Macroeconomic Effects of Financial Shocks

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PPREFACE

- Financial sector as a source of business cycle fluctuations:

The role of the financial sector in propagating shocks that originate in other sectors of the economy VS the importance of financial shocks that originate directly in the financial sector.

- The cyclical properties of firms' equity and debt flows at an aggregate level.

EQUITY PAYOUT AND DEBT REPURCHASE (/ GDP)

- There is some substitutability between equity and debt financing
- Recessions lead firms to restructure their financial positions by cutting the growth rate of debt and reducing the payments to shareholders.
- **The procyclicality of equity payouts and the countercyclicality of debt repurchases**

- Great Moderation: corresponds to a break in the volatility in many business cycle variables.
- spurred by regulatory changes, share repurchases had become more common, and this seems to have had a major impact on firms' payout policies and financial flexibility

TABLE 1—BUSINESS CYCLES PROPERTIES OF MACROECONOMIC AND FINANCIAL VARIABLES, 1984:I–2010:II

	Standard deviation(Variable)	Corr(Variable, GDP)
EquPay/GDP	1.13	0.45
DebtRep/GDP	1.46	−0.70

PREFACE

1. Business cycle model with explicit roles for firms' debt and equity financing: capable of capturing the empirical cyclical properties of the financial flows.
   - Debt is preferred to equity & the firms' ability to borrow is limited by an "enforcement constraint"
   - Enforcement constraint is subject to random disturbances
   - The disturbances affect the firms' ability to borrow
   - Refer to disturbances as "financial shocks"
2. Two methodological approaches:
   - The first based on the construction of time series for the financial shocks: Construct series for financial shocks and productivity shocks from data using model restrictions
   - The second based on the structural estimation of the model with Bayesian maximum likelihood methods: A richer model with many more shocks and frictions
3. Evaluate the importance of financial (and productivity) shocks for macroeconomic fluctuation

FINDINGS

- Financial shocks have played a central role in all recent recessions: 1991, 2001, and 2008.
- Financial shocks are important not only for capturing the dynamics of financial flows but also for the dynamics of the real business cycle quantities, especially labor.
- Using a richer model financial shocks contribute to almost half of the volatility of output and about 30 percent to the volatility of working hours.
- Despite the differences in methodology—calibration versus estimation—the dynamics induced by financial shocks using the two approaches are similar.

THE MODEL

- Continuum of firms with revenue function

$$F(z_t, k_t, n_t) = z_t k_t^{\theta} n_t^{1-\theta}.$$

- z_t is an exogenous productivity shock

FINANCIAL STRUCTURE

- Firms raise funds with debt and equity. The cost of borrowing is: $R_t = 1 + r_t\,(1 - \tau)$
- The intera period loan contracted by the firm is: $l_t = w_t n_t + i_t + d_t + b_t - b_{t+1}/R_t.$
- Using the firm's budget constraint,

$$b_t + w_t n_t + k_{t+1} + d_t = (1 - \delta)k_t + F(z_t, k_t, n_t) + b_{t+1}/R_t, \quad \Rightarrow \quad l_t = F(z_t, k_t, n_t)$$

- Debt is preferred to equity, but there is limited enforcement:

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

- Higher debt, either intertemporal or intra temporal, makes the enforcement constraint tighter.
- Higher stock of capital relaxes the enforcement constraint.

FINANCIAL STRUCTURE

- The enforcement constraint can be rewritten as:

$$\left(\frac{\xi_t}{1-\xi_t}\right)\left[(1-\delta)k_t - b_t - w_t n_t - d_t\right] \geq F(z_t, k_t, n_t)$$

- Rigidities affecting the substitution between debt and equity, Given d_t the equity payout, the actual cost for the firm is:

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

- k_t and b_t given, variables under the control of the firm: n_t , d_t .
- A negative financial shock (lower ξ t) requires a reduction in equity payout d_t: the firm is forced to increase its equity and reduce the new intertemporal debt.
- If the firm cannot reduce d_t , it has to cut employment.

