Credit and hiring

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November 14, 2013

CREDIT AND EMPLOYMENT LINKS

- When credit is tight, employers lack the liquidity for investing and hiring:
  - *Credit Channel*.

- When the supply of assets is low, the economy is in shortage of insurance instruments. Employers become more averse to risk and reduce hiring:
  - *Asset Channel*.

- When credit is tight, employers face weaker bargaining conditions with workers.
  - *Bargaining channel.*

THEORETICAL INTUITION

- Suppose that there are only two periods. No discounting.
  - **Period 1**: The firm issues debt b and hires a worker.
  - **Period 2**: Produces z and splits the net surplus with the worker:

    Wage $= \frac{1}{2}(z-b)$, Dividend $= \frac{1}{2}(z-b)$

- The value of hiring a worker in period 1 is:

$$b + \frac{1}{2}(z-b)$$

RELATION TO THE LITERATURE

- Theoretical and empirical studies have investigated the importance of the bargaining channel for the Financial Structure of firms:
  - Perotti & Spier (1993)
  - Klasa, Maxwell & Ortiz-Molina (2009), Matsa (2010)

- Fewer studies have investigated the importance of the bargaining channel for the Hiring Decision of firms.

CREDIT CONDITIONS

$\Downarrow$

FINANCIAL STRUCTURE

$\Downarrow$

HIRING

MACRO vs. MICRO ANALYSIS

- Monacelli, Quadrini & Trigari (2011)
  - Studies the importance of bargaining channel for aggregate dynamics.
  - Representative firm with one worker.
  - Aggregate shocks only.
  - Model estimated using time series aggregate data.

- Quadrini & Sun (2013)
  - Studies the importance of bargaining channel for firm dynamics.
  - Multi-worker heterogeneous firms.
  - Idiosyncratic shocks only.
  - Model estimated using firm-level data.

MODEL

- Continuum of firms with production technology

$$Y_t = z_t N_t$$

z_t = idiosyncratic productivity; N_t = number of employees

- Hiring is costly

$$\Upsilon\left(\frac{E_t}{N_t}\right) N_t$$

E_t = new employees (hiring); $\Upsilon(.)$ strictly increasing and convex.

- Employment evolves according to

$$N_{t+1} = (1 - \lambda_t) N_t + E_t$$

λ_t = idiosyncratic separation

MODEL (continue)

- Firms issue non-contingent debt subject to the enforcement constraint

$$q_t B_{t+1} \leq \xi_t \beta \mathbb{E}_t S_{t+1}$$

q_t = price of debt
B_{t+1} = debt issued at t and repaid at $t+1$
S_{t+1} = firm's surplus (defined later)
ξ_t = idiosyncratic stochastic variable (access to credit)

- Budget constraint

$$B_t + D_t + w_t N_t + \Upsilon\left(\frac{E_t}{N_t}\right) N_t = z_t N_t + q_t B_{t+1}$$

D_t = dividends
w_t = wage

BARGAINING

- Equity value: $V_t(B_t, N_t) = D_t + \beta \mathbb{E}_t V_{t+1}(B_{t+1}, N_{t+1})$

- Worker value: $W_t(B_t, N_t) = w_t + (1 - \lambda_t)\beta \mathbb{E}_t W_{t+1}(B_{t+1}, N_{t+1}) + \lambda_t \beta \mathbb{E}_t U_{t+1}$

- Net surplus: $S_t(B_t, N_t) = V_t(B_t, N_t) + \Big(W_t(B_t, N_t) - U_t\Big) N_t$

- Optimal policies:

$$\max_{w_t, D_t, E_t, B_{t+1}} \quad \left[\Big(W_t(B_t, N_t) - U_t\Big) N_t\right]^{\eta} \cdot V_t(B_t, N_t)^{1-\eta},$$

BARGAINING OUTCOME

- Wages are determined so that workers receive a faction η of the surplus

$$
\begin{aligned}
\Big(W_t(B_t, N_t) - U_t\Big) N_t &= \eta\, S_t(B_t, N_t) \\
V_t(B_t, N_t) &= (1-\eta)\, S_t(B_t, N_t)
\end{aligned}
$$

- Remaining policies (D_t, E_t, B_{t+1}) maximize the surplus.

