Macroeconomic Effects of Financial Shocks
Jermann and Quadrini, 2012 AER

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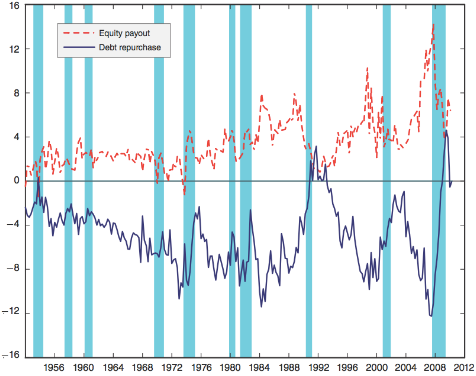
Introduction

- Questions: do financial shocks help explain business cycles?
- RBC model with financial frictions and financial shocks
- Uses data on firm financial structure to measure financial constraints and shocks.
- Results
  - financial shocks help explain financial flows
  - financial shocks improve model's performance for real variables (labor in particular)
  - financial shocks have been important for the last three US recessions (1991, 2001, 2008)

Motivation

- Net equity payout = dividends + share buybacks - equity issuance
- Net debt repurchase = debt repayment - debt issuance = negative change in stock of debt



Model

- Firms issue debt and equity.
  - Debt is preferred because of tax advantage.
- Budget constraint:

$$b_t + w_t n_t + k_{t+1} + \varphi(d_t) = (1-\delta) k_t + F(z_t, k_t, n_t) + \frac{b_{t+1}}{R_t}$$

- Revenue $F(z_t, n_t, k_t)$ isn't received until end of period so within-period loan l_t is necessary:

$$l_t = F(z_t, k_t, n_t)$$

- Issuing equity and paying dividends is costly. Cost of payout d_t:

$$\varphi(d_t) = d_t + \kappa\left(d_t - \bar{d}\right)^2$$

Enforcement constraint

- Firm can default on the within-period loan.
- If the firm defaults, the lender has the option of liquidating the firm.
  - Lender liquidates capital:
    - with probability ξ_t, recovers k_{t+1} less bond repayments,
    - with probability $1 - \xi_t$, recovers zero.
- Renegotiation: firm pays out to the lender just enough to prevent her from liquidating.
- This gives firm's "value of default",
  - lender caps lending such that value of default doesn't exceed value of repaying:

$$\xi_t \left(k_{t+1} - \frac{b_{t+1}}{1 + r_t} \right) \geq l_t$$

Firm's problem

$$V\left(\mathbf{s};k,b\right)=\max_{d,n,k',b'}\left\{d+Em'V\left(\mathbf{s}';k',b'\right)\right\}$$

subject to

$$\left(1-\delta\right)k+F\left(z,k,n\right)-wn+\frac{b}{R'}=b+\varphi\left(d\right)+k'$$

$$\xi\left(k'-\frac{b'}{1+r}\right)\geq F\left(z,k,n\right)$$

where

$$\begin{aligned}\varphi\left(d\right)&=d+\kappa\left(d-\bar{d}\right)^{2}\\R&=1+r\left(1+\tau\right)\end{aligned}$$

Households

- Representative household

$$\max E_0 \sum_{t=0}^{\infty} \beta^t U(c_t, n_t)$$

- Budget constraint:

$$w_t n_t + b_t + s_t (d_t + p_t) = \frac{b_{t+1}}{1 + r_t} + s_{t+1} p_t + c_t + T_t$$

- Firms are owned by households:

$$m' = \frac{\beta U_c(c', n')}{U_c(c, n)}$$

Calibration

- Parameters chosen with steady state targets:
  - Tax advantage of debt, $\tau = 0.35$, corresponds to marginal tax rate of 35%
    - At this level, financial constraint always binds.
  - Mean of financial variable, $\bar{\xi} = 0.1636$, chosen to match ratio of debt to quarterly GDP (3.36).
- Equity issuance cost parameter $\kappa = 0.146$, chosen to match standard deviation of equity payouts.