FINANCIAL STRUCTURE

- Whether the financial shock affects employment depends on the flexibility with which the firm can change its financial structure, i.e., the composition of debt and equity.
- Rigidities affecting the substitution between debt and equity, Given d_t the equity payout, the actual cost for the firm is:

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

  Where $\kappa \geq 0$, and $\bar{d}$ is a coefficient equal to the long-run payout target (steady state).
- The parameter κ is key for determining the impact of financial shocks.
- When $\kappa = 0$ the economy is almost equivalent to a frictionless economy.
- When $\kappa > 0$, the substitution between debt and equity becomes costly and firms readjust the sources of funds slowly: As a result, financial shocks will have nonnegligible short-term effects on the production decision of firms.

RECURSIVE PROBLEM

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

$$\text{subject to} \quad (1-\delta)k + F(z,k,n) - wn + \frac{b'}{R} = b + \varphi(d) + k'$$

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

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

$\{k_{t+1}\}$ $$Em' \cdot \left(\frac{\varphi_d(d)}{\varphi_d(d')}\right)[1-\delta+(1-\mu'\varphi_d(d'))F_k(z',k',n')] + \xi\mu\varphi_d(d) = 1,$$

$\{b_{t+1}\}$ $$REm' \cdot \left(\frac{\varphi_d(d)}{\varphi_d(d')}\right) + \xi\mu\varphi_d(d)\left(\frac{R}{1+r}\right) = 1,$$

HOUSEHOLD SECTOR

- There is a representative consumer with standard preferences: $E_0 \sum_{t=0}^{\infty} \beta^t U(c_t, n_t),$

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

$$\{n_t\} \quad w_t U_c(c_t, n_t) + U_n(c_t, n_t) = 0,$$

$$\{b_{t+1}\} \quad U_c(c_t, n_t) - \beta(1 + r_t) E U_c(c_{t+1}, n_{t+1}) = 0,$$

$$\{s_{t+1}\} \quad U_c(c_t, n_t) p_t - \beta E(d_{t+1} + p_{t+1}) U_c(c_{t+1}, n_{t+1}) = 0.$$

$$p_t = E_t \sum_{j=1}^{\infty} \left(\frac{\beta^j \cdot U_c(c_{t+j}, n_{t+j})}{U_c(c_t, n_t)} \right) d_{t+j}.$$

- Firms are owned by households, so that : $m_{t+j} = \beta^j U_c(c_{t+j}, n_{t+j}) / U_c(c_t, n_t).$

SOME CHARACTERIZATION OF THE EQUILIBRIUM

- PROPOSITION 1: if $\tau > 0$ the enforcement constraint binds in a steady state.
  - As long as there is a tax benefit of debt, the enforcement constraint is binding in a steady state.
  - With uncertainty, the constraint may not be always binding because firms could reduce their borrowing in anticipation of future shocks.
  - The constraint is always binding if τ is sufficiently large and the shocks are sufficiently small.

SOME CHARACTERIZATION OF THE EQUILIBRIUM

- PROPOSITION 2: With $\tau = 0$ and $\kappa = 0$, changes in ξ have no effect on employment n and next period capital k'.
  - when $\tau = 0$ and $\kappa = 0$, business cycle fluctuations are driven only by productivity. The model becomes a standard RBC where firms are indifferent between debt and equity.

