tuzel and Zhang (2015),Favilukis and Lin (2015a), Donangelo, Gourio, and Palacios (2015) who find links between operating leverage due to labor, and asset returns. There is also a more mature literature that explores the relationship between unions (which are one cause of labor market frictions) and asset prices: Ruback and Zimmerman (1984), Abowd (1989), Hirsch (1991), Lee and Mas (2009) find a negative relation between unions and firm values, while Chen, Kacperczyk, and Ortiz-Molina (2011) that unionization is related to higher costs of equity.

However, much of the work linking labor frictions to asset prices has focused on equity and there has been relatively little work relating it to the pricing of corporate debt. An exception is Gilchrist, Sim, and Zakrajsek (2012), who show credit spread predicts future movement in unemployment rate. We differ from the aforementioned papers because we focus on the link between labor market frictions and credit risk. Our paper provides both a large set of empirical results, as well as a calibrated structural model.

Multiple structural models have been built to study credit risk; these highlight the roles of financial leverage, asset volatility, and macroeconomic risk as the key determinants of credit spread (e.g., Collin-Dufresne, Goldstein, and Martin (2001), Hackbarth, Miao, and Morellec (2006), Chen, Collin-Dufresne, and Goldstein (2009), Chen (2010), Bhamra, Kuehn, and Strebulaev (2010a)). Closer to what we do, production based models who have studied credit risk include Gomes and Schmid (2010) and Gomes and Schmid (2012), who explore the propagation mechanism of movements in bond markets into the real economy; Gourio (2013) studies the impact of disaster risk on credit risk in a DSGE model; Kuehn and Schmid (2013) study the interaction between investment and credit spread; Gilchrist, Sim, and Zakrajsek (2014) study the relationship between uncertainty, investment, and credit risk in a DSGE model.

However, labor is not the focus of any of these papers.[1] As shown in Favilukis and Lin (2015b), wage rigidity is crucial to match cash flow dynamics in DSGE models and can help explain various asset pricing puzzles. We complement the previous literature by incorporating realistic labor markets into the analysis.

Our first set of empirical findings, on labor markets and credit risk, relates to the empirical literature on the determinants of credit spread. Collin-Dufresne et al. (2001) show that standard credit spread forecasters have rather limited explanatory power. Elton, Gruber, Agrawal, and Mann (2001) find that expected default accounts for a small fraction of the credit risk premium. We show that labor market variables have as strong explanatory power as financial leverage and stock market volatility in predicting the Baa-Aaa spread, and the cross-sectional variation in firms' EDFs. Campello, Gao, Qiu, and Zhang (2015) also relates labor markets to credit risk: using regression discontinuity around union elections they show that union elections lead to losses for bond holders.

Since we solve a general equilibrium model with endogenous debt, our work relates not only to the price of debt, but also to the quantity of debt. Dynamic models which focus on capital structure include Hennessy (2004), Hennessy and Whited (2005), Hennessy and Whited (2007), Bhamra, Kuehn, and Strebulaev (2010b), DeAngelo, DeAngelo, and Whited (2007), and Li, Whited, and Wu (2015). As with the literature on credit risk, we complement previous work by considering how labor market frictions affect the firm's financing decision. A closely related paper is Michaels, Page, and Whited (2015), which, through a structural model, asks how financing frictions affect the firm's labor decision.

Our second set of empirical findings, that labor leverage leads to lower debt issuance, complements that of Simintzi, Vig, and Volpin (2015), who show that firms tend to reduce financial leverage when employment protection rises and stress the importance of fixed costs of labor. The channel proposed in that paper works in a similar way to the wage rigidity we consider. Similarly, Schmalz (2015) shows that small or constrained firms are likely to reduce financial leverage after unionization and Bartram (2015) shows that firms with higher pension and health obligations tend to have lower financial leverage. Our finding that high

[1] A recent exception is Bai (2015), who explores unemployment and credit risk.

labor share firms hold less debt mirrors that of D'Acunto, Liu, Pflueger, and Weber (2015), who find that firms with inflexible prices are more exposed to aggregate risk and hold less debt. Several papers have explored the strategic role of debt, where firms use debt to attain a better bargaining position vis-a-vis labor (Baldwin (1983), Bronars and Deere (1991), Perotti and Spier (1989), Dasgupta and Sengupta (1993), Hennessy and Livdan (2009), Matsa (2010)), this channel would lead to an opposite prediction: debt should increase when labor leverage is stronger.

The rest of the paper is laid out as follows. Section 2 lays out the model. In section 3 we discuss the model's calibration. Section 4 presents the model's results. Section 5 presents both the aggregate and cross-sectional empirical results. Section 6 concludes.

2 Model

In this section, we present a dynamic general equilibrium model with heterogenous firms to understand links between labor market frictions and firms' credit risk. This model is very similar to Favilukis and Lin (2015b), however the model allows firms to endogenously choose the amount of debt in the capital structure. We begin with the household's problem. We then outline the firm's problem, the economy's key frictions are described there. Finally we define the equilibrium.

We consider one representative household who receives labor income, chooses between consumption and saving, and invests in a portfolio of all financial assets in the economy. The household maximizes utility as in Epstein and Zin (1989).

$$U_t = \max\left((1-\beta)C_t^{1-\frac{1}{\psi}} + \beta E_t[U_{t+1}^{1-\theta}]^{\frac{1-\frac{1}{\psi}}{1-\theta}}\right)^{\frac{1}{1-\frac{1}{\psi}}} \tag{1}$$

where C_t is the average consumption. For simplicity, we assume that aggregate labor supply is inelastic: $N_t = 1$. The preference parameters are the time discount factor β, the risk aversion θ, and the intertemporal elasticity of substitution ψ.

2.1 Firms

The interesting frictions in the model are on the firm's side. We assume a large number of firms (indexed by i and differing in idiosyncratic productivity) choose investment, labor, and the mix of equity versus corporate debt in their capital structure, to maximize the present value of future dividend payments. The dividend payments are equal to the firm's output net of wages, operating costs, payments to creditors, taxes, investment, and adjustment costs. Output is produced from labor and capital. Firms hold beliefs about the discount factor M_{t+1}, which is determined in equilibrium.

2.1.1 Technology.

The variable Z_t is an exogenously specified total factor (labor-augmenting) productivity common to all firms, idiosyncratic productivity of firm i is Z_t^i; their calibration is described below.

Firm i's output is given by

$$Y_t^i = Z_t^i \left(\alpha (K_t^i)^\eta + (1-\alpha)(Z_t N_t^i)^{\eta\rho} \right)^{\frac{1}{\eta}}. \tag{2}$$

Output is produced with CES technology from capital (K_t^i) and labor (N_t^i). ρ determines the degree of return to scale (constant return to scale if $\rho = 1$), $\frac{1}{1-\eta}$ is the elasticity of substitution between capital and labor (Cobb-Douglas production if $\eta = 0$), and $(1-\alpha)\rho$ is related to the share of labor in production.

2.1.2 The Wage Contract.

In standard production models wages are reset each period and employees receive the marginal product of labor. We assume that any employee's wage will be reset in the current period with probability $1-\mu$. When $\mu = 0$, our model is identical to models without rigidity: all wages are reset each period, each firm can freely choose the number of its employees, and each firm chooses N_t^i such that its marginal product of labor is equal to the spot wage. When $\mu > 0$, we must differentiate between the spot wage (w_t) which is paid to all employees resetting wages this period, the economy's average wage ($\overline{w}_t$), and the firm's average wage ($\overline{w}_t^i$). This wage contract is identical to Favilukis and Lin

(2015b) and similar to Gertler and Trigari (2009).

When a firm hires a new employee in a period with spot wage w_t, with probability μ it must pay this employee the same wage next period; on average this employee will keep the same wage for $\frac{1}{1-\mu}$ periods. All resetting employees come to the same labor market and the spot wage is selected to clear markets. The firm chooses its total labor force N_t^i each period. These conditions lead to a natural formulation of the firm's average wage as the weighted average of the previous average wage and the spot wage:

$$\overline{w}_t^i N_t^i = w_t(N_t^i - \mu N_{t-1}^i) + \overline{w}_{t-1}^i \mu N_{t-1}^i \tag{3}$$

Here $N_t^i - \mu N_{t-1}^i$ is the number of new employees the firm hires at the spot wage, and μN_{t-1}^i is the number of tenured employees with average wage $\overline{w}_{t-1}^i$.[2]

Note that the rigidity in our model is a real wage rigidity, although our channel could in principle work through nominal rigidities as well. There is evidence for the importance of both real and nominal rigidities.[3]

2.1.3 The debt contract.

The firm can raise capital through equity, or through long-term, risky debt with a coupon payment κ_t^i. In any period t, in which the firm is debt-free (i.e., $\kappa_t^i = 0$), the firm can choose to issue new debt with a promised coupon of κ_{t+1}^i, with repayment starting at $t+1$. When issuing new debt, the firm receives the market value of this debt Ψ_t^i from the creditors; the pricing of this debt is described below.

If the firm currently has outstanding debt (i.e., $\kappa_t^i > 0$), then the firm cannot alter its debt contract, so that $\kappa_{t+1}^i = \kappa_t^i$, unless one of the following conditions occur: i) The debt randomly expires between t and $t+1$, which happens with probability p^{exp}, ii) The firm chooses to default at the start of $t+1$. In both of these cases, $\kappa_{t+1}^i = 0$, and the firm can

[2] It is possible that $N_t^i < \mu N_{t-1}^i$, in which case μN_{t-1}^i cannot be interpreted as tenured employees. In this case we would interpret the total wage bill as including payments to prematurely laid-off employees. Note that the wage bill can be rewritten as $\overline{w}_t^i N_t^i = \overline{w}_{t-1}^i N_t^i + (\mu N_{t-1}^i - N_t^i)(\overline{w}_t^i - w_t)$. Here the first term on the right is the wage paid to current employees and the second term represents the payments to prematurely laid off employees.

[3] See Barwell and Schweitzer (2007), Devicenti, Maida, and Sestito (2007), and Bauer, Goette, and Sunde (2007), Dickens, Goette, Groshen, Holden, Messina, Schweitzer, Turunen, and Ward (2007).

issue new debt at $t+1$. We also assume that a firm's debt cannot expire before it has paid its first coupon payment.

The probability of debt expiration also determines the expected maturity of the debt, i.e., the average length of the debt contract is $\frac{1}{p^{\exp}}$. The firm defaults at t if its cum-dividend market value V_{t+1} is below 0. Additionally, consistent with payout-limiting covenants, if there is a positive amount of debt outstanding, the firm's dividend is not allowed to be so high as to make the firm's ex-dividend value less than or equal to zero.

In the event of bankruptcy, equity holders are left with nothing and creditors inherit a debt-free firm. Such a firm's cum-dividend value is denoted by V_{t+1}^0. Note that unlike most models of corporate debt, there are no explicit distress costs. However, long-term debt endogenously generates a debt overhang problem, as in Myers (1977), which causes under-investment. Therefore, despite the tax advantages of debt, forward looking firms choose to limit the amount of debt they take on. We will come back to this when we discuss the model's results.

The market price of a bond is determined in equilibrium; it depends on both the aggregate state (through the discount rate) and the firm's individual state (through probability of default and recovery value). It satisfies the following equation,

$$\Psi_t^i = E_t M_{t+1} \left[1_{\{\exp\}} \times 0 + 1_{\{V_{t+1} \leq 0\}} \times V_{t+1}^0 + \left(1 - 1_{\{\exp\}} - 1_{\{V_{t+1} \leq 0\}}\right) \left(\kappa_{t+1}^i + \Psi_{t+1}^i\right) \right], \tag{4}$$

where Ψ_t^i is the price of debt with coupon payment κ_{t+1}^i, $1_{\{\exp\}}$ is an indicator function that takes the value of one when the debt expires and zero otherwise, and $1_{\{V_{t+1} \leq 0\}}$ is an indicator function that takes the value of one when the firm is insolvent and zero otherwise.

2.1.4 Accounting. The equation for after-tax profit is

$$\Pi(K_t^i) = (1-\tau) \left(Y_t^i - \overline{w}_t^i N_t^i - F_t - \kappa_t^i\right) + \tau \delta K_t^i \tag{5}$$

$\Pi(K_t^i)$ is after-tax profit, which is output less labor, operating costs, coupon payments, and taxes, plus the capital depreciation tax shield. Operating costs are defined as $F_t = f \times K_t$;

they depend on aggregate (but not firm specific) capital.[4] Labor costs are $\overline{w}_t^i N_t^i$.

Convex capital adjustment costs are given by

$$\Phi(I_t^i, K_t^i) = \upsilon \left(\frac{I_t^i}{K_t^i} \right)^2 K_t^i,$$

where $\upsilon > 0$. The total dividend paid by the firm is

$$D_t^i = \Pi(K_t^i) - I_t^i - \Phi(I_t^i, K_t^i) + \Psi_t^i 1_{\{Issue\}}, \tag{6}$$

which is after-tax profit less investment and capital adjustment costs, plus the cash from newly issued debt where $1_{\{Issue\}}$ is an indicator function that takes the value of one when the firm issues new coupon and zero otherwise.

2.1.5 The Firm's Problem.

We now formally write down firm i's problem. The firm maximizes the present discounted value of future dividends

$$V_t^i = \max \left\{ 0, \max_{I_{t+j}^i, N_{t+j}^i, \kappa_{t+j+1}^i} E_t[\sum_{j=0,\infty} M_{t+j} D_{t+j}^i] \right\}, \tag{7}$$

subject to the standard capital accumulation equation

$$K_{t+1}^i = (1 - \delta) K_t^i + I_t^i, \tag{8}$$

as well as equations (2), (3), (4), (5), and (6).

2.1.6 Credit Spread.

We define the credit spread CS_t in the model as the difference between the yield ζ_t^B on the defaultable debt and the yield of a comparable bond without default risk, ζ_t, i.e.,

$$CS_t = \zeta_t^B - \zeta_t, \tag{9}$$

[4] Because this is a non-stationary economy, fixed costs must be scaled by some variable that is co-integrated with the economy. We choose aggregate capital because it is the smoothest state variable.

with $\zeta_t^B = \frac{\kappa_{t+1}^i}{\Psi_t^i}$ and $\zeta_t = \frac{\kappa_{t+1}^i}{\Psi_t^i(safe)}$ where $\Psi_t^i\,(safe)$ is the price of an identical bond (with the same expiry risk) but without the possibility of default.

2.2 Equilibrium

We assume that there exists some underlying set of aggregate state variables S_t which is sufficient for this problem. Each firm's individual state variables are given by the vector $S_t^i = [Z_t^i, K_t^i, N_{t-1}^i, \overline{w}_{t-1}^i, \kappa_t^i]$. Because the household is a representative agent, we are able to avoid explicitly solving the household's maximization problem and simply use the first order conditions to find M_{t+1} as an analytic function of consumption or expectations of future consumption. For instance, with CRRA utility, $M_{t+1} = \beta\left(\frac{C_{t+1}}{C_t}\right)^{-\theta}$ while for Epstein-Zin utility $M_{t+1} = \beta\left(\frac{C_{t+1}}{C_t}\right)^{-\frac{1}{\psi}}\left(\frac{U_{t+1}}{E_t[U_{t+1}^{1-\theta}]^{\frac{1}{1-\theta}}}\right)^{\frac{1}{\psi}-\theta}$.