FINANCIAL AND HIRING DECISIONS

$$
\begin{aligned}
S_t(B_t, N_t) \quad = \quad & \max_{E_t, B_{t+1}} \Bigg\{ D_t + w_t N_t - u_t N_t + \\
& \beta \left[1 - \eta + \eta (1 - \lambda_t) \left(\frac{N_t}{N_{t+1}} \right) \right] \mathbb{E}_t S_{t+1}(B_{t+1}, N_{t+1}) \Bigg\}
\end{aligned}
$$

subject to:

$$
D_t + w_t N_t = z_t N_t - \Upsilon \left(\frac{E_t}{N_t} \right) N_t + q_t B_{t+1} - B_t
$$

$$
q_t B_{t+1} \leq \xi_t \beta \mathbb{E}_t S_{t+1}(B_{t+1}, N_{t+1})
$$

$$
N_{t+1} = (1 - \lambda_t) N_t + E_t
$$

SIMPLIFYING ASSUMPTION

$$q_t = \beta$$

The interest rate is equal to the inter-temporal discount rate

Normalizing by N_t

$$s_t(b_t) \quad = \quad \max_{e_t, b_{t+1}} \left\{ d_t + w_t - u_t + \beta \Big(g_{t+1} - \eta e_t \Big) \mathbb{E}_t s_{t+1}(b_{t+1}) \right\}$$

subject to:

$$d_t + w_t = z_t - \Upsilon(e_t) + \beta g_{t+1} b_{t+1} - b_t$$

$$\xi_t \mathbb{E}_t s_{t+1}(b_{t+1}) \geq b_{t+1}$$

$$g_{t+1} = 1 - \lambda_t + e_t.$$

LINEAR SURPLUS

$$s_t(b_t) \quad = \quad \bar{s}_t - b_t$$

Proposition 1. *If $\eta > 0$, the firm borrows up to the limit whenever $e_t > 0$. If $\eta = 0$ the debt is undetermined.*

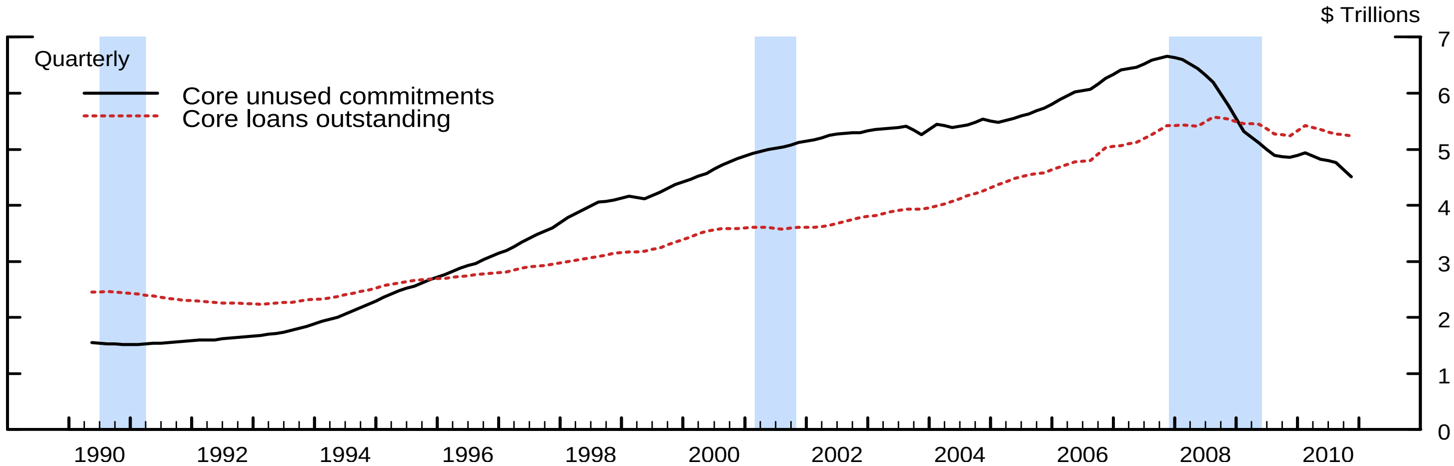
Proposition 2. *If $\eta = 0$, the hiring decision e_t is independent of b_{t+1}.*