CONSTRUCTING THE SHOCKS

- Productivity shocks are standard Solow residuals

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

- Financial shocks are measured with the linearized enforcement constraint

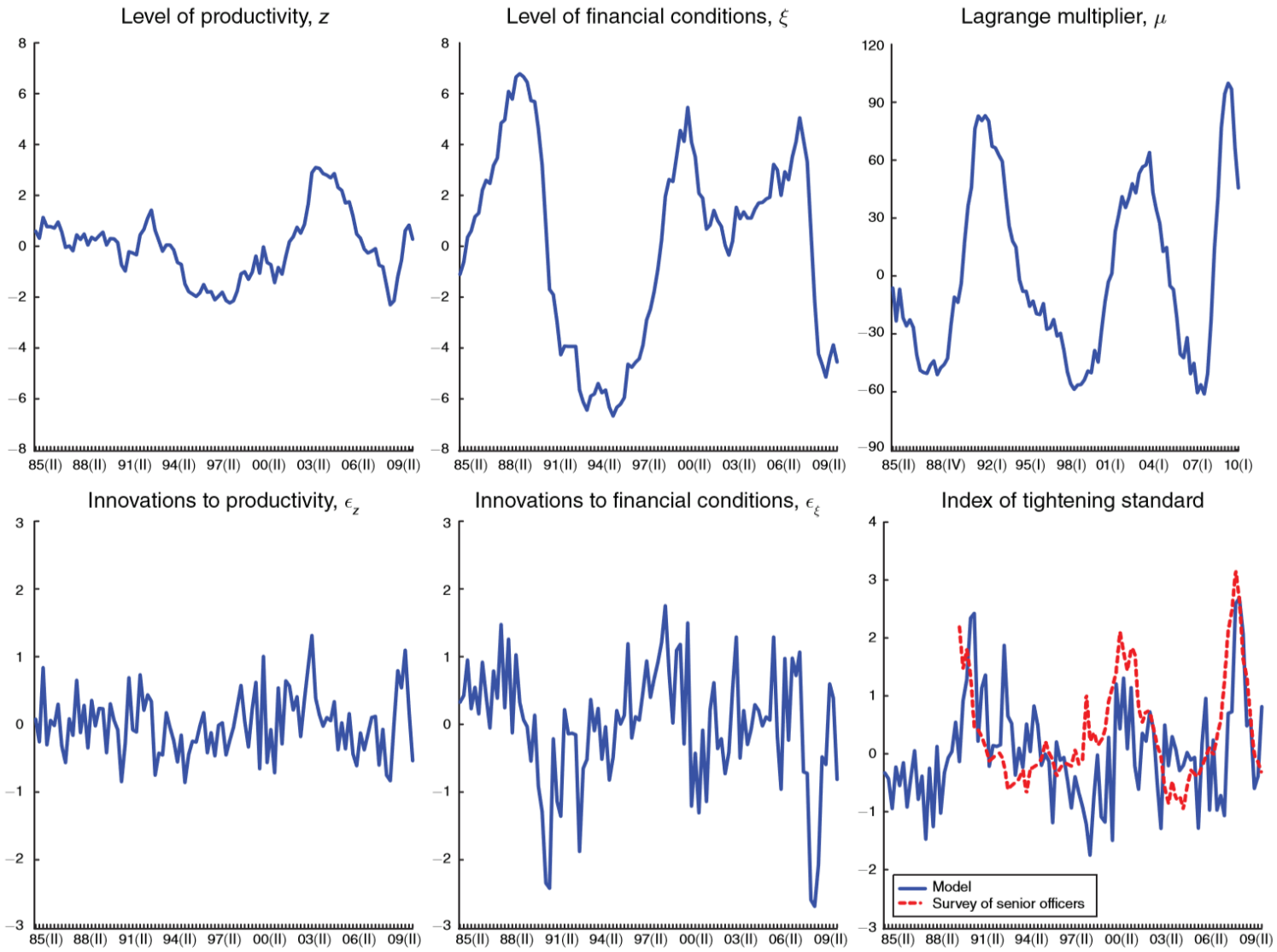
$$\xi_t \left(k_{t+1} - \frac{b_{t+1}}{1 + r_t} \right) = y_t.$$