Equilibrium consists of:

- Beliefs about the transition function of the aggregate state and the realized shocks: $S_{t+1} = \Gamma(S_t, Z_{t+1})$.
- Beliefs about the realized stochastic discount factor as a function of the aggregate state and the realized shocks: $M(S_t, Z_{t+1})$.
- Beliefs about the aggregate spot wage as a function of the aggregate state: $w(S_t)$.
- Beliefs about the price of debt, as a function of the state today and the firm's choice of coupon next period: $\Psi_t^i\left(S_t, S_t^i, \kappa_{t+1}^i\right)$.
- Firm policy functions for labor demand N_t^i and investment I_t^i, these are functions of S_t and S_t^i.

It must also be the case that given the above policy functions, all markets clear and the beliefs are consistent with simulated data, and therefore rational:

- The firm's policy functions maximize the firm's problem given beliefs about the wages, the discount factor, and the aggregate state variable.

- The labor market clears: $\sum N_t^i = N_t$. Recall that N_t is a function of the exogenous shock, which is part of the aggregate state S_t.
- The goods market clears: $C_t = \sum D_t^i + \kappa_i^t - \Psi_t^i 1_{\{Issue\}} + \overline{w}_t^i N_t^i + T_t^i + \Phi_t^i + F_t$. Inside the sum, the terms represent, in order, dividends paid by the firm, coupon payments made by the firm, cash paid to the firm during debt issuances, wages paid by the firm, taxes paid by the firm, capital adjustment costs, and fixed costs. Note that here we are assuming that all costs are paid by firms to individuals and are therefore consumed. The results look similar if all costs are instead wasted.
- The beliefs about M_{t+1} are consistent with goods market clearing through the household's Euler Equation.
- The belief about the price of debt is consistent with equation 4.
- Beliefs about the transition of the state variables are correct. For instance if aggregate capital is part of the aggregate state vector S_t, then it must be that $K_{t+1} = (1-\delta)K_t + \sum I_t^i$ where I_t^i is each firm's optimal policy.

3 Calibration

We solve the model at a quarterly frequency using a variation of the Krusell and Smith (1998) algorithm. We discuss the solution method in the appendix. The model requires us to choose the preference parameters: β (time discount factor), θ (risk aversion), ψ (IES); the technology parameters: α and ρ (these jointly determine the labor share of output and the degree of return to scale), $\frac{1}{1-\eta}$ (elasticity of substitution between labor and capital), δ (depreciation), f (operating cost), ν (capital adjustment cost). Finally, we must choose μ, which determines the frequency of wage resetting, and $p^{\exp}$, which determines the duration of corporate debt. Additionally, we must choose a process for aggregate productivity shocks, and for idiosyncratic productivity shocks. Table 1 presents parameters of the benchmark calibration, many of the parameter choices are the same as in Favilukis and Lin (2015b) and a more in depth justification of the choices can be found there.

Preferences β is set to 0.9975 per quarter, this parameter directly impacts the level of the risk-free rate and is also related to the average investment to output ratio. θ is set to 6.5, to get a reasonably high Sharpe ratio, while keeping risk aversion within the range recommended by Mehra and Prescott (1985). ψ (IES) is set to 2, this also helps with the Sharpe ratio, its value is consistent with the LRR literature.

Technology δ is set to 0.0233, to match quarterly depreciation. Our production function has constant elasticity of substitution (CES), which includes Cobb-Douglas production as a special case if $\eta = 0$. We set $\eta = 1$, which matches empirical estimates of the elasticity of substitution between labor and capital. In our model this elasticity is $\frac{1}{1-\eta} = 0.5$, which is consistent with estimates between 0.4 and 0.6 in a survey article by Chirinko (2008).

The parameters α and ρ are related to labor share, profit share, and the investment to capital ratio.[5] We set $\rho = 0.8$ and $\alpha = 0.5$, these allow the model with $\eta = -1$ to have roughly the same profit share (0.2), labor share (0.6), and investment-to-output ratio (0.2) as the U.S. economy.

Operating Cost $\digamma_t = f * K_t$ is a fixed cost from the perspective of the firm, however it depends on the aggregate state of the economy, in particular on aggregate capital. We choose $f = 0.02$ to roughly match the average market-to-book ratio (1.33) and default rate (0.6% per year) in the U.S. economy. While we think it is realistic for this cost to increase when aggregate capital is higher (during expansions), the results are not sensitive to this assumption. The results look very similar when $\digamma_t$ is simply growing at the same rate as the economy.

Capital Adjustment Cost We choose the capital adjustment cost ν to match the volatility of aggregate investment growth relative to the volatility of private GDP growth.

Productivity Shocks In order for the standard LRR channel (IES>1) to produce high Sharpe ratios, aggregate productivity must be non-stationary with a stationary growth rate. As Bansal and Yaron (2004) and Croce (2014), we assume productivity growth follows and ARMA(1,1) process: $g_{t+1} = x_t + \epsilon_{t+1}$ where $E_t[g_{t+1}] = x_t = \rho_x x_{t-1} + \eta_t$ is an AR(1) process and ϵ_{t+1} is an i.i.d. shock. We discretize x and ϵ to have 3 states each and choose

[5] In the Cobb-Douglas case, labor share and profit share are $(1-\alpha)\rho$ and $(1-\alpha)(1-\rho)$, the more general CES case does not allow for simple analytic formulas for these relationships.

the process to roughly match the volatility of the growth rate of real private GDP, which is 3.21% (1948-2014).[6]

Idiosyncratic productivity of firm i is Z_t^i. This follows a three-state Markov chain $Z_t^i \in \{Z_1^i, Z_2^i, Z_3^i\}$, where $Pr(Z_{t+1}^i = Z_j | Z_t^i = Z_k) = \pi_{kj}^Z \geq 0$. The parameters of this process are identical for all firms but the process is independent across firms. Note that unlike aggregate productivity, the level of firm productivity is stationary. We choose parameters so that the annual autocorrelation and unconditional standard deviation of Z_t^i are 0.9 and 0.1 respectively.[7]

Frequency of wage resetting In standard models wages are reset once per period, and employees receive the marginal product of labor as compensation. This corresponds to the $\mu = 0$ case. However, wages are far too volatile in these models relative to the data. We choose the frequency of resetting to roughly match the volatility of wages in the data. This results in $\mu = 0.9$ or an average resetting frequency of ten quarters, this may be thought as not only explicit contract length but also as any implicit mechanism which prevents more frequent resetting.[8]

Debt and Taxes We set the corporate tax rate τ to be 30%, which is consistent with the U.S. tax code. The only parameter governing debt is the probability of expiry p^{exp}, which is set to 0.025. This implies that corporate debt is repaid, on average, after 10 years. This number is roughly consistent with the duration of U.S. corporate debt. We chose this number because the trade-off between the tax advantage of financial leverage, and the debt overhang costs of under-investment, which are induced by long-term debt, imply a leverage ratio similar to that in the data.

[6] $\epsilon = \{-0.043, 0, 0.043\}$ with equal probability. $x = \{1.002, 1.005, 1.008\}$ with transition probabilities $\pi_{11} = 0.938$, $\pi_{12} = 0.062$, $\pi_{13} = 0$, $\pi_{21} = 0.031$, $\pi_{22} = 0.938$, $\pi_{23} = 0.031$, $\pi_{31} = 0$, $\pi_{32} = 0.062$, $\pi_{33} = 0.938$.

[7] The actual values are $Z_L = 0.2125$, $Z_M = 0.25$, $Z_H = 0.2875$ and the transition probabilities are $\pi_{11}^Z = 0.965$, $\pi_{12}^Z = 0.035$, $\pi_{13}^Z = 0$, $\pi_{21}^Z = 0.0175$, $\pi_{22}^Z = 0.965$, $\pi_{23}^Z = 0.0175$, $\pi_{31}^Z = 0$, $\pi_{32}^Z = 0.035$, $\pi_{33}^Z = 0.965$. We set the mean of Z^i to be 0.25 so that the average capital in our model is roughly the same as in a model solved annually with the same production function.

[8] An in depth discussion of this parameter can be found in Favilukis and Lin (2015b). Rich and Tracy (2004) estimate that a majority of labor contracts last between two and five years with a mean of three years. Estimates of separation rates for the US are around 3%/month (Hobijn and Sahin (2009), Shimer (2005)). If separations were equally likely for all workers, this would imply an average job length of around 2.8 years.

4 Model Results

In this section, we study the model implications for credit markets. First, it is useful to review the results in Favilukis and Lin (2015b), who solve a model very similar to the one presented here, but without an endogenous capital structure.

Favilukis and Lin (2015b) show that adding rigid wages to an otherwise standard model can improve the model's asset pricing performance. This is because rigid wages act like operating leverage, leading to more pro-cyclical profits and dividends. On the other hand, frictionless models tend to have wages that are too volatile, profits that are too smooth, and dividends that are counter-cyclical. Labor induced operating leverage caused by rigid wages greatly increases equity volatility. In addition, because labor leverage varies through time and in the cross-section, expected equity returns vary through time and across firms. In models of rigid wages, labor leverage is high when labor share is high, or when wage growth is low (the later effect happens because after a negative productivity shock, output is falling but wages are falling by less). Favilukis and Lin (2015a) show that indeed, wage growth negatively forecasts equity returns at the aggregate, industry, and U.S. state levels. Here, we extend the analysis to credit markets.

4.1 Aggregate Quantities

Table 2 presents aggregate statistics from our model; although the model is solved quarterly, we aggregate all results to an annual frequency. Panel A shows that the model does a reasonably good job at matching macroeconomic moments, with the volatilities of investment, consumption, and wages all about the right magnitude relative to the volatility of output.

In a standard model with Cobb-Douglas ($\eta = 0$) production and no wage rigidity ($\mu = 0$), wages are perfectly correlated with output and the labor share is constant. In our model, labor leverage arises due to a combination of wage rigidity ($\mu > 0$) and labor-capital complementarity ($\eta < 0$). Favilukis and Lin (2015b) show that these two departures from the standard model both induce labor leverage by reducing the volatility of wages and the correlation of wages with output. Because labor expenses are such a large fraction of the firm's total expenses, labor leverage can have a large influence on asset prices.

Panel B reports the means and volatilities of the risk free rate, the equity return, and the return on a corporate debt index. Due to a relatively high IES, the risk free rate is low and smooth and there is no risk free rate puzzle - this is a long run risk effect, as in Bansal and Yaron (2004). Although the equity volatility is only about half of what it is in the data, this is already a significant improvement over what a frictionless model would produce - this channel is explained in Favilukis and Lin (2015b).

Panel C reports several credit market variables: the leverage ratio, the default rate, and the credit spread. Market leverage (the ratio of the market value of the debt to the market value of the firm) is counter-cyclical, as in the data, because the market value of equity is more sensitive to aggregate shocks than the market value of debt. Importantly, the under leverage puzzle – the quantitative observation that trade-off theory between taxes and bankruptcy costs implies leverage that is much higher than in the data – is not present in our model. As in standard trade-off theory, firms in our model wish to take advantage of the interest tax deduction by issuing debt. In standard trade-off theory, this force is countered by the higher probability of paying bankruptcy costs when leverage is high. In our model, explicit bankruptcy costs are absent, however, the debt overhang problem limits the amount of debt financing firms choose to use.

The debt overhang problem, as described by Myers (1977), is that firms that have outstanding debt will invest less than optimal, which is bad for the firm's total value (debt plus equity). Equity holders anticipate future under-investment, and limit the amount of debt issued, despite the tax advantage. Hennessy (2004) and Moyen (2007) pointed out that the debt overhang problem may be more severe for long-term assets and long-term debt. We find that allowing for long-term debt, even without bankruptcy costs or financing frictions, is enough to generate a realistic leverage ratio. We also find that long-term debt overhang, and long run risk interact to make the effect quantitatively stronger.[9]

[9] Ours is not the first dynamic model with a realistic leverage ratio. For example, Hennessy and Whited (2005), Hennessy and Whited (2007), DeAngelo et al. (2007), and Li et al. (2015), among others, have shown that a realistic combination of financial frictions and distress costs can generate a realistic leverage ratio. We abstract from such frictions in our model.

The default rate, which is closely related to the size of idiosyncratic shocks and the fixed cost f, has a similar magnitude and volatility as in the data, although it is more counter-cyclical than in the data. It is counter-cyclical because when the economy is hit by negative shocks and revenues to fall, firms are unable to reduce the interest payments on long-term debt contracts, and find it optimal to default rather issue more equity. This effect is magnified by the presence of wage rigidity: not only do firms need to make fixed payments to creditors, which rise relative to revenues in bad times, firms must also make semi-fixed payments to employees, which also rise relative to revenues in bad times.

Finally, the credit spread in our model has similar magnitude, volatility, and cyclicality to the credit spread in the data. The credit spread is counter-cyclical because, as discussed above, expected defaults are highest after a series of negative output shocks. This is when both interest and wage obligations are highest relative to revenues. Because shocks are persistent, this is also when the credit spread is highest. Jones, Mason, and Rosenfeld (1984), Huang and Huang (2012), among others, argue that the size of the credit spread is difficult to rationalize in standard models, this is referred to as the credit spread puzzle. In our model, the credit spread is large due to an interaction between long-term corporate debt and long run risk. Bhamra et al. (2010a) have previously shown that long run risk can account for a sizable credit spread. In a long run risk world, shocks to the long-term growth rate of the economy are especially important for the price of risk. Safe long-term debt is a very good hedge against such shocks, because it promises a fixed set of payments far into the future, even if the economy experiences a long sequence of low growth. However, unlike safe long-term debt, corporate debt is likely to default exactly after such a low growth sequence. As a result, the spread between risky and safe corporate debt is large. As mentioned earlier, rigid wages magnify this effect because firms are limited in their ability to reduce their labor expenses when negative economic shocks hit. It is useful to compare this mechanism to Chen et al. (2009), who argue that defaults are likely to occur when the price of risk is high and use Campbell and Cochrane (1999) habit preferences to rationalize a large credit spread.

4.2 The interaction of labor and credit markets

As discussed earlier, if wages are rigid, labor leverage is especially high when wage growth is low, or when labor share is high. Our model suggests that times when labor leverage is high, as measured by low wage growth or high labor share, are times when the credit markets are especially risky. Thus, low wage growth and high labor share should be associated with stress in the credit markets.

To test this, we regress the credit spread at $t+1$, or the issuance of debt between t and $t+1$, on either labor share or on wage growth (labor expense growth for firm-level). We define the issuance of debt to be the change in the book value of debt between t and $t+1$. Table 3 reports these results for aggregate U.S. data, and aggregate model data in Panel A; and for firm-level international data, and firm-level model data in Panel B. Firm-level regressions employ the Fama and MacBeth (1973) cross-sectional approach. The results in this table are all univariate to facilitate the comparison of model and data. Below we discuss the data in detail and present a more thorough empirical analysis.

Consistent with our intuition, wage growth (negatively) and labor share (positively) forecast credit spread. At the same time, wage growth (positively) and labor share (negatively) forecast issuance of new debt. These results suggest that indeed, high labor leverage is associated with distress in the credit market. These are times when losses are high, issuance costs are high, and firms are hesitant to take on new debt. The slopes for credit spread and debt issuance are significant in both aggregate, and firm-level regressions.