Shock processes

- Productivity shocks are constructed from data on output, capital and labor:

$$\hat{z}_t = \hat{y}_t - \theta \hat{k}_t - (1 - \theta)\, \hat{n}_t$$

- Under the assumption that the borrowing constraint is always binding, financial shocks can be backed out from output, capital and debt:

$$\xi_t \left(k_{t+1} - \frac{b_{t+1}}{1 + r_t} \right) = y_t$$

- Estimate shock processes:

$$\begin{pmatrix} \hat{z}_{t+1} \\ \hat{\xi}_{t+1} \end{pmatrix} = \mathbf{A} \begin{pmatrix} \hat{z}_t \\ \hat{\xi}_t \end{pmatrix} + \begin{pmatrix} \epsilon_{z,t+1} \\ \epsilon_{\xi,t+1} \end{pmatrix}$$

Results: productivity shocks only

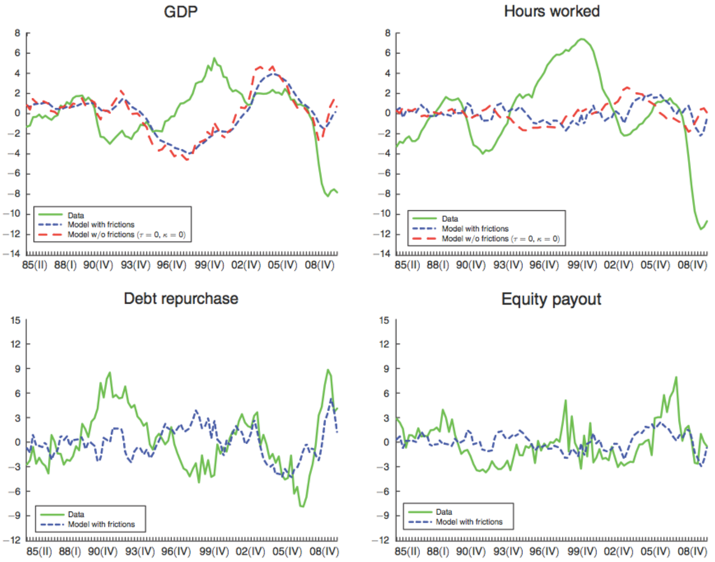


FIGURE 3. RESPONSE TO PRODUCTIVITY SHOCKS ONLY

Results: with financial shocks

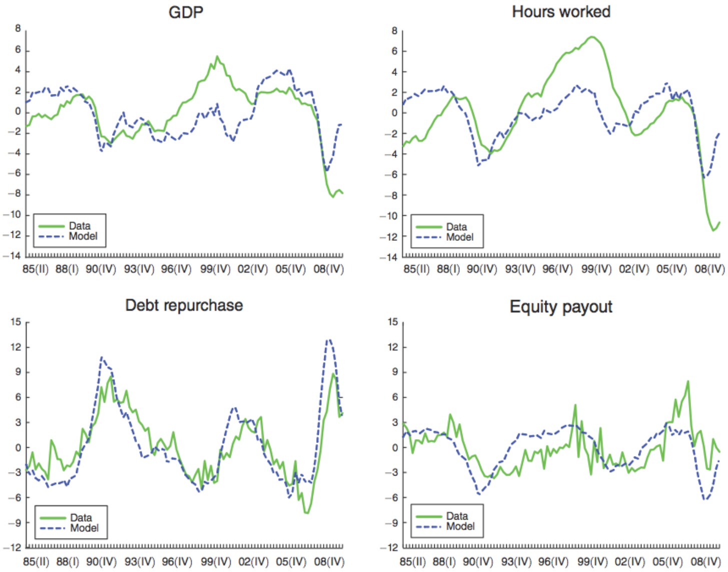


FIGURE 5. RESPONSE TO BOTH PRODUCTIVITY AND FINANCIAL SHOCKS

Labor

- First order condition with respect to labor:

$$F_n(z, k, n) = w \cdot \left(\frac{1}{1 - \mu \varphi_d(d)} \right)$$

  where μ is the Lagrange multiplier on the enforcement constraint.
- Given a negative financial shock, if not for financial frictions the firm would fund its working capital by issuing equity.
- However, κ and τ restrict equity issuance, so the firm absorbs some of the shock by reducing the scale of output.
  - Reducing output means hiring less output, since capital is fixed.
  - This gives a reduction in labor demand in financially constrained times.