- Based on constructed time series (1984-2009.1) we estimate

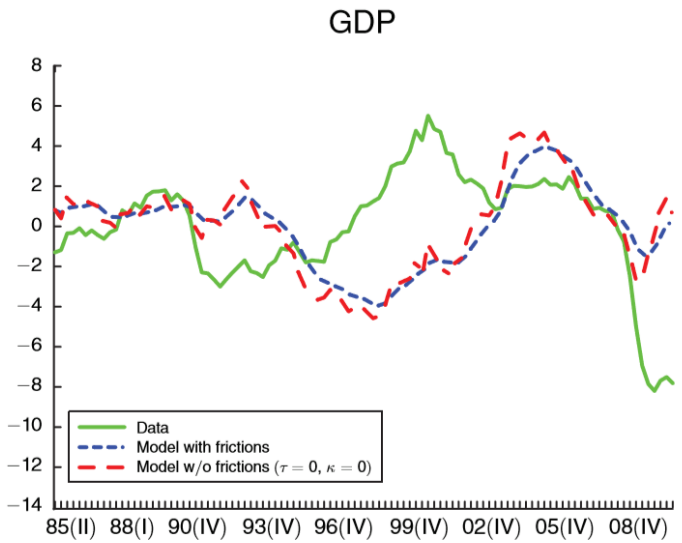
$$\begin{pmatrix} \hat{z}_{t+1} \\ \hat{\xi}_{t+1} \end{pmatrix} = \mathbf{A} \begin{pmatrix} \hat{z}_t \\ \hat{\xi}_t \end{pmatrix} + \begin{pmatrix} \epsilon_{z,t+1} \\ \epsilon_{\xi,t+1} \end{pmatrix},$$