Note that in a frictionless, Cobb-Douglas model, labor share is constant and cannot predict credit market quantities. The predictive power of labor share suggests that, at least through the lens of our model, accounting for labor market frictions is important for understanding credit markets. Interpreting the predictive power of wage growth is somewhat more complicated. In a frictionless, Cobb-Douglas model, wage growth is perfectly correlated with output growth, and can predict credit market quantities only if output growth can. Indeed, in such an economy, output growth does have predictive power, because of the properties of long-term debt. However, wage growth, once we control for output growth, cannot have predictive power in a frictionless, Cobb-Douglas economy. We have redone the exercise in Table 3 but with output growth as a control. In both model and data, wage growth remains a predictor of credit market variables, again suggesting that, through the lens of our model, labor market frictions are important for understanding credit markets.

5 Empirical Evidence

In this section we further explore the relationship between labor markets and credit markets. We do so first, using aggregate, time series U.S. data, and second, using firm-level data across a wide range of countries.

5.1 Time Series Analysis

We first describe the data, then the empirical specifications and the results.

5.1.1 Data and Variable Definitions. Panel A in Table 4 reports the descriptive statistics for the variables we use in our aggregate regressions. Panel B in Table 4 presents the correlations of all variables of interest with real GDP growth, and their cross correlations. Credit spread is counter-cyclical, the correlation with GDP growth is -0.52. Wage growth and investment growth are pro-cyclical, the correlations with GDP growth are 0.49 and 0.72, respectively; both are negatively correlated with credit spread. However, wage growth is only mildly positively correlated with investment growth, implying that wage growth contains different information than investment growth for explaining credit spread. Both labor share and financial leverage are negatively correlated with GDP growth, the correlations are -0.14 and -0.24, respectively. Consistent with the existing literature, the credit spread is positively correlated with financial leverage, market volatility, and the term spread. The relationship between the credit spread, wage growth, and labor share is also evident in Figure 1 where credit spread moves together with labor share, and in the opposite direction of wage growth.

The variables definitions are below.

Credit spread We use the Moody's Baa corporate bond yield in excess of Aaa corporate bond yield from the Federal Reserve. Chen et al. (2009) argue that the Baa-Aaa spread mostly reflects credit risk, because the components due to taxes, call/put/conversion options and liquidity are of similar magnitude for Aaa and Baa bonds.

Debt growth Aggregate debt growth is the growth rate of â€œNonfinancial business; credit market instruments; liabilityâ€ from Flow of Funds Table L102. Although the most recent Table L102, does not report this as a separate item, this is also equal to the sum of commercial paper, munis, bonds, and loans.

Wage growth We use the growth rate in the real wages and salaries per full-time equivalent employee from NIPA Table 6.6.

Labor share Labor share is the ratio of aggregate compensation of employees to GDP.

Controls The empirical finance literature has identified several variables related to the credit spread. We measure financial leverage as the book value of credit market instruments of nonfinancial business sector divided by the sum of the market value of equity in the nonfinancial corporate business sector and the credit market instruments from the Flow of Funds Accounts. Stock market volatility is the annualized volatility of monthly CRSP stock market returns in excess of riskfree rate. Term spread is the difference between the ten-year Treasury bond yield and the three-month Treasury bill yield from the Federal Reserve. Spot rate is the one-year Treasure bill rate. Our sample is from 1948 to 2014.[10]

5.1.2 Predicting aggregate credit risk. In this subsection, we explore the predictability of wage growth and labor share for credit spread in three steps. All regressions are at an annual frequency. First, we run univariate regressions of one year ahead credit spread, CS_{t+1}, on current wage growth, ΔW_t, or labor share, LS_t at year t; second, we run horse race regressions of either wage growth or labor share with a control one at a time; third, we conduct a multivariate regression with all the predictors at the right hand side including lagged credit spread which controls for the persistency in credit spread. Recall that our in

[10] We start in 1948 because financial leverage from Flow of Funds is available after 1946. We do not start in 1946 to avoid the influence of the WWII on our results. However, the predictability of wage growth for credit spread holds in a longer sample starting from 1929.

our model, wage growth predicts the credit spread with a negative sign, while labor share predicts it with a positive sign; this was shown in 3; the results in this section are consistent with our model's predictions.

Univariate regressions The first column in panels A and B in Table 5 reports the univariate regression results. Wage growth negatively forecasts credit spread with a slope of -15.4, this is highly significant, with a t-statistic of 4.15. The explanatory power of wage growth is as strong as the conventional predictors: the adjusted R^2 is 0.28, this is comparable to the explanatory power of market volatility (0.22) and financial leverage (0.37). Labor share positively predicts credit spread with the slope of 10.66 and a t-statistic of 2.15.[11]

Horse race regressions The remaining columns in panels A and B of Table 5 present horse race (bivariate) regressions where wage growth (or labor share), jointly with one control at a time, is used to forecast the credit spread. Wage growth remains statistically significant in all specifications. Furthermore, some of the other predictors lose significance when wage growth is included. Labor share remains significant in most specifications, but becomes only marginally so when including financial leverage and market volatility.

Multivariate regressions The final column of each panel presents the multivariate kitchen sink regression and includes all controls. In these regressions, the adjusted R^2 is above 0.73; recall that wage growth alone attains an R^2 of 0.28. Wage growth remains significant after controlling for all variables; however labor share is no longer significant due to its high correlation with lagged credit spread. Given that there are 10 regressors and 66 years of annual observations, this regression may be overfitted.

5.1.3 Predicting aggregate debt growth.

Here we turn to an alternative measure of stress in the debt market. As argued before, high labor leverage, proxied by low wage growth or high labor share, makes debt especially unattractive, causing firms to issue less debt. Recall that, as shown in Table 3, in our model, wage growth predicts debt growth with a positive sign, while labor share predicts it with a negative sign. In this section,

[11]In univariate regressions, investment growth negatively forecasts credit spread, but the adjusted R^2 is only 0.03. Both financial leverage and stock market volatility positively predict credit spread, consistent with Collin-Dufresne et al. (2001). However, the price-to-earnings ratio, term spread, and spot rate do not significantly predict credit spread.

we use aggregate debt growth as the dependent variable and carry out exactly the same exercise as with credit spread. The results in this section are consistent with our model's predictions.

Table 6 presents regressions of debt growth on either wage growth (Panel A), or labor share (Panel B). Wage growth positively forecasts debt growth, with t-statistics around 4 in the univariate and bivariate regressions. Labor share predicts debt growth with a negative sign, although it is insignificant in most specifications. Neither is significant in the kitchen sink regression, although, as mentioned earlier, this regression may be overfitted.

5.2 Cross Sectional Analysis

In this section, analogous to the previous section, we test the relationship between labor markets and credit markets. However, rather than using aggregate data, we use a large, international cross-section of individual firms. We describe the firm-level data first, followed by the cross-sectional regression results.

5.2.1 Data. Our accounting data come from Compustat North America (for U.S. and Canadian firms) and Compustat Global (for firms from other countries) Fundamentals Annual files. Similarly, the security data come from CRSP and Compustat Global Security Daily respectively. We use Moody-KMV's Expected Default Frequency (EDF) data to measure the default probability for global firms from 1992 to 2011, which is also the sample period for most of our firm-level analysis.

In Table 7, we report the number and percentage of annual (firm-year) observations that have non-missing labor expenses (Compustat variable XLR) and EDF for each of the thirty-nine countries. We follow Gao, Parsons, and Shen (2015) to filter out outliers and categorize the countries into seven different regions. First of all, we can see that for the U.S., only 7% (= 9588/135632) of the observations have non-missing labor expenses. If we further require non-missing EDF data, this percentage drops to 3.6%. Therefore, the sample with labor expenses based on U.S. firms is quite small and it is difficult to draw conclusions from this sample only. This is the main reason that we expand our scope to global firms for our firm-level analysis. Outside of the U.S., many countries have relatively good coverage of labor expenses, especially European countries. Japan is an exception — there are only 2 annual observations with XLR available — therefore our analysis does not include Japan.

Table 8 reports summary statistics for our main variables of interest: EDF, ΔXLR, and LS, where $\Delta XLR_{t+1} = \frac{XLR_{t+1} - XLR_t}{0.5(XLR_{t+1} + XLR_t)}$ is the labor expenses growth rate from year $t-1$ to year t and $LS_t = XLR_t/(XLR_t + EBITDA_t)$ is the labor share of value added at year t. Both ΔXLR and LS show quite a bit of variation across regions. In general, developed countries have higher labor share and lower labor expenses growth, whereas developing countries have lower labor share and higher labor expenses growth.[12]

5.2.2 Predicting Firm-Level Credit Risk. In this subsection, we show that at the firm-level, high labor leverage, measured by low compensation growth or high labor share, is associated with stress in the credit market, measured by expected default probability. The results below are consistent with the aggregate results presented earlier (Table 5), and with our model (Table 3).

We first conduct univariate, firm-level, time-series analysis. We compute the correlation of ΔXLR_t with EDF_{t+1}, and of LS_t with EDF_{t+1} for each individual firm using its time-series observations. We then report the mean of these correlations for each country in Table 9. We also report the t-statistic corresponding to the test $H_0 : Corr(\Delta XLR, EDF) = 0$. The average value of $Corr(\Delta XLR, EDF)$ is -0.04 for all countries (11,677 firms) with a t-stat of -7.89, suggesting that a fall in labor expenses (rise in labor leverage) is associated with high credit risk. The relationship is statistically significant for 16 of 38 countries, and the insignificant countries tend to have a small number of firms in the sample. The average value of $Corr(LS, EDF)$ is 0.18 for all countries (12,483 firms) with a t-stat of 34.24, suggesting that a high labor share is associated with high credit risk. The average value of this correlation is also positive and statistically significant for 31 of the 38 countries. These univariate, firm-level results indicate that labor obligations are an important determinant

[12] Both ΔXLR and LS are winsorized at 1% and 99% percentiles. The mean values of un-winsorized variables are much higher — an indication of outliers in labor expenses.

of credit risk.

We repeat the same univariate exercise but instead of EDF_{t+1}, we compute the correlation with debt growth between t and $t+1$. We define debt growth as $\Delta Debt_{t+1} = \frac{Debt_{t+1} - Debt_t}{0.5(Debt_t + Debt_{t+1})}$. These results are in Table 10. The average value of $Corr(\Delta XLR, \Delta Debt)$ is 0.03 for all countries (15,447 firms) with a t-stat of 7.47, suggesting that a fall in labor expenses (rise in labor leverage) is associated with low debt growth. Although the pooled result is highly significant, this relationship is generally weaker, with significance in only 10 of 38 countries. The average value of $Corr(LS, \Delta Debt)$ is -0.05 for all countries (16,972 firms) with a t-stat of 11.90, suggesting that a high labor share is associated with low debt growth. The average value of this correlation is also positive and statistically significant for 19 of the 38 countries. As with EDF, these results indicate that labor obligations are an important determinant of firms' capital structure choices.

Next, we use the Fama and MacBeth (1973) approach to analyze the predictive power of labor obligations for credit risk: within each period t, we run a cross-sectional regression of EDF_{t+1} on labor expenses growth realized in year t, or labor share in year t. We control for a list of well-known determinants of credit and distress risk, as suggested by Altman (1968), Zmijewski (1984), Collin-Dufresne et al. (2001), Shumway (2001), and Campbell, Hilscher, and Szilagyi (2008), among others. These regressions are analogous to the univariate regressions for both model and data in Table 3. In particular, when we use labor expenses growth (or labor share) as a determinant for default risk, we run the following cross-sectional regression

$$EDF_{i,t+1} = a + b \times \Delta XLR_{it} (\text{or } LS_{it}) + \boldsymbol{b_1} \times \boldsymbol{X_{it}} + \epsilon_{it}, \tag{10}$$

where $\boldsymbol{X_{it}}$ is a vector of firm characteristics that includes time t leverage, stock return volatility, working capital, retained earnings, EBIT, sales growth, net income, current asset to liability ratio, investments, relative firm size, market capitalization. We also control for individual firm's stock excess return and the market return for its country in year t. These regressions include country fixed effects.

The regression results are reported in Table 11, where the results on the left are for ΔXLR as the explanatory variable, and the results on the right are for LS as the explanatory variable. The coefficient on ΔXLR is negative and statistically significant, while the coefficient on LS is positive and statistically significant. For example, when we include all control variables, the t-statistics on ΔXLR and LS are -7.20 and 4.55 respectively. Thus, labor market variables forecast credit risk beyond the traditional characteristics in the existing literature.

5.2.3 Predicting Firm-Level Debt Growth.

We repeat exactly the same exercise as in the previous section, except that the left hand side variable is now debt growth, defined as $\Delta DEBT_{t+1} = \frac{DEBT_{t+1} - DEBT_t}{0.5(DEBT_{t+1} + DEBT_t)}$. This is regressed on time t compensation growth $\Delta XLR_t = XLR_t / XLR_{t-1}$ or time t labor share $LS_t = \frac{XLR_t}{Sales_t}$, and a set of controls. These results are in Table 12, which is analogous to Table 11.

As expected, the coefficients have opposite signs to the EDF regressions. Times of high labor leverage (low compensation growth, high labor share) are associated with relatively low issuance of new debt. For example, when we include all control variables, the t-statistic is 5.68 for ΔXLR and -4.23 for LS. As with EDF, the positive coefficient on compensation growth and the negative coefficient on labor share are consistent with our aggregate analysis in Table 5, and with our model.

Finally, in Tables 13 and 14, we investigate the relationship between labor share and the *level* of financial leverage, rather than the growth rate of debt. Table 13 is analogous to Tables 11 and 12, where Fama and MacBeth (1973) regressions are used to test the relationship between financial leverage at $t+1$, and labor share at t and controls. On the other hand, Table 14 presents the results of a cross-sectional regression which compares the average financial leverage over the entire sample for each firm, with the average labor share of that firm, and controls. This is done for both market and book leverage.

We also present these results graphically in Figure 2. The three panels on the left are for book leverage, while on the right are for market leverage. In the top two panels, we plot each country's median labor share against its median financial leverage. In the middle two panels, we compute a median labor share (leverage) by subtracting a country labor share (leverage) from a firm's labor share (leverage). We then sort firms into 100 portfolios based on labor share and plot each portfolio's median. We present results from the model in the bottom two panels. These show a strikingly strong negative relationship between labor share and financial leverage.

We find that consistent with the debt growth regression, firms with high labor share tend to have less debt in the capital structure. The results are highly significant, with average labor share alone explaining roughly 6% of the variation in average financial leverage across firms; this rises to 14% once controlling for country fixed effects. Since high labor share makes the firm riskier, high labor leverage firms behave optimally, by having less financial leverage in the capital structure. We interpret these results to say that high labor leverage is associated with more risk in credit markets.

6 Conclusion

We argue that understanding labor markets is crucial for understanding credit markets. We first solve a model with labor market frictions and show that in such a model, the credit spread is predictable by wage growth (negatively) and labor share (positively). Conversely, debt growth is predictable by wage growth (positively) and labor share (negatively). This is because these variables are related to labor induced operating leverage, which makes debt more risky. In addition to time-series dynamics, the model performs well quantitatively along several dimensions, including the average size of the credit spread, the default rate, the financial leverage ratio, and the mean and volatility of equity returns. We explore this model's implications in both aggregate and firm-level data and find broad support for the labor leverage channel.

Regarding credit risk, we find that the aggregate U.S. Baa-Aaa credit spread is negatively predicted by wage growth and positively by labor share. Similarly, we find that the firm-level Moody-KMV expected default probability (for a large cross-section of international firms) is negatively predicted compensation growth, and positively by labor share.