Unattractive property of the model

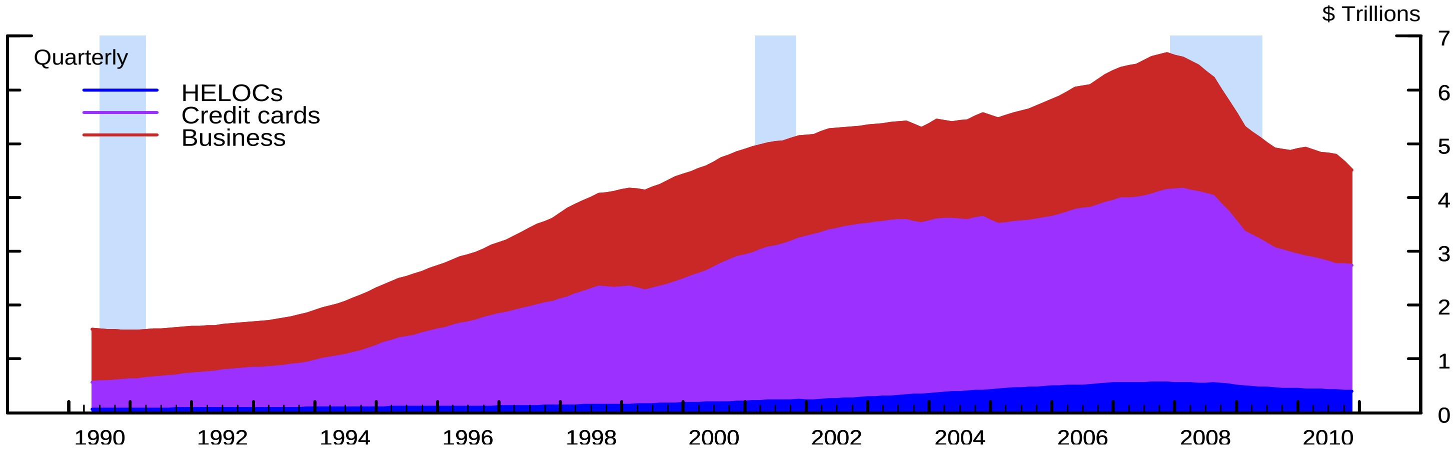
- If the firm hires $(E_t > 0)$ the borrowing limit is always binding.

- However, firms hold a lot of cash and unused lines of credit.

Figure 6: Core Loans and Unused Commitments at Commercial Banks



(a) Core Loans Outstanding and Unused Commitments



(b) Composition of Unused Commitments

Does the bargaining channel work when firms accumulate liquidity?

FINANCIAL DISTRESS

- The borrowing constraint at time t is

$$b_{t+1} \leq \xi_t \mathbb{E}_t s_{t+1}(b_{t+1}).$$

- When the firm enters $t+1$, the constraint may be violated if

$$b_{t+1} > \xi_{t+1} s_{t+1}(b_{t+1}).$$

- In this case the firm is forced to pay back part of the loan before it can access the equity market or retain earnings. This requires the firm to access alternative sources of funds with (distress) cost:

$$\varphi_{t+1}(b_{t+1}) = \kappa \Big(b_{t+1} - b^*_{t+1} \Big)^2.$$

FIRM PROBLEM

$$s_t(b_t) \quad = \quad \max_{e_t, b_{t+1}} \left\{ d_t + w_t - u_t + \beta \Big(g_{t+1} - \eta e_t \Big) \mathbb{E}_t s_{t+1}(b_{t+1}) \right\}$$

subject to:

$$d_t + w_t = z_t - \Upsilon(e_t) + \beta g_{t+1} b_{t+1} - b_t - \varphi_t(b_t)$$