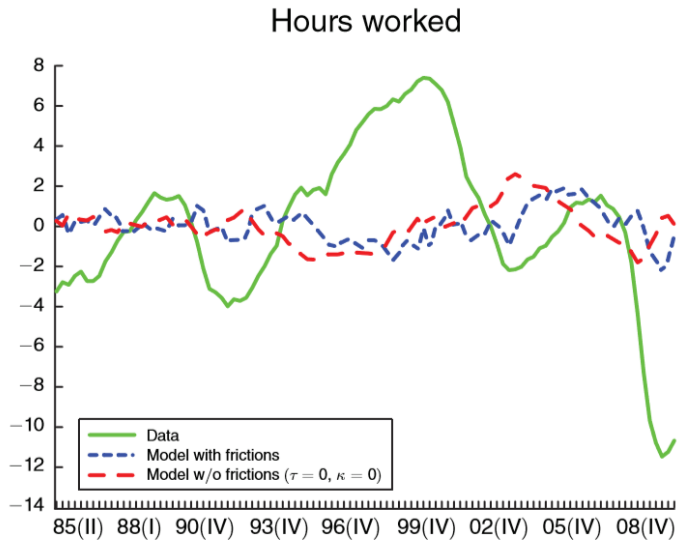
Findings

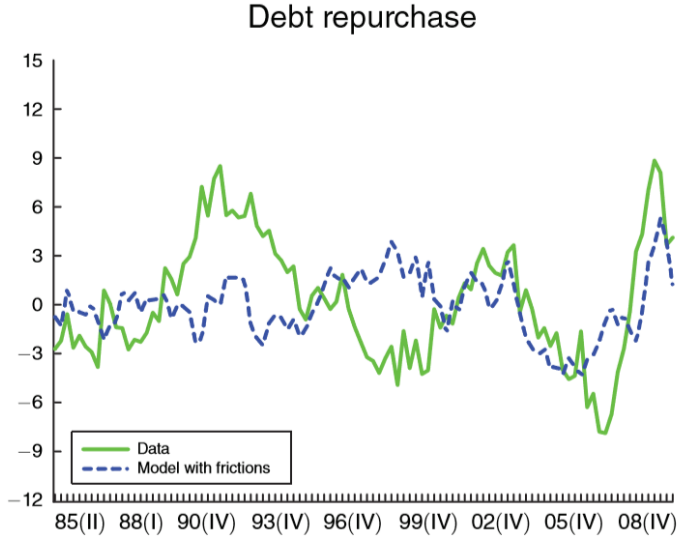
TIME SERIES OF SHOCKS TO PRODUCTIVITY AND FINANCIAL CONDITIONS

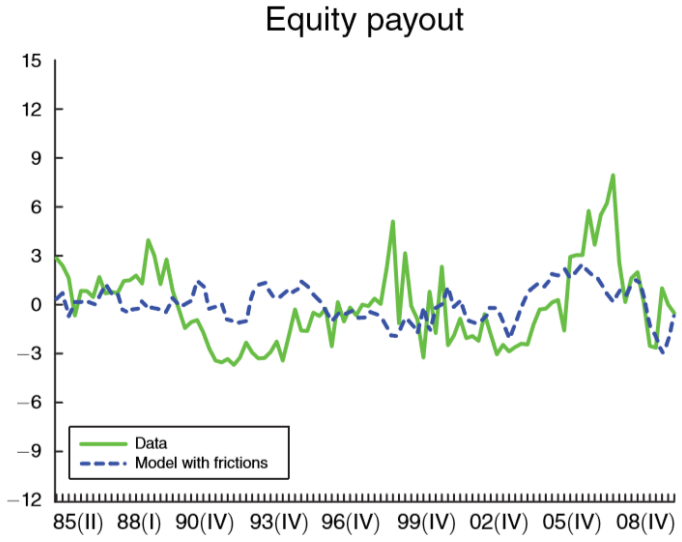


RESPONSE TO PRODUCTIVITY SHOCKS ONLY

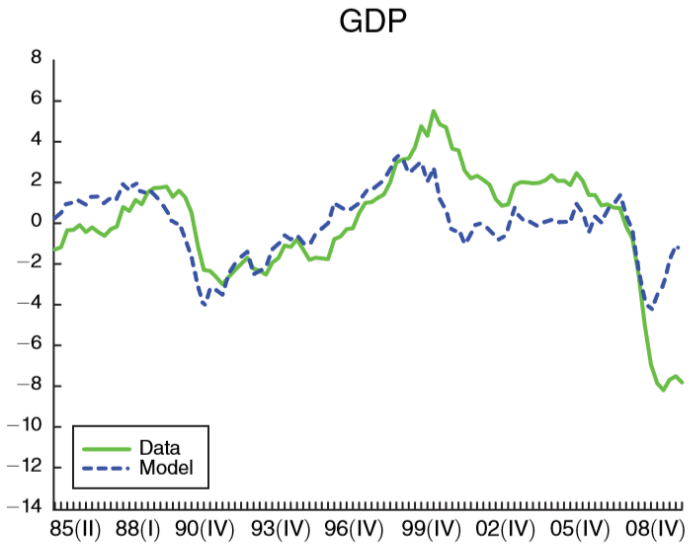


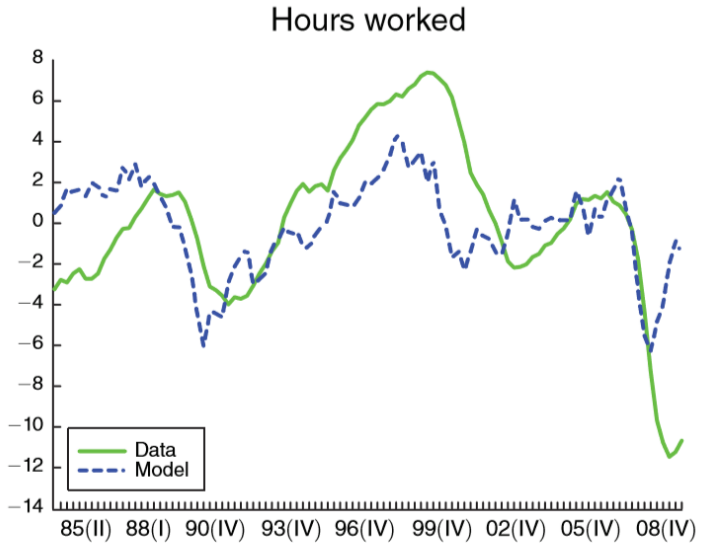


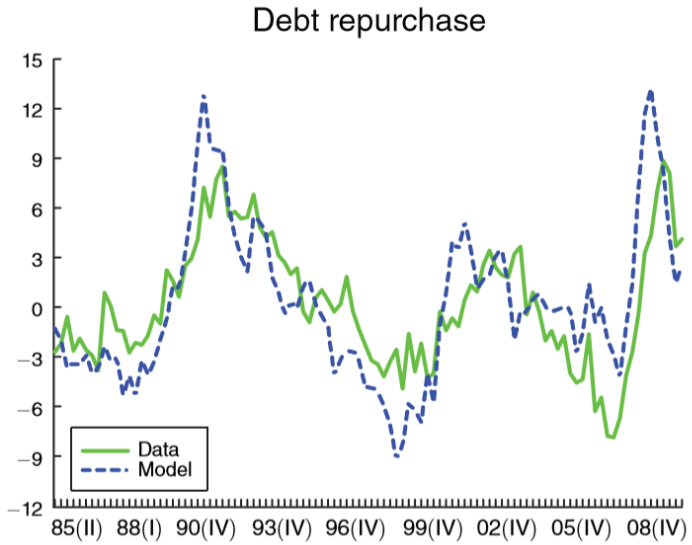


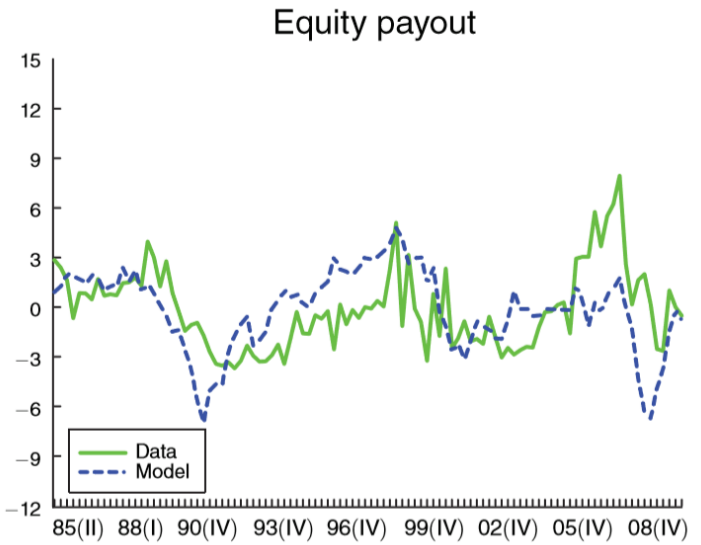


RESPONSE TO FINANCIAL SHOCKS ONLY