Regarding capital structure, we find that the growth rate of aggregate debt in the U.S. is positively predicted by wage growth and negatively by labor share. Similarly, we find that the firm-level debt growth (for a large cross-section of international firms) is positively predicted compensation growth, and negatively by labor share.

Taken together, these results suggest that labor markets have an important effect on credit markets. Information from labor markets should be considered when computing the cost of debt capital, and the decision to issue debt.

A Numerical Solution

A.1 Making the Model Stationary

Note that the model is not stationary. In order to solve it numerically, we must rewrite it in terms of stationary quantities. We will show that a normalizing all non-stationary variables by Z_t^ρ implies a stationary competitive equilibrium. We will do this in two steps. First we will show that if the firm believes that the stochastic discount factor is stationary and that aggregate quantities (in particular the spot wage) normalized by Z_t^ρ are stationary than the firm's policy functions normalized by Z_t^ρ will also be stationary. Second we show that these policy functions imply that these aggregate quantities are indeed stationary when normalized by Z_t^ρ.

The firm's problem is:

$$\begin{aligned} V(Z_t^i, K_t^i, N_{t-1}^i, \kappa_t^i, \overline{W}_{t-1}^i; Z_t, K_t, S_t, \overline{W}_{t-1}) \quad &= \quad \max_{I_t^i, N_t^i, \kappa_{t+1}^i} (1-\tau)\left(Y_t^i - \overline{w}_t^i N_t^i - F_t - \kappa_t^i\right) + \tau\delta K_t^i \\ &+ E_t[M_{t+1} V(Z_{t+1}^i, K_{t+1}^i, N_t^i, \kappa_{t+1}^i, \overline{W}_t^i; Z_{t+1}, K_{t+1}, S_{t+1}, \overline{W}_t)] \end{aligned} \tag{11}$$

Where Z_t^i is the idiosyncratic productivity, K_t^i is the firm's individual capital, N_{t-1}^i is the firm's employment last period, κ_t^i is the current coupon payment paid, $\overline{W}_{t-1}^i$ is the firm's average wage last period, Z_t is aggregate productivity, $\overline{W}_{t-1}$ is the aggregate average wage from last period, and W_t is the spot wage this period. Following Krusell and Smith (1998) the state space potentially contains all information about the joint distribution of capital and productivity. K_t and S_t summarize this distribution. We explicitly write its first moment K_t as an aggregate state variable and let S_t be a vector of any other relevant moments normalized by the mean (i.e. the normalized second moment is $E[(K_t^i - K_t)^2]/K_t^2$).

Households have beliefs about the evolution of the aggregate quantities M_{t+1}, K_t, and S_t and about the spot wage as a function of the aggregate state. Aggregate wage evolves as $\overline{W}_t = \mu\overline{W}_{t-1} + (1-\mu)W_t$. The individual state variables evolve as:

$$\begin{aligned} K_{t+1}^i &= (1-\delta)K_t^i + I_t^i \\ \overline{W}_t^i &= \frac{\overline{W}_{t-1}^i N_{t-1}^i \mu + (N_t^i - N_{t-1}^i \mu) W_t}{N_t^i} \end{aligned} \tag{12}$$

Let us define $k_t^i = \frac{K_t^i}{Z_t^\rho}$, $k_t = \frac{K_t}{Z_t^\rho}$, $i_t^i = \frac{I_t^i}{Z_t^\rho}$, $\hat{\kappa}_t^i = \frac{\kappa_t^i}{Z_t^\rho}$,$w_t = \frac{W_t}{Z_t^\rho}$, $\overline{w}_t^i = \frac{\overline{W}_t^i}{Z_{t+1}^\rho}$, and $\overline{w}_t = \frac{\overline{W}_t}{Z_{t+1}^\rho}$ (not that the timing of $\overline{w}_t^i$ and $\overline{w}_t$ differs from the others). We will now show by induction that the value function is linear in Z_t^ρ. Suppose this is true at t+1:

$$V(Z_{t+1}^i, K_{t+1}^i, N_t^i, \kappa_t^i, \overline{W}_t^i; Z_{t+1}, K_{t+1}, S_{t+1}, \overline{W}_t) = Z_{t+1}^\rho V(Z_{t+1}^i, k_{t+1}^i, N_t^i, \kappa_{t+1}^i, \overline{w}_t^i; 1, k_{t+1}, S_{t+1}, \overline{w}_t)$$

Than we can rewrite the firm's problem as:

$$
\begin{aligned}
V(Z_t^i, k_t^i, N_{t-1}^i, \hat{\kappa}_t^i, \overline{w}_{t-1}^i; 1, k_t, S_t, \overline{w}_{t-1}) \;=\;& \max_{i_t^i, N_t^i, \kappa_{t+1}^i} (1-\tau)\left(Y_t^i - \overline{w}_t^i N_t^i - F_t - \kappa_t^i\right) + \tau\delta K_t^i \\
& + E_t[\left(\frac{Z_{t+1}}{Z_t}\right)^{\rho} M_{t+1} V(Z_{t+1}^i, k_{t+1}^i, N_t^i, \hat{\kappa}_{t+1}^i, \overline{w}_t^i; 1, k_{t+1}, S_{t+1}, \overline{w}_t)]
\end{aligned}
\tag{13}
$$

where the aggregate wage evolves as $\overline{w}_t = (\mu \overline{w}_{t-1} + (1-\mu) w_t)\left(\frac{Z_{t+1}}{Z_t}\right)^{-\rho}$ and the individual state variables evolve as:

$$
\begin{aligned}
k_{t+1}^i &= \left((1-\delta)k_t^i + i_t^i\right)\left(\frac{Z_{t+1}}{Z_t}\right)^{-\rho} \\
\overline{w}_t^i &= \left(\frac{\overline{w}_{t-1}^i N_{t-1}^i \mu + (N_t^i - N_{t-1}^i \mu) w_t}{N_t^i}\right)\left(\frac{Z_{t+1}}{Z_t}\right)^{-\rho}
\end{aligned}
\tag{14}
$$

As long as $\left(\frac{Z_{t+1}}{Z_t}\right)^{\rho}$, M_{t+1}, k_{t+1}, and w_{t+1} are stationary this is a well defined stationary problem where the firm's optimal policy (i_t^i and N_t^i) will also be stationary. But this implies that k_{t+1}^i and $k_{t+1} = \sum k_{t+1}^i$ are stationary as well, confirming the firm's beliefs.

It is similarly straight forward to show that the stochastic discount factor is stationary. First of all note that M_{t+1} is related to the growth rate of consumption, so it should be stationary. More formally:

$$
\begin{aligned}
U_t &= \left(C_t^{1-\frac{1}{\psi}} + \beta E_t[U_{t+1}^{1-\theta}]^{\frac{1-\frac{1}{\psi}}{1-\theta}}\right)^{\frac{1}{1-\frac{1}{\psi}}} \\
M_{t+1} &= \beta\left(\frac{U_{t+1}}{E_t[U_{t+1}^{1-\theta}]^{\frac{1}{1-\theta}}}\right)^{\frac{1}{\psi}-\theta}\left(\frac{C_{t+1}}{C_t}\right)^{-\frac{1}{\psi}}
\end{aligned}
\tag{15}
$$

Define $c_t = \frac{C_t}{Z_t^{\rho}}$ and $u_t = \frac{U_t}{Z_t^{\rho}}$ and note that the firm's optimal policy implies that c_t is stationary. Now we can rewrite the above equations as:

$$
\begin{aligned}
u_t &= \left(c_t^{1-\frac{1}{\psi}} + \beta E_t[\left(\frac{Z_{t+1}}{Z_t}\right)^{\rho} u_{t+1}^{1-\theta}]^{\frac{1-\frac{1}{\psi}}{1-\theta}}\right)^{\frac{1}{1-\frac{1}{\psi}}} \\
M_{t+1} &= \beta\left(\frac{\left(\frac{Z_{t+1}}{Z_t}\right)^{\rho} u_{t+1}}{E_t[\left(\frac{Z_{t+1}}{Z_t}\right)^{\rho} u_{t+1}^{1-\theta}]^{\frac{1}{1-\theta}}}\right)^{\frac{1}{\psi}-\theta}\left(\frac{c_{t+1}}{c_t}\right)^{-\frac{1}{\psi}}\left(\frac{Z_{t+1}}{Z_t}\right)^{-\frac{\rho}{\psi}}
\end{aligned}
\tag{16}
$$

which are stationary as long as c_t is stationary.

Next, we must show that the spot wage is stationary. The firm's first order condition for labor implies:

$$
w_t = Z_t^i\left(\alpha(k_t^i)^{\eta} + (1-\alpha)(N_t^i)^{\rho\eta}\right)^{\frac{1-\eta}{\eta}}(1-\alpha)\rho(N_t^i)^{\rho\eta-1} + E_t[\left(\frac{Z_{t+1}}{Z_t}\right)^{\rho} M_{t+1}\frac{\partial V_{t+1}}{\partial N_t^i}]
\tag{17}
$$

For every firm, the right hand side is well defined and stationary, therefore the wage is too. To jointly find the wage and each firm's choice of N_t^i one must solve a system of N equations. N-1 equations where the right hand side of the first order condition for firm 1 is set equal to firm i (i=2,N), and the labor market clearing equation $\sum N_t^i = 1$.

There remains one last complication, is S_t stationary? This is related to a more general problem of the validity and accuracy of the Krusell and Smith (1998) algorithm. We cannot give an explicit answer as it is not clear what exactly S_t must contain. Krusell and Smith (1998) argue that S_t should contain higher order moments of the distribution since they fully describe the distribution. Since we define S_t to be normalized by its first moment, it is likely that these normalized higher moments are stationary. We have also checked the behavior of several simulated higher order moments and they appear stationary. In practice our numerical algorithm (described in the next section) only considers the first moment so S_t is an empty set, which is stationary by definition.

A.2 Numerical Algorithm

We will now describe the numerical algorithm used to solve the stationary problem above. We will first describe the algorithm used to solve a model with CRRA utility and then the extension necessary to solve the recursive utility version. The algorithm is a variation of the algorithm in Krusell and Smith (1998).

The aggregate state space is potentially infinite because it contains the full distribution of capital across firms. We follow Krusell and Smith (1998) and summarize it by the average aggregate capital k_t and the state of aggregate productivity ΔZ_t; because past wages matter, we augment the aggregate state space with the previous period's average wage $\overline{w}_{t-1}$. Each of these is put on a grid, with the grid sizes of 20 for capital, 9 for past wage, and 13 for coupon. Productivity is a 3-state Markov process. We also discretize the firm's individual state space with grid sizes of 25 for individual capital (k_t^i), 11 for last period's labor (N_{t-1}^i), and 5 for last period's average wage ($\overline{w}_{t-1}^i$). Individual productivity is a 2-state Markov process. We chose these grid sizes after careful experimentation to determine which grid sizes had the most effect on Euler equation errors and predictive R^2.

For each point in the aggregate state space $(k_t, \overline{w}_{t-1}, \Delta Z_t)$ we start out with an initial belief about consumption, spot wages, and investment (c_t, w_t, and i_t); note that this non-parametric approach is different from Krusell and Smith (1998).[13] From these we can solve for aggregate capital next period $k_{t+1} = ((1-\delta)k_t + i_t)\left(\frac{Z_{t+1}}{Z_t}\right)^{-\rho}$ for each realization of the shock. Combining k_{t+1} with beliefs about consumption as a function of capital we can also

[13]The standard Krusell and Smith (1998) algorithm instead assumes a functional form for the transition, such as $log(\overline{k}_{t+1}) = A(Z_t) + B(Z_t)log(\overline{k_t})$ and forms beliefs only about the coefficients $A(Z_t)$ and $B(Z_t)$ however we find that this approach does not converge in many cases due to incorrect beliefs about off-equilibrium situations and that our approach works better. Without heterogeneity and infrequent resetting we would not need beliefs about w_t because it would just be the marginal product of aggregate capital. Similarly, we would not need beliefs about c_t as we could solve for it from $y_t = c_t + i_t$ where y_t is aggregate output, however aggregate output is no longer a simple analytic function of aggregate capital.

solve for the stochastic discount factor next period: $M_{t+1} = \beta \left(\frac{c_{t+1}}{c_t}\right)^{-\theta} \left(\frac{Z_{t+1}}{Z_t}\right)^{-\theta\rho}$. This is enough information to solve the stationary problem described in the previous section. We solve the problem by value function iteration with the output being policies and market values of each firm for each point in the state space.

The next step is to use the policy functions to simulate the economy. We simulate the economy for 5500 periods (we throw away the initial 500 periods). In addition to the long simulation, we start off the model in each point of the aggregate state space. We must do this because unlike Krusell and Smith (1998), the beliefs in our algorithm are non-parametric and during the model's typical behavior it does not visit every possible point in the state space. From the simulation we form simulation implied beliefs about c_t, w_t, and i_t at each point in the aggregate state space by averaging over all periods in which the economy was sufficiently close to that point in the state space. Our updated beliefs are a weighted average of the old beliefs and the new simulation implied beliefs.[14] With these updated beliefs we again solve the firm's dynamic program; we continue doing this until convergence.

In order to solve this model with recursive preferences an additional step is required. Knowing c_t and k_{t+1} as functions of the aggregate state is not alone enough to know M_{t+1} because in addition to consumption growth, it depends on the household's value function next period: $M_{t+1} = \beta \left(\frac{C_{t+1}}{C_t}\right)^{-\frac{1}{\psi}} \left(\frac{U_{t+1}}{E_t[U_{t+1}^{1-\theta}]^{\frac{1}{1-\theta}}}\right)^{\frac{1}{\psi}-\theta}$. However this problem is not difficult to overcome. After each simulation step we use beliefs about c_t and k_{t+1} to recursively solve for the household's value function at each point in the state space. This is again done through value function iteration, however as there are no choice variables this recursion is very quick.

We perform the standard checks proposed by Krusell and Smith (1998) to make sure we have found the equilibrium. Although our beliefs are non-parametric, we can still compute an R^2 analogous to a regression; all of the R^2 are above 0.999. We have also checked that an additional state variable (either the cross-sectional standard deviation of capital or lagged capital) does not alter the results.

A.3 Variable Construction

Our firm-level control variables are constructed as follows:

- $WCTA$: Working capital is the ratio of Compustat item WCAP to total assets (Compustat item AT).

[14] The weight on the old belief is often required to be very high in order for the algorithm to converge. This is because while rational equilibria exist, they are only weakly stable in the sense described by Marcet and Sargent (1989). However, we find that this is only a problem when capital adjustment costs are very close to zero.