$$\xi_t \mathbb{E}_t s_{t+1}(b_{t+1}) \geq b_{t+1}$$

$$g_{t+1} = 1 - \lambda + e_t,$$

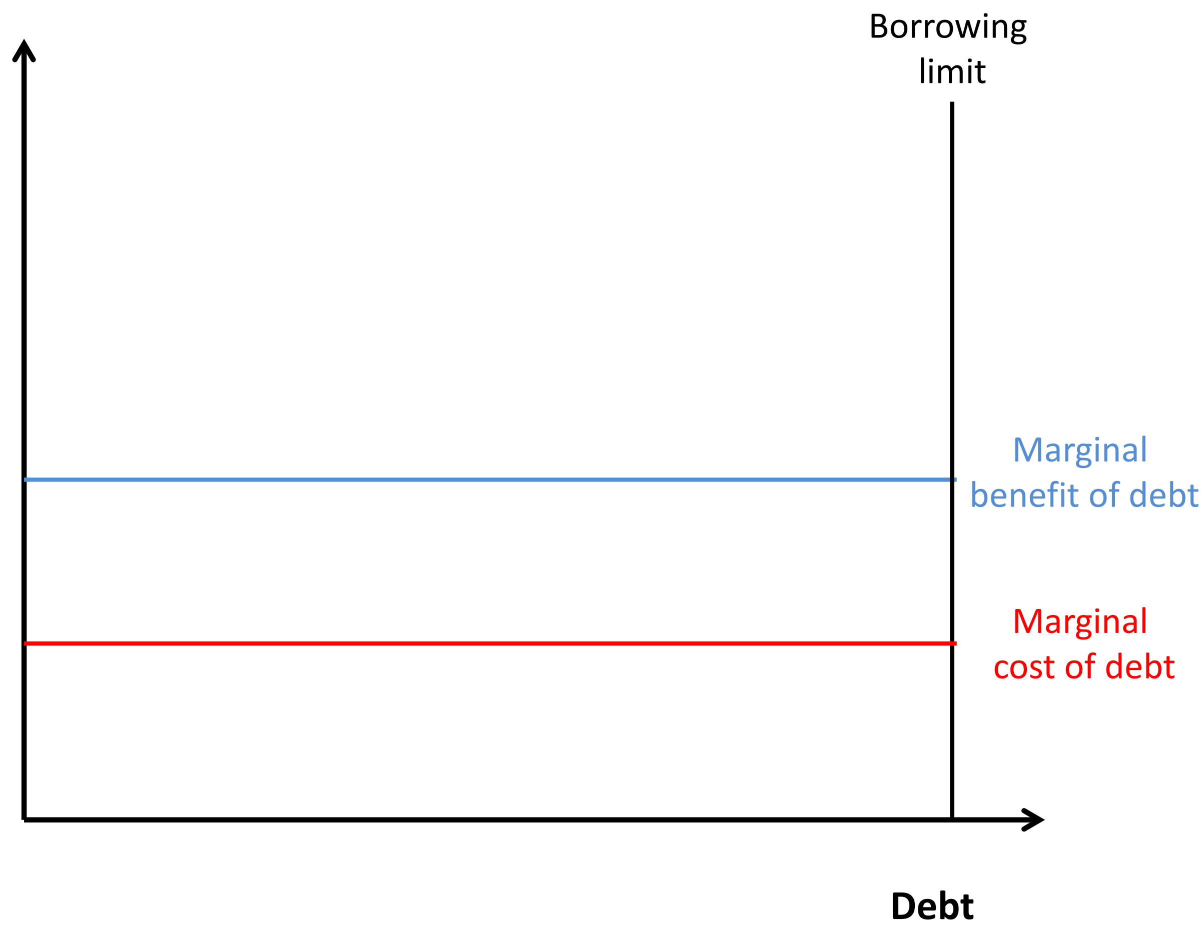
Slope of the surplus functions

$$\frac{\partial s_t(b_t)}{\partial b_t} = -1 - \varphi_t'(b_t).$$

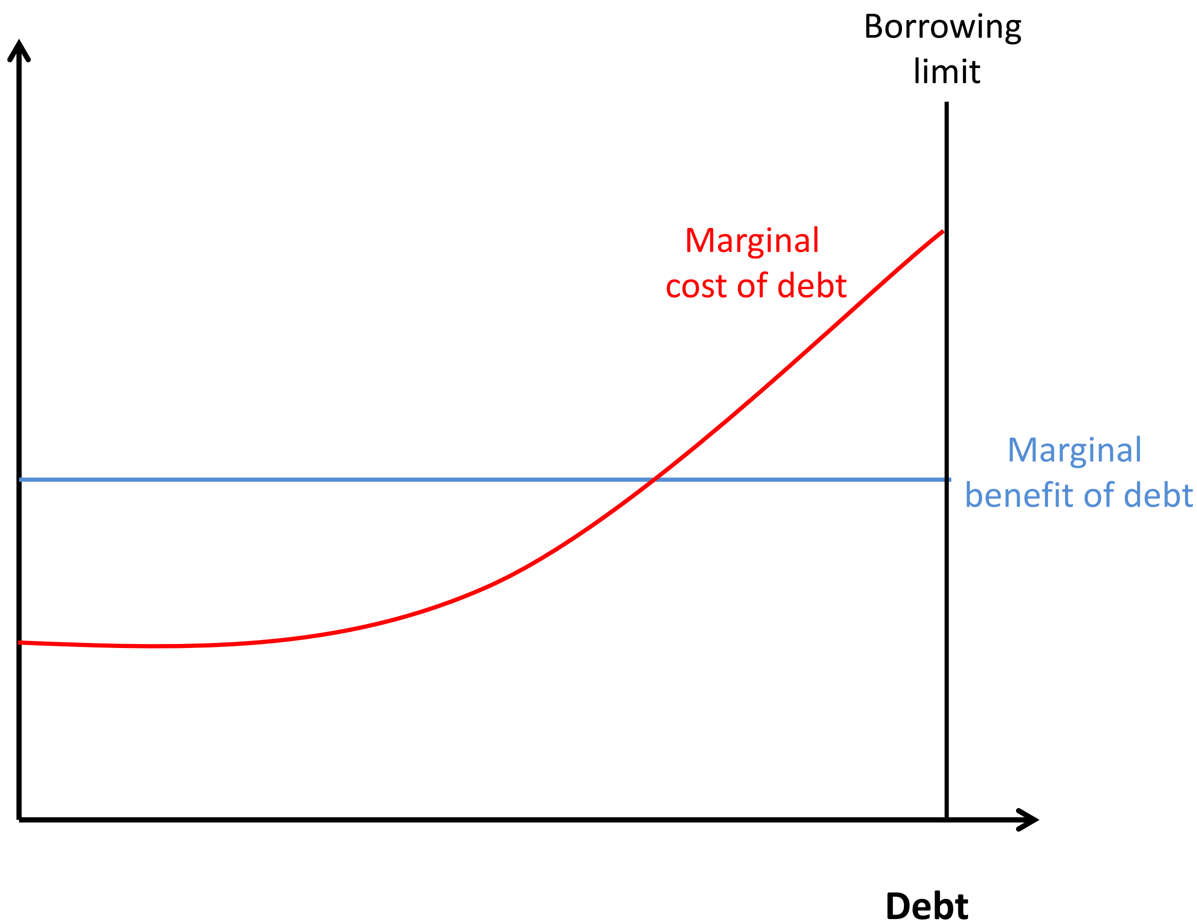
Therefore,

$$s_t(b_t) = \bar{s}_t - b_t - \varphi_t(b_t)$$

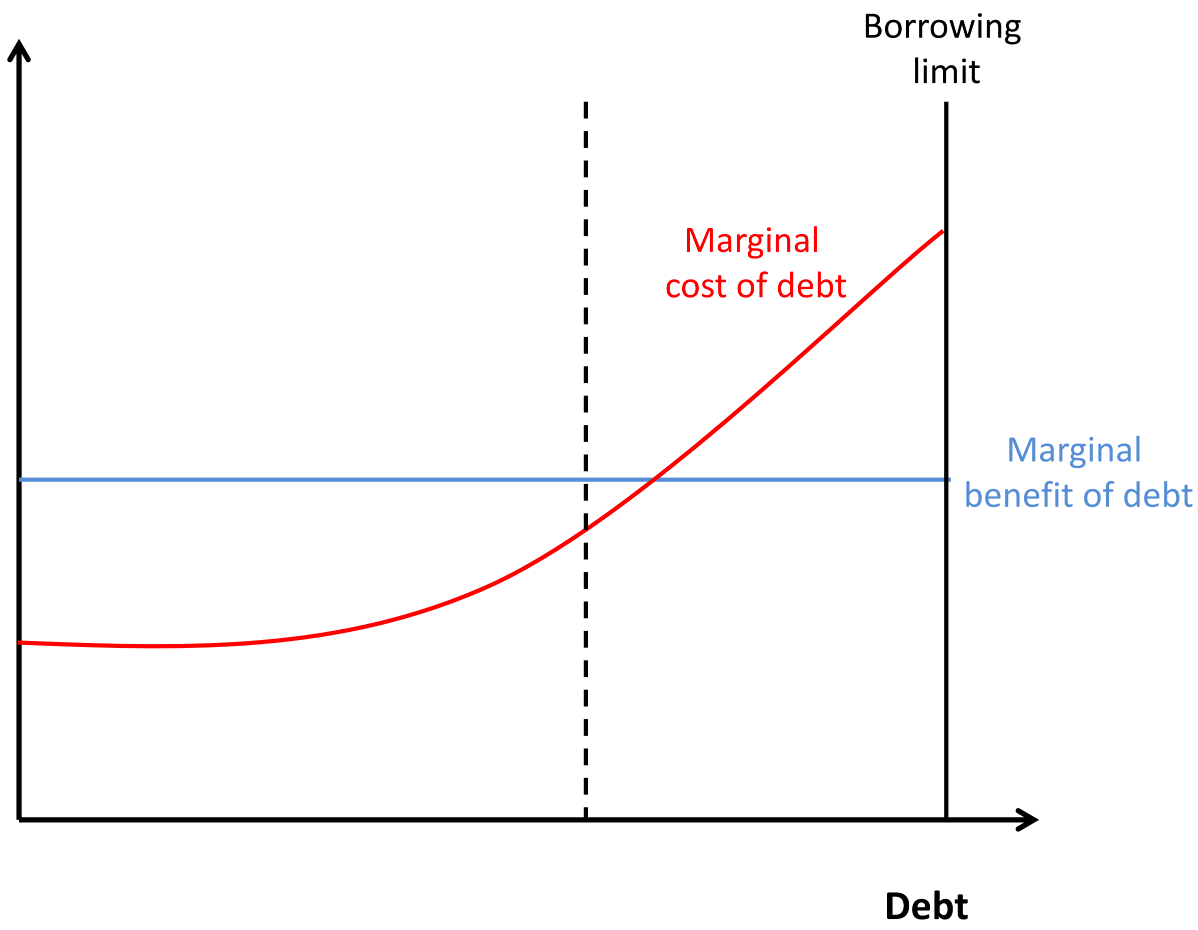
MODEL WITHOUT FINANCIAL DISTRESS



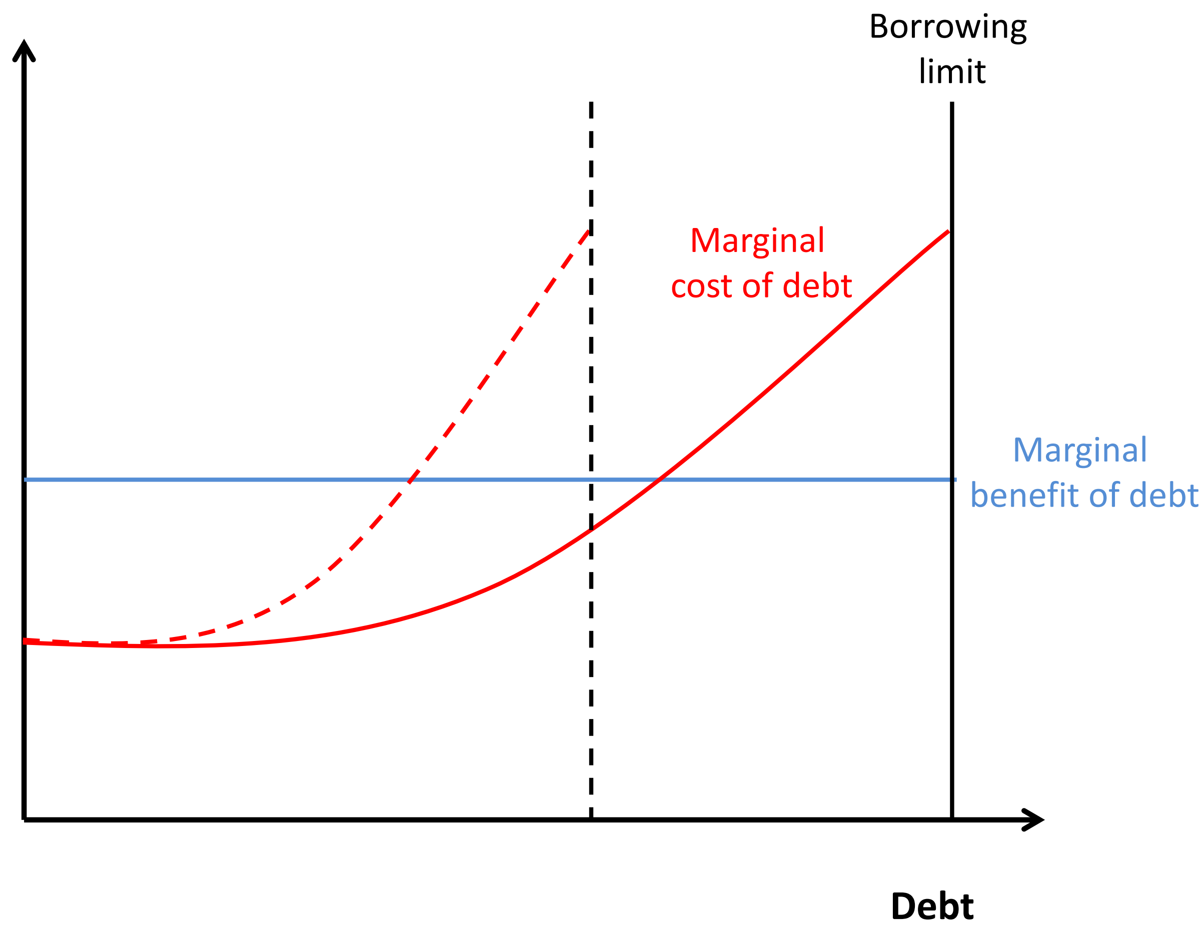
MODEL WITH FINANCIAL DISTRESS



MODEL WITH FINANCIAL DISTRESS



MODEL WITH FINANCIAL DISTRESS