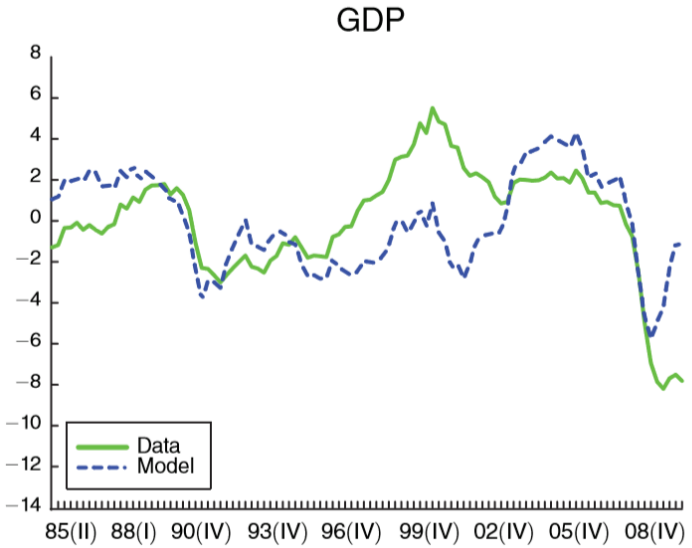


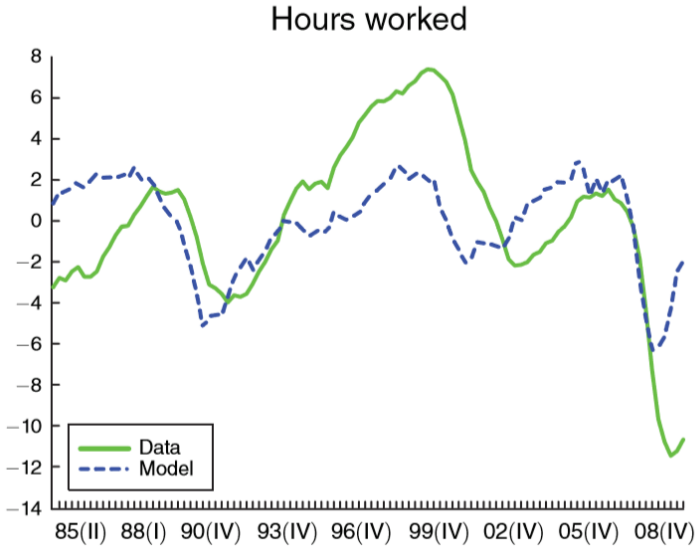


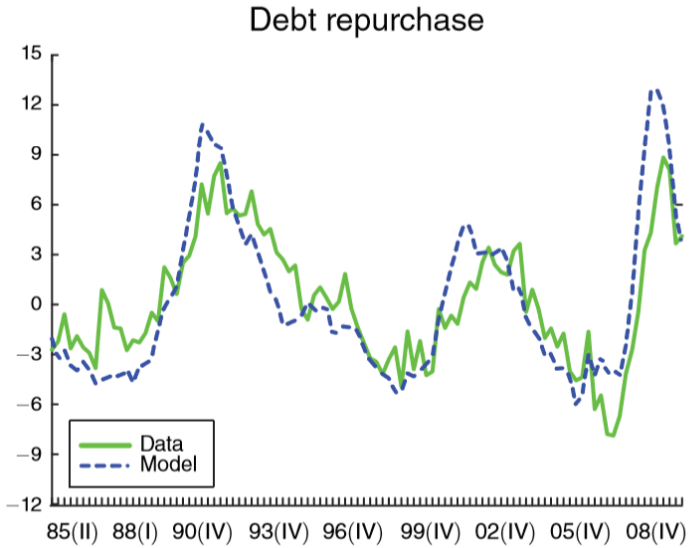


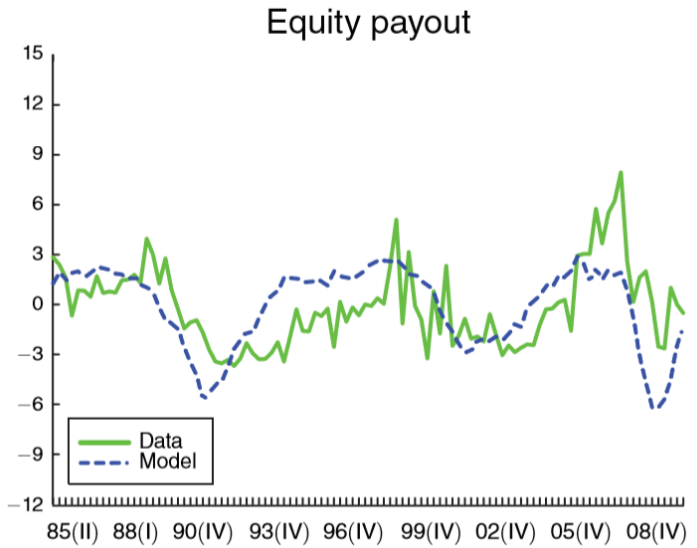


RESPONSE TO BOTH PRODUCTIVITY AND FINANCIAL SHOCKS









EXTENDED MODEL AND STRUCTURAL ESTIMATION

- Business Sector

$$V(\mathbf{s};p_{-1},i_{-1},k,b) = \max_{d,n,u,p,i,k',b'} \{d + Em'V(\mathbf{s}';p,i,k',b')\}$$

subject to

$$P\left[F(k,u,n;\mathbf{s}) - \Psi(u)k\right] + \frac{b'}{R} - b = Wn + PG(p_{-1},p;\mathbf{s}) + P\varphi(d) + Pi$$

$$\xi\left(k' - \frac{b'}{P(1+r)}\right) \geq F(k,u,n;\mathbf{s})$$

$$\frac{p}{P} = D(k,u,n;\mathbf{s})$$

$$(1-\delta)k + \Upsilon(i_{-1},i;\zeta) = k'.$$

FINDINGS

- Financial shocks contribute significantly to the volatility of the growth rate of output (46 percent), investment (25 percent), and labor (33 percent).
- Financial shocks, however, contribute only marginally to the volatility of consumption.

THANK YOU