- $RETA$: Retained earnings is the ratio of Compustat item RE to total assets.
- $EBITTA$: EBIT is the ratio of Compustat item EBIT to total assets.
- $Leverage$: Financial leverage is defined as $(DLTT + DLC)/AT$, where $DLTT$ and DLC are Compustat items for long-term and short-term debt respectively. We also calculate an alternative measure using $(DLTT + DLC)/(DLTT + DLC + AT + TXDITC - PSTK - LT)$ but find that empirically the correlation between these two measures is high (95% correlation). Therefore we only report the results based on our main definition of financial leverage.
- STA: Sales is the ratio of Compustat item SALE to total assets.
- $NITA$: Net income is the ratio of Compustat item NI (for North America) and NICON (for Global) to total assets.
- $CACL$: Current ratio is the ratio of Compustat item ACT (current assets) to LCT (current liabilities).
- σ: Stock return volatility is the standard deviation of monthly returns. For US firms, stock returns are retried from CRSP. For firms in other countries, we use data from Compustat Global Security Daily to calculate stock return in month t as

  $$RET_t = \frac{PRCCD_t/AJEXDI_t \times TRFD_t - PRCCD_{t-1}/AJEXDI_{t-1} \times TRFD_{t-1}}{PRCCD_{t-1}/AJEXDI_{t-1} \times TRFD_{t-1}}$$

  where $PRCCD_t$ is the closing price at month end, $AJEXDI_t$ and $TRFD_t$ are the corresponding share and return adjustment factors.
- $Invest$: Investment ratio is defined as the ratio of Compustat item CAPX to lagged PPENT (Property, Plant and Equipment).
- $MCAP$: The market capitalization of a firm at year for is defined as the logarithm of the product of year end closing price (PRCCD) and shares outstanding (CSHOC).
- $RSIZE$: Relative size is defined as the logarithm of the ratio of company's market capitalization to the total market capitalization in its country at the year end. In other words, it is a company's weight in its country's value-weighted market portfolio.
- R_m: The return on the value-weighted market portfolio for each country at annual frequency.
- R_{excess}: The excess return of a firm's stock is defined as the difference between firm's raw return (RET) and the value-weighted market portfolio return (R_m).

References

Abowd, J. 1989. The Effect of Wage Bargains on the Stock Market Value of the Firm. *American Economic Review* 79:774–800.

Altman, E. I. 1968. Financial ratios, discriminant analysis, and the prediction of corporate bankruptcy. *Journal of Finance* 23:589–609.

Arellano, C., and A. Ramanarayanan. 2012. Default and the Maturity Structure in Sovereign Bonds. *Journal of Political Economy* 120:187–232.

Bai, H. 2015. Unemployment and Credit Risk. *Working Paper* .

Baldwin, C. 1983. Productivity and Labor Unions: An Application of the Theory of Self-Enforcing Contracts. *Journal of Business* 2:155–185.

Bansal, R., and A. Yaron. 2004. Risks for the Long Run: A Potential Resolution of Asset Pricing Puzzles. *Journal of Finance* 59:1481–509.

Bartram, S. 2015. Corporate poPost-Retirement Benefit Plans and Leverage. *Review of Finance* forthcoming.

Barwell, R., and M. Schweitzer. 2007. The Incidence of Nominal and Real Wage Rigidities in Great Britain: 1978-98. *Economic Journal* 117:553–69.

Bauer, T., L. Goette, and U. Sunde. 2007. Wage Rigidity: Measurement, Causes and Consequences. *Economic Journal* 117:499–507.

Belo, F., X. Lin, and S. Bazdresch. 2014. Labor Hiring, Investment and Stock Return Predictability in the Cross Section. *Journal of Political Economy* 122:129–77.

Berk, J. B., and J. Walden. 2013. Limited capital market participation and human capital risk. *Review of Asset Pricing Studies* 3:1–37.

Bhamra, H., L.-A. Kuehn, and I. Strebulaev. 2010a. The aggregate dynamics of capital structure and macroeconomic risk. *Review of Financial Studies* 23:4187–241.

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

Bronars, S., and D. Deere. 1991. The Threat of Unionization, the Use of Debt, and the Preservation of Shareholder Wealth. *Quarterly Journal of Economics* 106:231–254.

Calvo, G. A. 1982. Staggered contracts and exchange rate policy. *In: J.A. Frankel, ed., Exchange Rates and International Macroeconomics (University of Chicago Press, Chicago, IL)* .

Campbell, J., and J. Cochrane. 1999. By Force of Habit: A Consumption-Based Explanation of Aggregate Stock Market Behavior. *Journal of Political Economy* 107:205–51.

Campbell, J. Y., J. Hilscher, and J. Szilagyi. 2008. In search of distress risk. *Journal of Finance* 63:2899–2939.

Campello, M., J. Gao, J. Qiu, and Y. Zhang. 2015. Bankruptcy and the (hidden) cost of organized labor: evidence from union elections. *Working paper* .

Chatterjee, S., and E. Burcu. 2012. Maturity, Indebtedness, and Default Risk. *American Economic Review* 102:2674–99.

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

Chen, H., M. Kacperczyk, and H. Ortiz-Molina. 2011. Labor Unions, Operating Flexibility, and the Cost of Equity. *Journal of Financial and Quantitative Analysis* 48:25–58.

Chen, L., P. Collin-Dufresne, and R. Goldstein. 2009. On the Relation Between the Credit Spread Puzzle and the Equity Premium Puzzle. *Review of Financial Studies* 22:3367–3409.

Chirinko, R. 2008. [sigma]: The long and short of it. *Journal of Macroeconomics* 30:671–86.

Collin-Dufresne, P., R. Goldstein, and S. Martin. 2001. The Determinants of Credit Spread Changes. *Journal of Finance* 56:2177–2207.

Croce, M. 2014. Long-Run Productivity Risk: A New Hope for Production-Based Asset Pricing? *Journal of Monetary Economics* 66:13–31.

D'Acunto, F., R. Liu, C. Pflueger, and M. Weber. 2015. Flexible Prices and Leverage. *Working paper* .

Danthine, J., and J. Donaldson. 2002. Labour Relations and Asset Returns. *Review of Economic Studies* 69:41–64.

Dasgupta, S., and K. Sengupta. 1993. Sunk Investment, Bargaining, and Choice of Capital Structure. *International Economic Review* 34:203–220.

DeAngelo, H., L. DeAngelo, and T. Whited. 2007. Capital Structure Dynamics and Transitory Debt. *Journal of Financial Economics* 99:235–261.

Devicenti, F., A. Maida, and P. Sestito. 2007. Downward Wage Rigidity in Italy: Micro-based Measures and Implications. *Economic Journal* 117:530–52.

Dickens, W., L. Goette, E. Groshen, S. Holden, J. Messina, M. Schweitzer, J. Turunen, and M. Ward. 2007. How Wages Change: Micro Evidence from the International Wage Flexibility Project. *Journal of Economic Perspectives* 21:195–214.

Donangelo, A. 2014. Labor mobility: implications for asset pricing. *Journal of Finance* 68:1321–46.

Donangelo, A., F. Gourio, and M. Palacios. 2015. Labor Leverage and the Value Premium. *Working paper* .

Elton, E. J., M. J. Gruber, D. Agrawal, and C. Mann. 2001. Explaining the Rate Spread on Corporate Bonds. *Journal of Finance* 56:247–277.

Epstein, L., and S. Zin. 1989. Substitution, risk aversion, and the temporal behavior of consumption and asset returns: a theoretical framework. *Econometrica* 57:937–69.

Fama, E., and J. MacBeth. 1973. Risk, Return, and Equilibrium: Empirical Tests. *Journal of Political Economy* 81:607–636.

Favilukis, J., and X. Lin. 2015a. Does Wage Rigidity Make Firms Riskier? Evidence From Long Horizon Return Predictability. Working Paper, University of British Columbia.

Favilukis, J., and X. Lin. 2015b. Wage Rigidity: A Quantitative Solution to Several Asset Pricing Puzzles. *Review of Financial Studies* forthcoming.

Gao, P., C. Parsons, and J. Shen. 2015. The Global Relation between Financial Distress and Equity Returns .

Gertler, M., and A. Trigari. 2009. Unemployment Dynamics with Nash Wage Bargaining. *Journal of Political Economy* 117:38–86.

Gilchrist, S., J. Sim, and E. Zakrajsek. 2012. Credit Spreads and Business Cycle Fluctuations. *American Economic Review* 102:1692–1720.

Gilchrist, S., J. Sim, and E. Zakrajsek. 2014. Uncertainty, Financial Frictions and Investment Dynamics. *Working Paper* .

Gomes, J., and L. Schmid. 2010. Levered Returns. *Journal of Finance* 65:467–494.

Gomes, J., and L. Schmid. 2012. Equilibrium Credit Spreads and the Macroeconomy. *Working Paper* .

Gourio, F. 2013. Credit risk and Disaster risk. *American Economic Journal: Macroeconomics* 5:1–34.

Hackbarth, D., J. Miao, and E. Morellec. 2006. Capital structure, credit risk and macroeconomic conditions. *Journal of Financial Economics* 82:519–550.

Hall, R. 2005. Employment Efficiency and Sticky Wages: Evidence from Flows in the Labor Market. *The Review of Economics and Statistics* 87:397–407.

Hennessy, C. 2004. Tobin's Q, Debt Overhang, and Investment. *Journal of Finance* 59:1717–1742.

Hennessy, C., and D. Livdan. 2009. Debt, Bargaining and Credibility in Firm-Supplier Relationships. *Journal of Financial Economics* 93:382–399.

Hennessy, C., and T. Whited. 2005. Debt Dynamics. *Journal of Finance* 60:1129–65.

Hennessy, C., and T. Whited. 2007. How Costly is External Financing? Evidence from a Structural Estimation. *Journal of Finance* 62:1705–45.

Hirsch, B. 1991. Union Coverage and Profitability among U.S. Firms. *Review of Economics and Statistics* 73:69–77.

Hobijn, B., and A. Sahin. 2009. Job-Finding and Separation Rates in the OECD. *Economic Letters* 104:107–11.

Huang, J., and M. Huang. 2012. How Much of the Corporate-Treasury Yield Spread Is Due to Credit Risk? A New Calibation Approach. *Review of Asset Pricing Studies* 2:153–202.

Jones, P., S. Mason, and E. Rosenfeld. 1984. Contingent Claims Analysis of Corporate Capital Structures: An Empirical Investigation. *Journal of Finance* 39:611–25.

Kaltenbrunner, G., and L. Lochstoer. 2010. Long-Run Risk through Consumption Smoothing. *Review of Financial Studies* 23:3141–89.

Krusell, P., and A. Smith, Jr. 1998. Income and Wealth Heterogeneity in the Macroeconomy. *The Journal of Political Economy* 106:867–96.

Kuehn, L.-A., and L. Schmid. 2013. Investment-Based Corporate Bond Pricing. Working Paper, .

Lee, D., and A. Mas. 2009. Long-run Impacts of Unions on Firms: New Evidence from Financial Markets, 1961-1999. *Working Paper* .

Li, E., and F. Palomino. 2014. Nominal Rigidities, Asset Returns, and Monetary Policy. *Journal of Monetary Economics* 66:210–25.

Li, S., T. Whited, and Y. Wu. 2015. Collateral, Taxes, and Leverage. *Review of Financial Studies* forthcoming.

Matsa, D. 2010. Capital Structure as a Strategic Variable: Evidence from Collective Bargaining. *Journal of Finance* 65:1197–1232.

Mehra, R., and E. Prescott. 1985. The Equity Premium: A Puzzle. *Journal of Monetary Economics* 15:145–61.

Michaels, R., B. Page, and T. Whited. 2015. Labor and Capital Dynamics under Financing Frictions. *Working paper* .

Moyen, N. 2007. How Bit Is the Debt Overhang Problem? *Journal of Economic Dynamics and Control* 31:433–472.

Myers, S. 1977. Determinants of Corporate Borrowing. *Journal of Financial Economics* 5:147–175.

Perotti, E., and K. Spier. 1989. Capital Structure as a Bargaining Tool: The Role of Leverage in Contract Renegotiation. *American Economic Review* 83:1131–41.

Petrosky-Nadeau, N., L. Zhang, and L.-A. Kuehn. 2013. An Equilibrium Asset Pricing Model with Labor Markets Search. Working Paper, The Ohio State University.

Pissarides, C. 1979. Job Matchings with State Employment Agencies and Random Search. *Economic Journal* 89:818–33.

Rich, R., and J. Tracy. 2004. Uncertainty and Labor Contract Durations. *The Review of Economics and Statistics* 86:270–87.

Ruback, R., and M. Zimmerman. 1984. Unionization and Profitability: Evidence from the Capital Market. *Journal of Political Economy* 92:1134–1157.

Schmalz, M. 2015. Unionization, Cash, and Leverage. *Working Paper* .

Shimer, R. 2005. The Cyclical Behavior of Equilibrium Unemployment and Vacancies. *American Economic Review* 95:25–49.

Shumway, T. 2001. Forecasting bankruptcy more accurately: A simple hazard model. *Journal of Business* 74:101–124.

Simintzi, E., V. Vig, and P. Volpin. 2015. Forecasting bankruptcy more accurately: A simple hazard model. *Review of Financial Studies* forthcoming.

Taylor, J. 1983. Union wage settlements during a disinflation. *American Economic Review* 73:981–993.

Taylor, J. 1999. Staggered Price and Wage Setting in Macroeconomics. *In: John B. Taylor and Michael Woodford (Eds.) Handbook of Macroeconomics, North-Holland, Elsevier, 1, Part 2* pp. 1009–1050.

Tuzel, S., and B. Zhang. 2015. Local Risk, Local Factors, and Asset Pricing. *Journal of Finance* forthcoming.

Zhang, M. 2015. Who Bears Firm-Level Risk? Implications for Cash Flow Volatility. *Working paper* .

Zmijewski, M. E. 1984. Methodological issues related to the estimation of financial distress prediction models. *Journal of Accounting Research* 22:59–82.

Figure 1: Labor Market Variables and Credit Spread

This figure plots the Baa-Aaa credit spread, wage growth (ΔW) and labor share (LS). Wage growth is the growth rate of real wages and salaries per employee; labor share is the total compensation scaled by GDP, and credit spread is the Moody's Baa-Aaa corporate bond yield. Sample is from 1948 to 2014. The grey bars are the NBER recessions. All variables are standardized to allow for an easy comparison in one plot.