Structural estimation

- Specify and estimate a full structural model:
  - Smets and Wouters (2007)
  - additional financial constraint and shock
  - additional time series for estimation — debt repurchases

TABLE 4—VARIANCE DECOMPOSITION: AVERAGE FROM 10,000 DRAWS OF PARAMETERS FROM POSTERIOR

	TFP shock z	Invest. shock ζ	Intert. shock γ	Price MK shock η	Wage MK shock υ	Govern. shock G	Money shock ς	Financial shock ξ
GDP	4.1	4.1	1.1	24.9	12.9	0.8	5.9	46.4
Consum	2.1	27.8	56.6	2.9	2.7	7.1	0.2	0.6
Invest	2.5	16.5	13.3	13.8	9.6	15.2	4.4	24.7
GDPdefl	2.2	24.0	2.0	3.7	5.2	2.8	50.6	9.5
FF rate	3.6	61.9	4.1	3.4	8.1	9.7	4.5	4.7
Hours	19.4	5.1	0.8	16.0	17.7	1.1	6.5	33.5
Wages	0.5	2.9	3.1	5.4	83.3	0.7	3.1	1.0
DebtPay	6.9	5.8	0.5	51.3	15.3	5.8	0.9	13.5

- Conclusion: financial shocks contribute to GDP fluctuations over the sample period.

Conclusion

- The paper argues that shocks to financial frictions and shocks are important contributors to business cycles.
- Key mechanism: firms prefer debt to equity and debt financing is constrained.
  - This gives procyclical net debt issuance, countercyclical net equity issuance
- Additional mechanism: equity financing is costly.
  - This means production (i.e. labor) absorbs some of the shock.

Conclusion

- The paper argues that shocks to financial frictions and shocks are important contributors to business cycles.
- Key mechanism: firms prefer debt to equity and debt financing is constrained.
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- Issues
  - Cyclicality of debt and equity is not undisputed.
    - Korajczyk and Levy (2003) find procyclical equity issuance and countercyclical debt issuance.
    - Covas and den Haan argue show that largest 1% of firms very different from the rest.
  - Interpretation of financial shocks?

First order conditions

Labor:

$$F_n\left(z,k,n\right)=w\cdot\left(\frac{1}{1-\mu\varphi\left(d\right)}\right)$$

Capital:

$$Em'\cdot\left(\frac{\varphi_d\left(d\right)}{\varphi_d\left(d'\right)}\right)\left[1-\delta+\left(1-\mu'\varphi_d\left(d'\right)F_k\left(z',k',n'\right)\right)\right]+\xi\mu\varphi_d\left(d\right)=1$$

Debt:

$$REm'\cdot\left(\frac{\varphi_d\left(d\right)}{\varphi_d\left(d'\right)}\right)+\xi\mu\varphi_d\left(d\right)\left(\frac{R}{1+r}\right)=1$$

Impulse responses

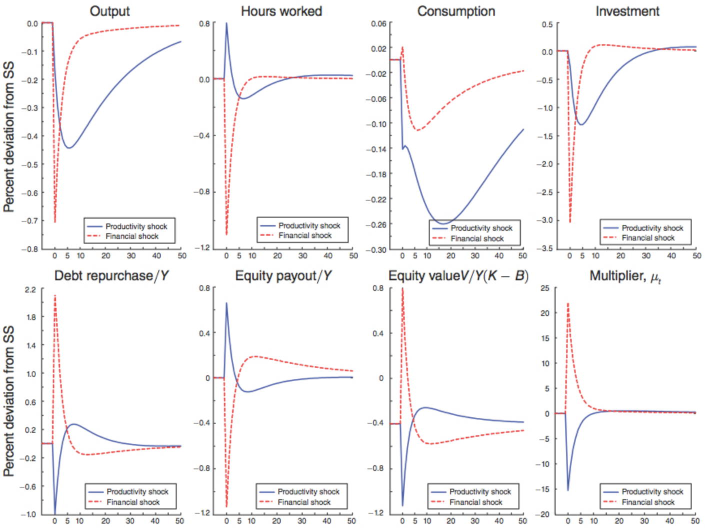

FIGURE 6. IMPULSE RESPONSES TO ONE-TIME PRODUCTIVITY AND FINANCIAL SHOCKS

Calibration

TABLE 2—PARAMETERIZATION

Description	
Discount factor	$\beta = 0.9825$
Tax advantage	$\tau = 0.3500$
Utility parameter	$\alpha = 1.8834$
Production technology	$\theta = 0.3600$
Depreciation rate	$\delta = 0.0250$
Enforcement parameter	$\bar{\xi} = 0.1634$
Payout cost parameter	$\kappa = 0.1460$
Standard deviation productivity shock	$\sigma_z = 0.0045$
Standard deviation financial shock	$\sigma_\xi = 0.0098$
Matrix for the shocks process	$\mathbf{A} = \begin{bmatrix} 0.9457 & -0.0091 \\ 0.0321 & 0.9703 \end{bmatrix}$