STRUCTURAL ESTIMATION

Simulated Methods of Moments

- Two data sets:
  - Compustat annual files.
  - Capital IQ database.

- Excluded: financial firms and utilities with SIC codes 4900-4949 and 6000-6999; firms with SIC codes greater than 9000; firms with some missing value.

- All variables are winsorized at 2.5% and 97.5% percentiles.

- Nominal variables are deflated by the Consumer Price Index.

- Balanced panel of 1,508 firms over 9 years, from 2002 to 2010.

Target Moments	*Observed*	*Simulated*
$Mean(\frac{unused_t}{credit_t})$	0.411	0.419
$Std(\frac{unused_t}{credit_t})$	0.172	0.150
$Std(\Delta employ_t)$	0.134	0.108
$Std(\Delta sales_t)$	0.181	0.170
$Std(\Delta credit_t)$	0.500	0.483
$Autocor(\frac{unused_{t-1}}{credit_{t-1}})$	0.317	0.376
$Autocor(\Delta employ_{t-1})$	-0.029	0.345
$Autocor(\Delta sales_{t-1})$	0.007	0.035
$Autocor(\Delta credit_{t-1})$	-0.185	-0.130
$Cor(\frac{unused_t}{credit_t}, \Delta employ_t)$	-0.067	0.109
$Cor(\frac{unused_t}{credit_t}, \Delta sales_{it})$	-0.046	-0.013
$Cor(\frac{unused_t}{credit_t}, \Delta credit_{it})$	-0.001	0.271
$Cor(\Delta employ_t, \Delta sales_{it})$	0.497	0.404
$Cor(\Delta employ_t, \Delta credit_{it})$	0.296	0.346
$Cor(\Delta sales_t, \Delta credit_{it})$	0.197	0.148

Estimated Parameters

Persistence productivity shock, ρ_z	0.717
Volatility productivity shock, σ_z	0.173
Persistence credit shock, ρ_ξ	0.830
Volatility credit shock, σ_ξ	0.175
Persistence separation shock, ρ_λ	0.112
Volatility separation shock, σ_λ	0.099
Financial distress cost, κ	10.323
Workers' bargaining power, η	0.692
Hiring cost, ϕ	0.360
Average separation, $\bar{\lambda}$	0.309
Unemployment flow, $\bar{u}$	0.452