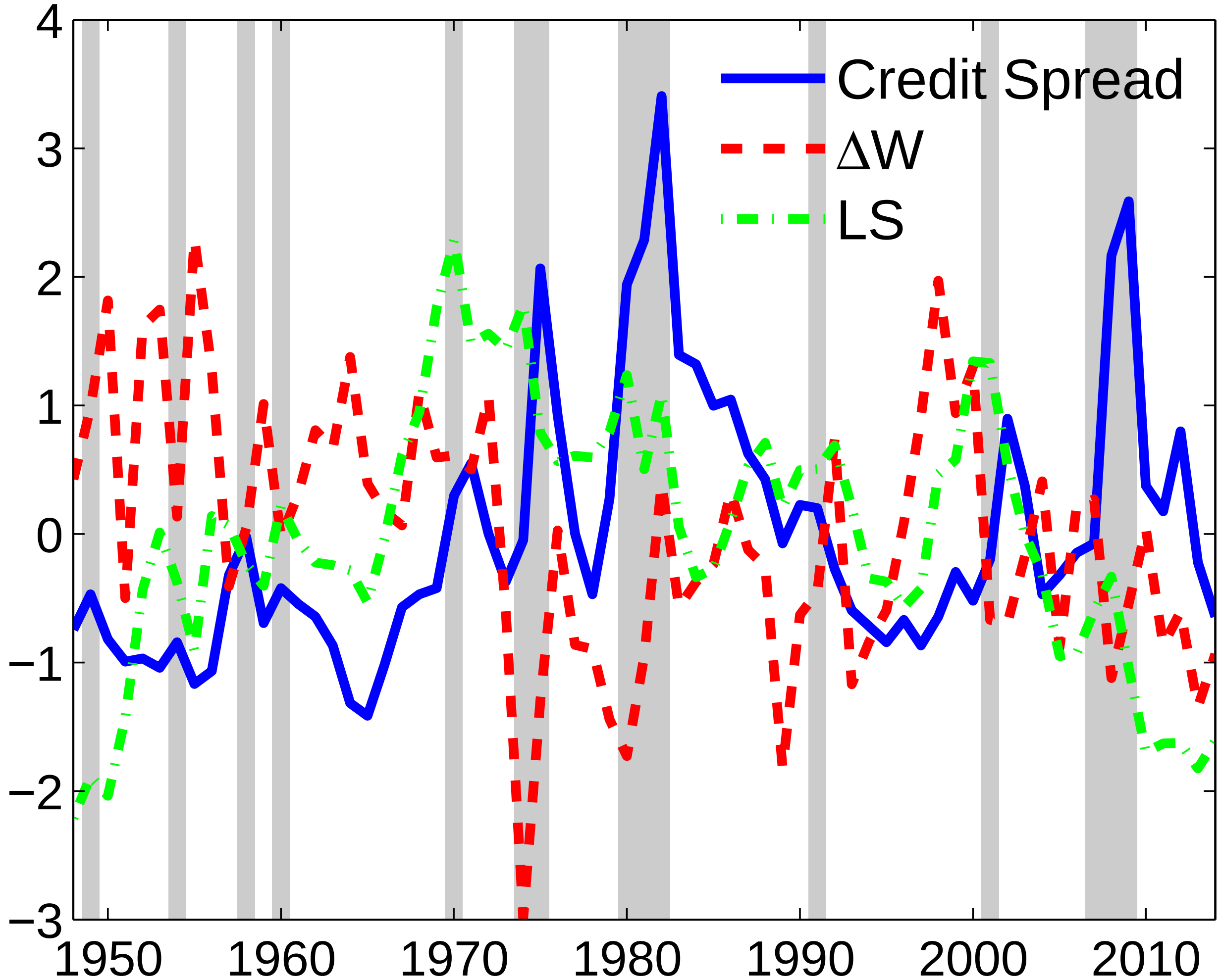

Figure 2: Labor share and financial leverage

This figure compares labor share and financial leverage. The three panels on the left contain book leverage, and the three on the right market leverage. The top two panels contain the median labor share in each country and the median leverage in each country. For the middle two panels, we define the relative labor share as a firm's labor share minus the country's labor share and we define relative leverage analogously. We then sort all firms into 100 portfolios based on relative labor share and plot the median relative labor share of each portfolio against the median relative leverage of each portfolio. In the bottom two panels, for each 5 year period each firm's life we compute its average labor share and financial leverage. We then sort all of these into 100 portfolios based on labor share and plot the median labor share of each portfolio against its median financial leverage. Labor share and financial leverage are defined in the text.

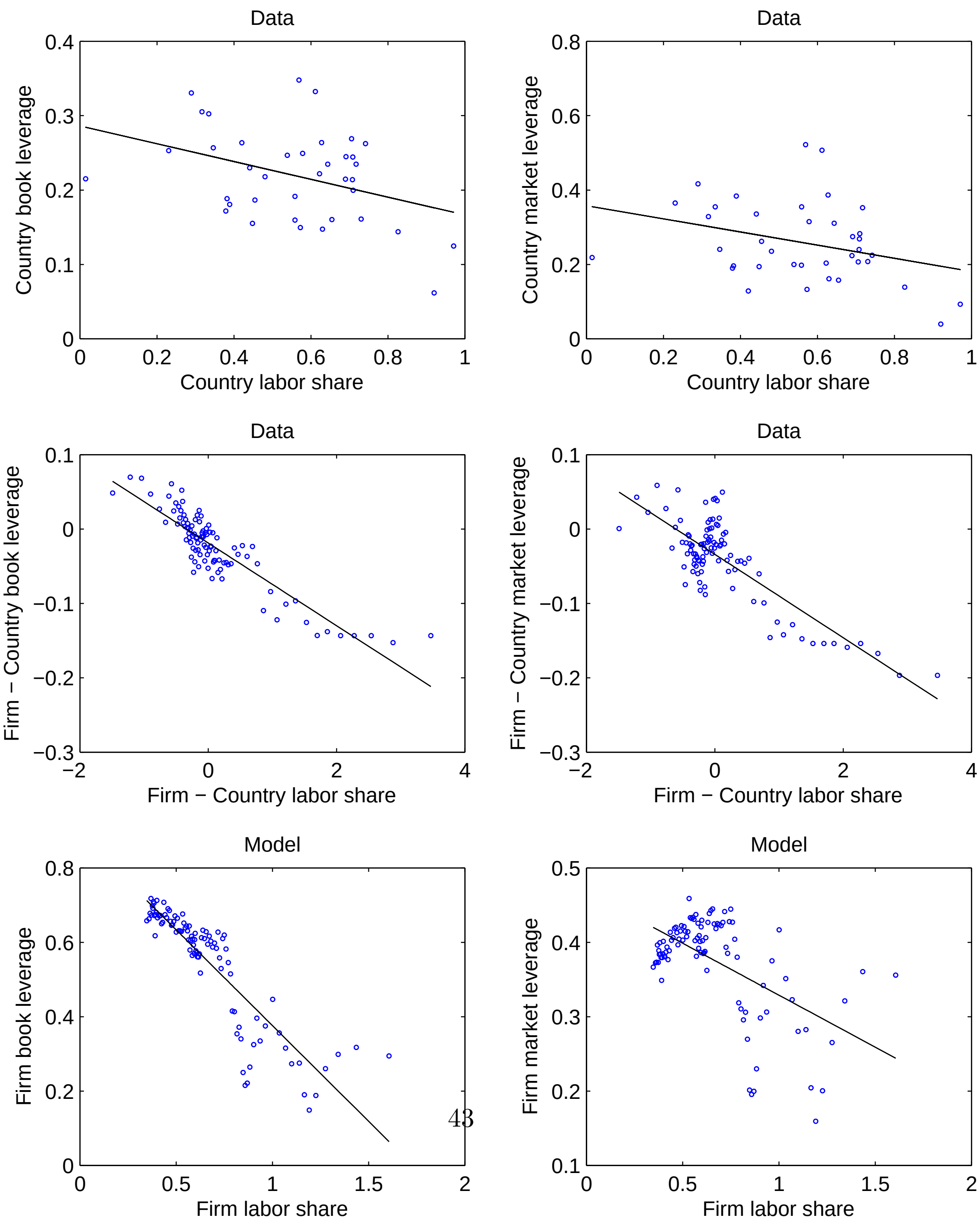

Table 1: Calibration

This table presents the model's calibrated parameters. The model is solved at a quarterly frequency.

Parameter	Description	Benchmark
	Preferences	
β	Time Preference	0.9975
θ	Risk Aversion	6.5
ψ	IES	2
	Production	
$(1-\alpha)\rho$	Related to Labor Share	0.4
$\alpha+\rho-\alpha\rho$	Returns to Scale	0.9
$\frac{1}{1-\eta}$	Labor Capital Elasticity	0.50
δ	Depreciation	0.0233
υ	Capital Adj. Cost	8
f	Operating Cost	0.02
μ	Probability No Resetting	0.90
τ	Corporate tax rate	0.3
$p^{\exp}$	Debt expiration probability	0.025

Table 2: Aggregate statistics

This table compares aggregate moments (annual) from the data to the model. Panel A presents macroeconomic moments. In the data all variables are real and deflated by CPI. y is GDP (private sector) c is consumption (services, non-durable, and durable), i is investment (private non-residential fixed), and w is compensation per employee. These variables are expressed either as HP filtered, or in growth rates. Note that the table reports the volatility of quantities relative to GDP volatility. The volatilities of HP filtered GDP and growth of GDP in the data are 2.42% and 3.21% respectively; the model volatilities are very close to these. Panel B presents asset pricing moments. Panel C presents variables related to credit markets.

Panel A: Macro

x	$\frac{\sigma(x)}{\sigma(y)}$	$\rho(x,y)$	AC(x)	$\frac{\sigma(\Delta x)}{\sigma(\Delta y)}$	$\rho(\Delta x,\Delta y)$	AC(Δx)
			Data			
y	1.00	1.00	0.31	1.00	1.00	0.06
c	0.67	0.89	0.41	0.66	0.88	0.29
i	2.36	0.91	0.46	2.12	0.90	0.19
w	0.52	0.59	0.50	0.55	0.60	0.39
			Model			
y	1.00	1.00	0.38	1.00	1.00	0.28
c	0.69	0.97	0.42	0.74	0.97	0.43
i	2.31	0.97	0.35	2.18	0.95	0.14
w	0.40	0.52	0.69	0.51	0.59	0.85

Panel B: Asset pricing

	$E[R^F]$	$\sigma(R^F)$	$E[R^E]$	$\sigma(R^E)$	SR	$E[R^D]$	$\sigma(R^D)$
Data	1.10	2.27	8.42	18.08	0.47		
Model	0.95	0.48	3.12	8.18	0.37	0.64	1.20

Panel C: Credit market

	Data			Model		
	$E[x]$	$\sigma(x)$	$\rho(x,\Delta y)$	$E[x]$	$\sigma(x)$	$\rho(x,\Delta y)$
LEV	0.44	0.09	-0.24	0.38	0.02	-0.22
CS	0.95	0.40	-0.52	1.31	0.23	-0.60
DEF	0.60	1.05	-0.16	0.73	0.46	-0.59

Table 3: Credit markets are related to labor markets

This table presents univariate regressions of the form $y_{t+1} = a + bx_t + \epsilon_{t+1}$ where y_{t+1} is either the default rate realized at $t+1$, the credit spread realized at $t+1$, or debt growth between t and $t+1$; and where x_t is either labor expense growth between $t-1$ and t or the labor share at t. Panel A presents these regressions for aggregate variables and Panel B for firm-level variables. For the firm-level, the default rate is replaced by 1 if the firm defaults and 0 otherwise.

Panel A: Aggregate				
	CS_{t+1}		$\Delta DEBT_{t+1}$	
Data				
ΔW	-0.154**		1.350**	
	(4.15)		(4.51)	
LS		0.107*		-0.420
		(2.15)		(-0.93)
R^2	0.28	0.09	0.25	0.00
Model				
ΔW	-0.114		1.958	
	(-10.10)		(7.86)	
LS		0.076		-1.224
		(11.66)		(-8.10)
R^2	0.64	0.69	0.45	0.43

Panel B: Firm-level				
	CS_{t+1}		$\Delta DEBT_{t+1}$	
Data				
ΔXLR	-0.092**		0.10***	
	(-7.64)		(6.32)	
LS		0.043**		-0.03***
		(5.46)		(-7.01)
R^2	0.01	0.01	0.01	0.00
Model				
ΔXLR	-0.072		1.019	
LS		0.187		-1.58
R^2	0.14	0.08	0.06	0.01

Table 4: Descriptive Statistics

Panel A reports the descriptive statistics of the variables of interests. Panel B reports the cross correlations of the variables. Credit spread (CS) is the Moody's Baa-Aaa corporate bond yield. Wage growth is the growth rate of real wages & salaries per employee; labor share (LS) is the aggregate compensation divided by GDP; investment growth (InvGr) is the growth rate of real private nonresidential fixed investment; P/E is the equity price to earnings ratio from Shiller; term spread (TS) is the long-term government bond yield (10 year) minus the short-term government bond yield (1 year); financial leverage (FinLev) is book value of nonfinancial credit instruments divided by the sum of the market value of equities and credit instruments of nonfinancial corporate sector. Market volatility (MktVol) is the annual volatility of CRSP value-weighted market premium; spot rate (RF) is the real 1 year government bond yield from Shiller's webpage. GDP growth (GDPGr) is the real GDP growth from NIPA. Wage growth, labor share, investment growth, term spread, credit spread, and spot rate are in percentage terms. Sample is from 1948 to 2014.

Panel A: Summary Statistics			
	Mean	s.d	AC
GdpGr	3.22	2.39	0.15
WageGr	1.5	1.42	0.47
LS	55.29	1.23	0.86
InvGr	4.46	6.31	0.2
DebtGr	0.05	0.04	0.63
P/E	16.58	16.16	0.82
TS	1.37	1.28	0.44
FinLev	0.44	0.09	0.88
MktVol	0.14	0.05	0.33
RF	1.57	2.73	0.56
Def	0.2	0.23	0.66
CS	0.95	0.4	0.74

Panel B: Cross Correlations											
	GdpGr	WageGr	LS	IGr	DebtGr	P/E	TS	FinLev	MktVol	RF	Def
WageGr	0.49										
LS	-0.14	-0.10									
InvGr	0.72	0.20	-0.06								
DebtGr	0.63	0.48	0.02	0.57							
P/E	0.07	0.20	0.21	0.06	0.06						
TS	-0.15	0.01	-0.21	-0.29	-0.36	-0.07					
FinLev	-0.24	-0.54	0.25	-0.15	-0.27	-0.17	0.09				
MktVol	-0.35	-0.20	0.32	-0.32	-0.22	0.11	-0.02	0.38			
RF	-0.11	0.16	0.30	-0.07	0.19	0.12	0.00	0.19	0.08		
Def	-0.34	-0.18	0.19	-0.38	-0.52	0.13	0.39	0.11	0.32	0.04	
CS	-0.52	-0.42	0.22	-0.49	-0.4	-0.08	0.25	0.62	0.45	0.3	0.37

Table 5: Labor Market Variables and Aggregate Credit Spread

This table reports the predictive regression of variables of interests for credit spread. Credit spread (CS) is the Moody's Baa-Aaa corporate bond yield. Wage growth (ΔW) is the growth rate of real wages and salaries per employee; labor share (LS) is the aggregate compensation divided by GDP; investment growth (InvGr) is the growth rate of real private nonresidential fixed investment; P/E is the equity price to earnings ratio from Shiller; term spread (TS) is the long-term government bond yield (10 year) minus the short-term government bond yield (1 year); financial leverage (FinLev) is book value of nonfinancial credit instruments divided by the sum of the market value of equities and credit instruments of nonfinancial corporate sector. Market volatility (MktVol) is the annual volatility of CRSP value-weighted market premium; spot rate (SR) is the real 1 year government bond yield from Shiller's webpage. GDP growth (GDPGr) is the real GDP growth from NIPA. [t] are heteroscedasticity and autocorrelation consistent t-statistics (Newey-West). Sample is from 1948 to 2014.

Panel A: Wage growth											
WageGr	-15.4	-14.47	-14.82	-8.08	-13.04	-14.86	-15.29	-16.67	-11.9	-7.80	-1.80
	-4.15	-4.41	-3.75	-2.86	-4.32	-4.92	-4.90	-3.68	-2.90	-2.22	-1.03
LS		8.52									0.07
		3.13									0.04
InvGr			-0.63								1.32
			-1.24								2.12
FinLev				2.17							1.25
				4.77							2.25
MktVol					2.84						0.46
					6.35						1.10
P/E						0.00					0.01
						-0.49					1.51
TS							-5.36				-10.47
							-1.62				-4.20
RF								4.63			-0.12
								2.61			-0.19
GdpGr									-4.03		-3.34
									-2.05		-1.75
lag CS										0.62	0.65
										7.47	7.31
R^2	0.28	0.34	0.28	0.42	0.41	0.28	0.30	0.37	0.32	0.59	0.75

Panel B: Labor share										
LS	10.66	10.33	6.33	6.33	11.14	9.83	9.28	8.57	5.82	0.04
	2.15	2.09	1.46	1.45	2.04	2.19	1.83	2.57	3.11	0.22
InvGr		-1.20								1.39
		-2.45								2.34
FinLev			2.71							1.45
			5.73							2.83
MktVol				3.14						0.36
				4.68						0.88
P/E					-0.01					0.01
					-1.06					1.78
TS						-3.79				-10.74
						-0.71				-4.11
RF							2.24			-0.42
							0.98			-0.72
GdpGr								-6.72		-3.88
								-3.01		-2.52
lag CS									0.70	0.66
									12.58	7.17
R^2	0.09	0.11	0.40	0.24	0.13	0.09	0.10	0.25	0.56	0.75

Table 6: Labor Market Variables and Aggregate Debt Growth

This table reports the predictive regression of variables of interests for aggregate debt growth. Aggregate debt growth is the growth rate of â€œNonfinancial business; credit market instruments; liabilityâ€ from Flow of Funds Table L102. Wage growth (ΔW) is the growth rate of real wages and salaries per employee; labor share (LS) is the aggregate compensation divided by GDP; investment growth (InvGr) is the growth rate of real private nonresidential fixed investment; P/E is the equity price to earnings ratio from Shiller; term spread (TS) is the long-term government bond yield (10 year) minus the short-term government bond yield (1 year); financial leverage (FinLev) is book value of nonfinancial credit instruments divided by the sum of the market value of equities and credit instruments of nonfinancial corporate sector. Market volatility (MktVol) is the annual volatility of CRSP value-weighted market premium; spot rate (SR) is the real 1 year government bond yield from Shiller's webpage. GDP growth (GDPGr) is the real GDP growth from NIPA. [t] are heteroscedasticity and autocorrelation consistent t-statistics (Newey-West). Sample is from 1948 to 2014.

Panel A: Wage growth											
WageGr	1.35	1.33	1.25	1.12	1.19	1.43	1.36	1.29	0.98	0.71	-0.16
	4.51	4.10	4.90	3.04	3.61	4.36	4.46	4.58	4.92	2.35	-0.69
LS		-0.22									0.02
		-0.69									0.10
InvGr			0.12								-0.02
			1.33								-0.31
FinLev				-0.07							-0.24
				-0.81							-4.76
MktVol					-0.20						-0.04
					-2.37						-0.65
P/E						-0.00					-0.00
						-1.51					-3.92
TS							-0.15				0.54
							-0.41				2.93
RF								0.22			0.33
								2.76			3.43
GdpGr									0.43		0.19
									0.58		0.98
lag DebtGr										0.50	0.51
										4.91	3.96
R^2	0.01	0.06	0.02	0.00	0.19	0.33	0.01	0.05	0.07	0.44	0.57

Panel B: Labor share										
LS	-0.42	-0.23	-0.15	-0.05	-0.42	-0.47	-0.67	-0.21	-0.45	0.02
	-0.93	-0.52	-0.32	-0.10	-0.92	-1.13	-1.59	-0.63	-2.19	0.09
InvGr		-0.03								-0.01
		-1.20								-0.19
FinLev			-0.17							-0.22
			-1.96							-4.85
MktVol				-0.27						-0.05
				-1.96						-0.72
P/E					-0.00					-0.00
					-0.09					-4.19
TS						-0.21				0.51
						-0.35				2.97
RF							0.40			0.31
							4.04			3.30
GdpGr								0.69		0.15
								2.28		0.77
lag DebtGr									0.64	0.49
									8.60	3.76
R^2	0.05	0.06	0.04	0.20	0.30	0.07	0.06	0.12	0.41	0.58

Table 7: Annual observations with non-missing labor expenses, hiring, and EDF

This table reports the number of annual (firm-year) observations for each individual country. In particular, the number of annual observations with non-missing labor expenses (Compustat variable XLR), hiring (Compustat variable EMP), and the EDF is reported in the column titled "# Obs w XLR/EMP/EDF". The percentage of observations with non-missing labor expenses, hiring, and EDF is reported for each country (column titled "Within country % of obs w XLR/EMP/EDF"). The last column titled "For all countries % of obs w XLR/EMP/EDF" presents the percentage of observations with non-missing labor expenses, hiring, and EDF contributed by each country to the final sample of all observations with non-missing labor expenses, hiring, and EDF (total # of obs = 63274).

Country	Start Year	End Year	All Obs	# Obs w XLR	# Obs w EDF	# Obs XLR/EDF	Within Country % of obs w/ XLR/EDF	For all Countries % of obs w/ XLR/EDF
Region: Europe								
Austria	1992	2011	1425	1318	981	914	64.14	0.99
Belgium	1992	2011	1769	1597	1224	1118	63.20	1.21
Denmark	1992	2011	2244	2048	1457	1347	60.03	1.46
Finland	1992	2011	1995	1897	1544	1474	73.88	1.59
France	1992	2011	10855	10055	8105	7597	69.99	8.21
Germany	1992	2011	11151	10005	7200	6612	59.30	7.14
Greece	1994	2011	2443	1443	1724	1002	41.02	1.08
Italy	1992	2011	3631	3425	2584	2448	67.42	2.64
Netherlands	1992	2011	2756	2492	2085	1919	69.63	2.07
Norway	1992	2011	3021	2607	1900	1672	55.35	1.81
Poland	1994	2011	3722	2699	1457	1072	28.80	1.16
Portugal	1992	2011	857	771	643	585	68.26	0.63
Spain	1992	2011	2216	2149	1674	1657	74.77	1.79
Sweden	1992	2011	5712	4798	3041	2644	46.29	2.86
Switzerland	1992	2011	3485	3176	2378	2195	62.98	2.37
United Kingdom	1992	2011	26546	21034	18954	16223	61.11	17.53
Region: North America								
Canada	1992	2011	23575	3228	11908	1769	7.50	1.91
United States	1992	2011	135632	9588	69610	4877	3.60	5.27
Region: Japan								
Japan	1992	2011	50011	2	42403		0.00	0.00
Region: Asia Pacific (ex. Japan)								
Australia	1992	2011	19885	11285	12018	7472	37.58	8.07
China	1992	2011	27448	1210	10755	594	2.16	0.64
Hong Kong	1992	2011	3468	2363	1812	1244	35.87	1.34
India	1992	2011	29938	26949	6603	6283	20.99	6.79
Indonesia	1992	2011	4017	2705	2377	1607	40.00	1.74
Malaysia	1992	2011	12457	7986	9084	6777	54.40	7.32
New Zealand	1992	2011	1633	563	1029	435	26.64	0.47
Philippines	1992	2011	2198	1296	995	651	29.62	0.70
Singapore	1992	2011	7903	5210	5211	3779	47.82	4.08
S. Korea	1993	2011	8701	75	5916	49	0.56	0.05
Taiwan	1992	2011	14520	214	10868	106	0.73	0.11
Thailand	1992	2011	5749	3171	3240	1978	34.41	2.14
Region: Other America (ex. Canada and U.S.)								
Argentina	1992	2011	934	352	667	266	28.48	0.29
Brazil	1992	2011	4558	2039	671	414	9.08	0.45
Chile	1992	2011	2171	346	1303	231	10.64	0.25
Mexico	1992	2011	1674	282	993	145	8.66	0.16
Region: Middle East								
Israel	1992	2011	2975	2058	1008	735	24.71	0.79
Pakistan	1994	2011	2814	2033	993	738	26.23	0.80
Turkey	1992	2011	1905	854	1443	670	35.17	0.72
Region: Africa								
South Africa	1992	2011	3761	1893	2330	1254	33.34	1.35
Total			451755	157216	260188	92553		

Table 8: Summary statistics on labor expenses and EDF

This table reports the summary statistics on EDF, labor expenses growth, and labor share. We define labor expenses growth as $\Delta XLR = (XLR_t - XLR_{t-1})/XLR_{t-1}$ and labor share as $LS_t = XLR_t/Sale_t$ for year t. We report the mean and standard deviation of these variables within each country; we also report the same summary statistics for all countries in the last row "Total".

	EDF		ΔXLR			LS		
Country	Mean	St.D.	Mean (EW)	Mean (VW)	St.D.	Mean (EW)	Mean (VW)	St.D.
Region: Europe								
Austria	1.57	3.90	0.06	0.02	0.39	0.67	0.72	0.39
Belgium	1.25	3.14	0.10	0.06	0.50	0.55	0.72	0.53
Denmark	1.34	3.45	0.11	0.14	0.43	0.65	0.72	0.64
Finland	1.03	2.79	0.10	0.12	0.43	0.67	0.65	0.32
France	1.94	4.15	0.11	0.10	0.42	0.65	0.70	0.57
Germany	2.47	5.44	0.09	0.08	0.46	0.66	0.70	0.74
Greece	3.71	6.09	0.05	0.19	0.56	0.53	0.83	0.99
Italy	1.39	3.22	0.08	0.02	0.42	0.57	0.75	0.51
Netherlands	1.30	3.72	0.08	0.12	0.47	0.62	0.73	0.43
Norway	2.50	5.50	0.17	0.13	0.52	0.52	0.71	1.41
Poland	2.40	4.80	0.08	0.04	0.38	0.58	0.51	0.74
Portugal	2.27	4.52	0.08	0.12	0.28	0.56	0.70	0.30
Spain	0.85	2.38	0.09	0.07	0.25	0.58	0.72	0.34
Sweden	1.73	4.18	0.15	0.08	0.42	0.57	0.79	1.46
Switzerland	0.82	2.74	0.09	0.16	0.43	0.61	0.64	0.40
United Kingdom	2.07	4.50	0.16	0.20	0.64	0.46	0.53	0.89
Region: North America								
Canada	4.14	7.61	0.15	0.05	0.64	(0.02)	0.59	0.94
United States	2.77	6.12	0.10	0.05	0.32	0.44	0.70	1.05
Region: Japan								
Japan	2.31	4.22	0.13	0.07		0.51	0.51	0.03
Region: Asia Pacific (ex. Japan)								
Australia	2.50	5.15	0.27	0.32	0.79	(0.05)	0.60	1.91
China	0.87	1.74	0.24	0.23	0.40	0.40	0.59	0.51
Hong Kong	1.79	3.73	0.21	0.25	0.57	0.37	0.51	0.99
India	4.00	6.30	0.13	0.24	0.49	0.33	0.52	0.61
Indonesia	6.71	9.50	0.14	0.22	0.57	0.32	0.49	0.59
Malaysia	2.98	5.43	0.10	0.17	0.39	0.42	0.45	0.85
New Zealand	1.63	4.25	0.18	0.21	0.58	0.30	0.55	1.18
Philippines	5.67	8.98	0.08	0.23	0.64	0.22	0.47	0.70
Singapore	2.59	4.41	0.13	0.23	0.53	0.50	0.41	0.95
S. Korea	4.15	6.51	0.12	0.04	0.41	0.27	0.30	0.83
Taiwan	1.74	3.29	0.21	0.09	0.40	0.39	0.56	0.77
Thailand	3.53	6.76	0.12	0.20	0.35	0.46	0.48	0.71
Region: Other America (ex. Canada and U.S.)								
Argentina	4.31	7.15	0.16	0.24	0.42	0.41	0.47	0.43
Brazil	3.68	7.06	0.19	0.35	0.69	0.31	0.85	0.68
Chile	1.55	4.17	0.19	0.17	0.54	0.38	0.63	0.45
Mexico	2.91	6.12	0.05	0.12	0.84	0.16	0.75	0.28
Region: Middle East								
Israel	1.92	4.13	0.16	0.31	0.77	0.35	0.56	0.62
Pakistan	5.84	8.93	0.08	0.10	0.53	0.29	0.35	0.43
Turkey	1.68	2.81	0.14	0.07	0.53	0.42	0.47	0.51
Region: Africa								
South Africa	3.61	6.97	0.19	0.26	0.64	0.52	0.62	0.45
Total	2.56	5.39	0.13	0.15	0.53	0.43	0.60	0.94

Table 9: Time-series correlation between labor expenses and EDF

This table reports the distribution of the firm-level time-series correlation between labor expenses growth and EDF ($Corr(\Delta XLR, EDF)$), and the correlation between labor share and EDF ($Corr(LS, EDF)$). ΔXLR and LS are time t variables, whereas EDF is a $t+1$ variable. For every firm, we calculate $Corr(\Delta XLR, EDF)$ and $Corr(LS, EDF)$ using its time-series observations. Then we report the mean and standard deviation of these two correlations within each country; we also report the same summary statistics for all countries in the last row "Total". The t-stat is for testing whether $Corr(\Delta XLR, EDF) = 0$ or $Corr(LS, EDF) = 0$.

	$Corr(\Delta XLR, EDF)$				$Corr(LS, EDF)$			
Country	Mean	St.D.	No of firms	t-stat	Mean	St.D.	No of firms	t-stat
Region: Europe								
Austria	-0.10	0.54	95	-1.73	0.16	0.54	101	3.06
Belgium	-0.00	0.53	115	-0.06	0.23	0.54	123	4.77
Denmark	-0.11	0.44	131	-2.96	0.25	0.50	137	5.80
Finland	-0.08	0.40	135	-2.37	0.31	0.41	139	8.76
France	-0.12	0.50	793	-6.84	0.25	0.51	822	14.16
Germany	-0.11	0.50	701	-5.67	0.22	0.53	719	10.95
Greece	-0.30	0.61	141	-5.85	0.25	0.61	157	5.22
Italy	-0.13	0.46	263	-4.69	0.26	0.54	272	8.07
Netherlands	-0.12	0.50	179	-3.17	0.17	0.56	186	4.25
Norway	-0.11	0.57	199	-2.75	0.24	0.57	215	6.16
Poland	0.01	0.64	191	0.21	0.25	0.61	200	5.88
Portugal	-0.14	0.56	57	-1.85	0.23	0.53	60	3.43
Spain	-0.07	0.46	151	-1.89	0.21	0.53	155	4.85
Sweden	-0.07	0.53	296	-2.19	0.23	0.59	313	6.80
Switzerland	-0.08	0.47	211	-2.44	0.23	0.47	211	7.13
United Kingdom	-0.05	0.55	1736	-4.19	0.21	0.59	1929	15.63
Region: North America								
Canada	-0.06	0.66	257	-1.34	0.06	0.69	290	1.49
United States	-0.10	0.65	671	-3.89	0.16	0.67	777	6.84
Region: Japan								
Japan								
Region: Asia Pacific (ex. Japan)								
Australia	-0.01	0.61	1204	-0.35	0.11	0.57	1291	6.86
China	0.04	0.58	79	0.65	0.23	0.59	88	3.58
Hong Kong	0.17	0.53	169	4.13	0.08	0.53	171	1.95
India	0.00	0.58	1242	0.21	0.16	0.58	1271	9.93
Indonesia	0.07	0.61	213	1.79	0.02	0.58	224	0.65
Malaysia	-0.04	0.54	863	-2.18	0.11	0.55	895	5.94
New Zealand	0.08	0.73	84	1.04	0.23	0.65	95	3.45
Philippines	-0.01	0.52	85	-0.12	0.14	0.53	87	2.50
Singapore	0.04	0.55	507	1.83	0.17	0.52	524	7.51
S. Korea	-0.16	0.96	6	-0.42	-0.04	0.92	10	-0.14
Taiwan	0.94		1		0.57	0.87	4	1.30
Thailand	0.06	0.63	278	1.72	0.17	0.60	293	4.89
Region: Other America (ex. Canada and U.S.)								
Argentina	0.08	0.66	36	0.72	0.29	0.53	42	3.59
Brazil	0.10	0.73	73	1.17	0.09	0.68	76	1.12
Chile	-0.06	0.86	9	-0.22	-0.04	0.94	40	-0.29
Mexico	0.15	0.80	28	1.01	0.38	0.73	36	3.10
Region: Middle East								
Israel	-0.13	0.59	104	-2.20	0.11	0.57	110	2.11
Pakistan	-0.04	0.52	97	-0.70	0.06	0.58	103	1.04
Turkey	0.19	0.61	102	3.23	0.19	0.62	114	3.34
Region: Africa								
South Africa	-0.02	0.65	175	-0.34	0.17	0.62	203	3.90
Total	-0.04	0.57	11677	-7.89	0.18	0.58	12483	34.24

Table 10: Time-series correlation between labor expenses and debt growth

This table reports the distribution of the firm-level time-series correlation between labor expenses growth and debt growth ($Corr(\Delta XLR, \Delta Debt)$), and the correlation between labor share and debt growth ($Corr(LS, \Delta Debt)$). ΔXLR and LS are time t variables, whereas $\Delta Debt = \frac{Debt_{t+1}+Debt_t}{0.5(Debt_{t+1}-Debt_t)}$ is a $t+1$ variable. For every firm, we calculate $Corr(\Delta XLR, \Delta Debt)$ and $Corr(LS, \Delta Debt)$ using its time-series observations. Then we report the mean and standard deviation of these two correlations within each country; we also report the same summary statistics for all countries in the last row "Total". The t-stat is for testing whether $Corr(\Delta XLR, \Delta Debt) = 0$ or $Corr(LS, \Delta Debt) = 0$.