THE ROLE OF EACH SHOCK

	Observed	Benchmark Model	Credit Shock	Productivity Shock	Separation Shock
$Mean(\frac{unused_t}{credit_t})$	0.411	0.419	0.425	0.511	0.511
$Std(\frac{unused_t}{credit_t})$	0.172	0.150	0.150	0.023	0.017
$Std(\Delta employ_t)$	0.134	0.108	0.050	0.051	0.080
$Std(\Delta sales_t)$	0.181	0.170	0.050	0.137	0.080
$Std(\Delta credit_t)$	0.500	0.483	0.445	0.121	0.092
$Autocor(\frac{unused_{t-1}}{credit_{t-1}})$	0.317	0.376	0.383	0.624	0.082
$Autocor(\Delta employ_{t-1})$	-0.029	0.345	0.736	0.626	0.083
$Autocor(\Delta sales_{t-1})$	0.007	0.035	0.736	-0.075	0.083
$Autocor(\Delta credit_{t-1})$	-0.185	-0.130	-0.148	-0.039	-0.052
$Cor(\frac{unused_t}{credit_t}, \Delta employ_t)$	-0.067	0.109	0.289	-0.999	0.997
$Cor(\frac{unused_t}{credit_t}, \Delta sales_{it})$	-0.046	-0.013	0.266	-0.690	0.083
$Cor(\frac{unused_t}{credit_t}, \Delta credit_{it})$	-0.001	0.271	0.314	-0.734	0.987
$Cor(\Delta employ_t, \Delta sales_{it})$	0.497	0.404	0.736	0.694	0.083
$Cor(\Delta employ_t, \Delta credit_{it})$	0.296	0.346	0.220	0.736	0.990
$Cor(\Delta sales_t, \Delta credit_{it})$	0.197	0.148	-0.262	0.994	-0.054

ALTERNATIVE

EMPIRICAL APPROACH

Optimality condition for hiring without financial distress

$$\beta\left[(1-\eta)\mathbb{E}_t\bar{s}_{t+1}+\frac{\eta g^B_{t+1}b_t}{g^N_{t+1}}\right]=\Upsilon'\Big(g^N_{t+1}-1+\lambda\Big)$$

LINEARIZED OPTIMALITY CONDITION

$$g_{t+1}^N = \alpha_c + \alpha_s \cdot \mathbb{E}_t \bar{s}_{t+1} + \alpha_b \cdot b_t + \alpha_g(\eta) \cdot g_{t+1}^B$$

where

$$\begin{aligned}
\alpha_s &= \frac{(1-\eta)\gamma(g^N - 1 + \lambda)g^N}{[\eta\gamma(g^N - 1 + \lambda)/g^N + \eta(1-\gamma) + (1-\eta)(1-\gamma)(1+\xi)/\xi]bg^B}, \\
\alpha_b &= \frac{\eta\gamma(g^N - 1 + \lambda)}{[\eta\gamma(g^N - 1 + \lambda)/g^N + \eta(1-\gamma) + (1-\eta)(1-\gamma)(1+\xi)/\xi]b}, \\
\alpha_g(\eta) &= \frac{\eta\gamma(g^N - 1 + \lambda)}{[\eta\gamma(g^N - 1 + \lambda)/g^N + \eta(1-\gamma) + (1-\eta)(1-\gamma)(1+\xi)/\xi]g^B}
\end{aligned}$$

TESTING HYPOTHESIS

The sensitivity of employment to credit increases with the bargaining power of workers.

EMPIRICAL EQUATION

$$
\begin{aligned}
\Delta employ_{it} \quad = \quad & \beta_1 \cdot union_{cic,t} \cdot \Delta debt_{it} + \\
& \beta_2 \cdot union_{cic,t} + \\
& \beta_3 \cdot \Delta debt_{it} + \\
& \beta_4 \cdot leverage_{it-1} + \\
& \beta_5 \cdot \log(employ_{it-1}) + \\
& \beta_6 \cdot Q_{it} + \\
& \beta_7 \cdot cashflow_{it} + \nu_i + \tau_t + \varepsilon_{it}
\end{aligned}
$$

		Unionization Rate	
		High	Low
$union_{cic,t} \cdot \Delta debt_{it}$	**0.285*****		
	(0.089)		
$union_{cic,t}$	**0.056**		
	(0.058)		
$\Delta debt_{it}$	**0.162*****	**0.208*****	**0.167*****
	(0.010)	(0.010)	(0.010)
$leverage_{it-1}$	**0.048*****	**0.083*****	**0.024**
	(0.019)	(0.029)	(0.027)
$\log(employ_{t-1})$	**-0.122*****	**-0.141*****	**-0.110*****
	(0.010)	(0.011)	(0.015)
Q_{it}	**0.026*****	**0.023*****	**0.029*****
	(0.005)	(0.008)	(0.006)
$cashflow_{it}$	**0.254*****	**0.268*****	**0.245*****
	(0.026)	(0.046)	(0.033)
Firm Fixed Effects	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes
Adjusted R^2	0.39	0.42	0.36
Observation	12,173	5,877	6,296