	$Corr(\Delta XLR, \Delta Debt)$				$Corr(LS, \Delta Debt)$			
Country	Mean	St.D.	No of firms	t-stat	Mean	St.D.	No of firms	t-stat
Region: Europe								
Austria	0.02	0.44	111	0.45	-0.08	0.50	121	-1.87
Belgium	-0.07	0.45	141	-1.71	-0.02	0.46	149	-0.66
Denmark	0.01	0.47	172	0.35	-0.09	0.46	183	-2.55
Finland	-0.09	0.40	153	-2.65	-0.13	0.42	161	-3.98
France	-0.02	0.45	909	-1.52	-0.05	0.45	960	-3.22
Germany	-0.01	0.48	833	-0.60	-0.07	0.47	876	-4.66
Greece	0.10	0.55	203	2.56	-0.09	0.47	211	-2.87
Italy	-0.06	0.45	323	-2.45	-0.04	0.44	341	-1.56
Netherlands	-0.01	0.46	199	-0.29	-0.13	0.45	215	-4.16
Norway	0.08	0.55	248	2.25	-0.05	0.58	281	-1.45
Poland	0.07	0.57	389	2.30	-0.09	0.55	422	-3.20
Portugal	-0.06	0.50	73	-1.04	-0.04	0.49	77	-0.69
Spain	-0.01	0.38	171	-0.26	-0.04	0.43	178	-1.24
Sweden	0.10	0.54	418	3.68	-0.07	0.55	455	-2.60
Switzerland	0.04	0.44	250	1.27	-0.10	0.40	255	-3.83
United Kingdom	0.07	0.54	1861	5.39	-0.07	0.56	2084	-5.62
Region: North America								
Canada	0.12	0.72	231	2.49	-0.05	0.83	488	-1.33
United States	0.01	0.62	1011	0.54	-0.04	0.63	1233	-2.20
Region: Japan								
Japan								
Region: Asia Pacific (ex. Japan)								
Australia	0.09	0.63	1024	4.60	-0.08	0.61	1142	-4.56
China	0.07	0.51	153	1.78	0.01	0.51	164	0.30
Hong Kong	0.02	0.56	318	0.56	-0.01	0.54	336	-0.48
India	0.05	0.43	2452	5.37	-0.02	0.42	2503	-2.69
Indonesia	-0.03	0.51	312	-1.13	0.04	0.53	345	1.44
Malaysia	0.06	0.53	900	3.18	-0.05	0.48	938	-2.92
New Zealand	0.04	0.58	88	0.72	-0.09	0.59	107	-1.53
Philippines	0.02	0.53	132	0.42	-0.02	0.52	144	-0.37
Singapore	0.02	0.55	637	0.83	-0.01	0.48	657	-0.36
S. Korea	-0.37	0.70	7	-1.40	0.04	0.87	14	0.18
Taiwan	0.19	0.73	17	1.09	-0.31	0.65	21	-2.14
Thailand	0.01	0.55	410	0.27	-0.05	0.51	433	-2.16
Region: Other America (ex. Canada and U.S.)								
Argentina	-0.13	0.61	47	-1.41	-0.09	0.59	55	-1.12
Brazil	-0.04	0.57	272	-1.08	-0.09	0.52	294	-3.13
Chile	-0.02	0.87	93	-0.20	0.06	0.76	117	0.86
Mexico	0.01	0.75	39	0.06	0.03	0.70	64	0.32
Region: Middle East								
Israel	0.03	0.61	240	0.83	-0.04	0.60	261	-1.16
Pakistan	0.02	0.56	241	0.53	0.04	0.51	262	1.11
Turkey	0.02	0.58	127	0.41	0.00	0.62	157	0.10
Region: Africa								
South Africa	0.02	0.61	241	0.63	-0.07	0.55	267	-2.03
Total	0.03	0.53	15447	7.47	-0.05	0.53	16972	-11.90

Table 11: Labor expenses and default risk

This table reports the results of cross-sectional regressions using labor expense growth or labor share at t to predict default risk (EDF) at $t+1$. Results based on labor expenses growth (ΔXLR) are on the left, and based on labor share (LS) are on the right. The control variables include leverage ($Leverage$), stock volatility (σ), working capital ($WCTA$), retained earnings ($RETA$), EBIT ($EBITTA$), sales (STA), net income ($NITA$), current asset to liability ($CACL$), investment ($Invest$), stock excess return (R_{excess}), relative size ($RSIZE$), market return (R_m), market capitalization ($MCAP$). The details of the variable constructions can be found in the appendix. All the results are estimated using Fama and MacBeth (1973) cross-sectional regressions. The t-statistics reported in the parentheses below each coefficient estimate are heteroscedasticity and autocorrelation consistent t-statistics (Newey-West). Statistical significance levels of 1%, 5%, and 10% are indicated with ***, **, and * respectively.

	$x = \Delta XLR$				$x = LS$			
x	-0.92***	-0.98***	-0.87***	-0.45***	0.43***	0.61***	0.66***	0.61***
	(-7.64)	(-8.47)	(-8.85)	(-7.20)	(5.46)	(6.11)	(7.01)	(4.55)
$Leverage$			6.30***	4.75***			6.15***	4.62***
			(4.73)	(4.05)			(4.75)	(3.99)
σ			1.52***	1.48***			1.49***	1.47***
			(4.88)	(6.78)			(4.64)	(6.75)
$WCTA$				-2.58**				-2.54***
				(-7.18)				(-7.76)
$RETA$				-0.14				-0.19
				(-0.71)				(-0.83)
$EBITTA$				-2.83***				-2.84***
				(-3.52)				(-3.32)
STA				0.64***				-0.79***
				(8.63)				(-9.33)
$NITA$				-0.51				-0.64
				(-1.30)				(-1.63)
$CACL$				0.01				0.02
				(0.42)				(0.71)
$Invest$				0.02***				0.02***
				(5.66)				(6.40)
R_{excess}				-0.36				-0.45
				(-0.66)				(-0.76)
$RSIZE$				0.50				0.51
				(0.94)				(1.00)
R_m				9.36***				9.25***
				(3.40)				(3.43)
$MCAP$				-1.00				-0.99
				(-1.62)				(-1.67)
FE	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Obs	77082	77082	76527	74786	76553	76553	76021	73376
Avg R^2	0.01	0.085	0.173	0.290	0.00	0.086	0.174	0.296

Table 12: Labor expenses and debt growth

This table reports the results of cross-sectional regressions using labor expense growth or labor share at t to predict debt growth between t and $t+1$. Results based on labor expenses growth (ΔXLR) are on the left, and based on labor share (LS) are on the right. The control variables include leverage ($Leverage$), stock volatility (σ), working capital ($WCTA$), retained earnings ($RETA$), EBIT ($EBITTA$), sales (STA), net income ($NITA$), current asset to liability ($CACL$), investment ($Invest$), stock excess return (R_{excess}), relative size ($RSIZE$), market return (R_m), market capitalization ($MCAP$). The details of the variable constructions can be found in the appendix. All the results are estimated using Fama and MacBeth (1973) cross-sectional regressions. The t-statistics reported in the parentheses below each coefficient estimate are heteroscedasticity and autocorrelation consistent t-statistics (Newey-West). Statistical significance levels of 1%, 5%, and 10% are indicated with ***, **, and * respectively.

	$x = \Delta XLR$				$x = LS$			
x	0.10***	0.10***	0.09***	0.06***	-0.03***	-0.03***	-0.03***	-0.02***
	(6.32)	(5.40)	(5.75)	(5.68)	(-7.01)	(-5.86)	(-6.02)	(-4.23)
$Leverage$			-0.47***	-0.47***			-0.49***	-0.49***
			(-9.72)	(-7.45)			(-11.89)	(-8.81)
σ			-0.01**	-0.01***			-0.00*	-0.01***
			(-2.74)	(-4.91)			(-1.73)	(-4.26)
$WCTA$				-0.03				-0.04
				(-0.93)				(-0.94)
$RETA$				-0.02*				-0.02**
				(-1.93)				(-2.25)
$EBITTA$				0.10				0.12**
				(1.62)				(2.17)
STA				0.08***				0.11***
				(7.62)				(8.16)
$NITA$				0.00				-0.01
				(0.16)				(-0.57)
$CACL$				0.00				0.00
				(1.14)				(0.86)
$Invest$				0.00*				0.00
				(1.93)				(1.69)
R_{excess}				0.03				0.03
				(1.49)				(1.51)
$RSIZE$				-0.00				-0.00
				(-0.40)				(-0.65)
R_m				-0.21***				0.22***
				(-4.72)				(-3.76)
$MCAP$				0.01***				0.01***
				(4.13)				(5.04)
FE	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Observations	117835	117835	116498	115450	104628	104628	103556	101517
R-squared	0.01	0.025	0.046	0.056	0.00	0.022	0.044	0.058

Table 13: Labor expenses and financial leverage

This table reports the results of cross-sectional regressions using labor share at t to predict financial leverage at $t+1$. Results using market leverage ($LEVM$) are on the left, and book leverage ($LEVB$) are on the right. The control variables include leverage, stock volatility (σ), working capital ($WCTA$), retained earnings ($RETA$), EBIT ($EBITTA$), sales (STA), net income ($NITA$), current asset to liability ($CACL$), investment ($Invest$), stock excess return (R_{excess}), relative size ($RSIZE$), market return (R_m), market capitalization ($MCAP$). The details of the variable constructions can be found in the appendix. All the results are estimated using Fama and MacBeth (1973) cross-sectional regressions. The t-statistics reported in the parentheses below each coefficient estimate are heteroscedasticity and autocorrelation consistent t-statistics (Newey-West). Statistical significance levels of 1%, 5%, and 10% are indicated with ***, **, and * respectively.

	$x = LS_t, y = LEVM_{t+1}$				$x = LS_t, y = LEVB_{t+1}$			
LS	-0.041***	-0.029***	-0.005***	-0.006***	-0.031***	-0.028***	-0.002**	-0.003**
	(-4.72)	(-19.16)	(-5.73)	(-7.75)	(-5.57)	(-15.23)	(-2.55)	(-2.38)
$LEVM_t$			0.859***	0.857***				
			-60.94	-51.54				
$LEVB_t$							0.866***	0.859***
							-143.11	-124.74
σ				-0.025***				-0.016***
				(-3.66)				(-3.66)
$WCTA$				0.002***				-0.001
				-4.42				(-0.49)
$RETA$				-0.021***				-0.008
				(-3.89)				(-1.67)
$EBITTA$				0.009***				0.004***
				-4.62				-6.62
$SaleGr$				0.015***				-0.006
				-3.05				(-1.47)
$NITA$				0.001***				0
				-4.57				-0.37
$CACL$				0				-0.001
				-0.06				(-0.54)
$Invest$				0				0
				(-0.72)				(-0.41)
R_{excess}				-0.006**				-0.014***
				(-2.17)				(-9.13)
$RSIZE$				-0.009***				-0.001**
				(-4.12)				(-2.56)
R_m				-0.005				-0.022***
				(-0.26)				(-5.49)
$MCAP$				0.008***				0.002***
				-4.25				-4.46
FE	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Observations	95225	95225	90015	88001	95225	95225	94740	92412
Avg. R^2	0.017	0.142	0.766	0.773	0.018	0.09	0.754	0.762

Table 14: Labor expenses and financial leverage

This table reports the results of cross-sectional regressions using the average of each firm's average labor share over the entire sample to explain the average of each firm's contemporaneous average financial leverage over the entire sample. Results using market leverage ($LEVM$) are on the left, and book leverage ($LEVB$) are on the right. The control variables include leverage, stock volatility (σ), working capital ($WCTA$), retained earnings ($RETA$), EBIT ($EBITTA$), sales (STA), net income ($NITA$), current asset to liability ($CACL$), investment ($Invest$), stock excess return (R_{excess}), relative size ($RSIZE$), market return (R_m), market capitalization ($MCAP$). The details of the variable constructions can be found in the appendix. The t-statistics reported in the parentheses below each coefficient estimate are heteroscedasticity and autocorrelation consistent t-statistics (Newey-West). Statistical significance levels of 1%, 5%, and 10% are indicated with ***, **, and * respectively.

	$x = Avg(LS_t), y = Avg(LEVM)$			$x = Avg(LS_t), y = Avg(LEVM)$		
LS	-0.066***	-0.043***	-0.026***	-0.045***	-0.034***	-0.015***
	(-32.86)	(-19.95)	(-9.39)	(-30.27)	(-20.57)	(-7.19)
σ			0.017***			0.005**
			-6.48			-2.49
$WCTA$			-0.280***			-0.230***
			(-43.91)			(-48.62)
$RETA$			0.011***			0.006***
			-15.32			-10.89
$EBITTA$			0.029**			0.072***
			-2.07			-7.02
$SaleGr$			-0.060***			-0.016***
			(-11.92)			(-4.36)
$NITA$			0.021**			-0.015**
			-2.09			(-2.02)
$CACL$			-0.002***			-0.001***
			(-7.08)			(-4.55)
$Invest$			0.001			0
			-1.23			(-0.24)
R_{excess}			0.084***			0.007
			-4.55			-0.52
$RSIZE$			0.003			0.007***
			-0.97			-3.09
R_m			0.231***			-0.003
			-5.92			(-0.10)
$MCAP$			-0.018***			-0.005**
			(-6.31)			(-2.17)
Country fixed effects	No	Yes	Yes	No	Yes	Yes
Observations	16046	16046	15752	16046	16046	15752
Avg. R^2	0.063	0.143	0.261	0.054	0.123	0.258