Macroeconomic Effects of Financial Shocks

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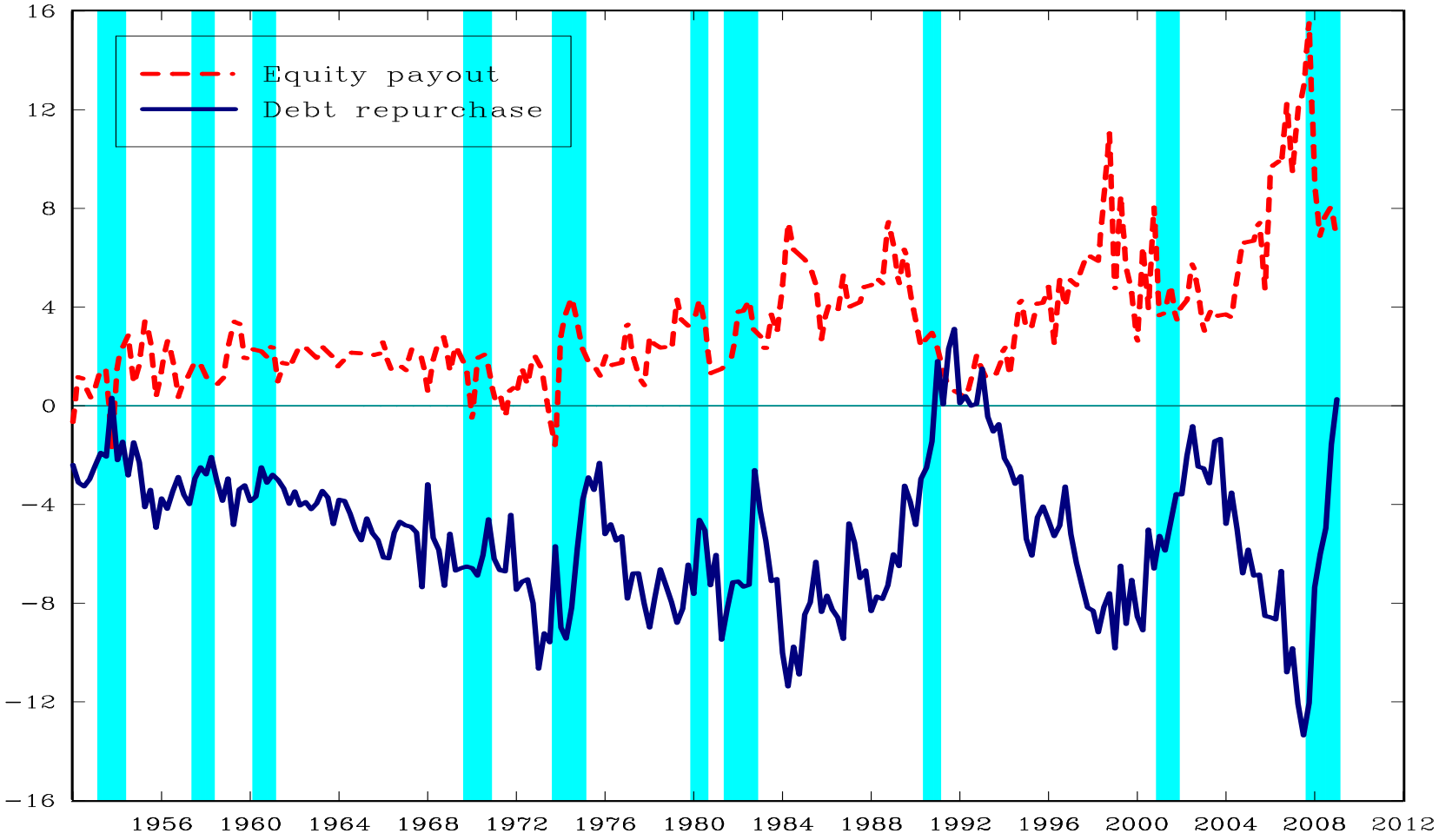
Financial flows in the nonfarm business sector



WHAT DO WE DO?

1. Extend the Real Business Cycle model with:

   - Financial frictions.
   - Credit shocks.

2. Construct series for 'productivity' and 'credit' shocks from the data using model's restrictions.

3. Evaluate the importance of credit (and productivity) shocks for macroeconomic fluctuations.

PREVIOUS OF THE RESULTS

- To capture the key empirical properties of financial flows we need credit shocks.

- Credit shocks improve the performance of model in terms of real macroeconomic variables.

- Credit shocks have played a central role in all recent recessions: 1990-91, 2001, 2008-09.

THE MODEL

- Continuum of firms with revenue function

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

z_t is an exogenous productivity shock.

Financial structure

- Firms raise funds with debt and equity. Debt is preferred to equity because of taxes:

$$R_t = 1 + r_t(1 - \tau)$$

- There is limited enforcement:

$$\underbrace{\xi_t \cdot \left(E_t \sum_{j=1}^{\infty} m_{t+j} d_{t+j} \right)}_{\text{Collateral value}} \quad \geq \quad \underbrace{F(z_t, k_t, l_t)}_{\text{Working capital loan}}$$

- Issuing/repurchasing shares and paying dividends are costly:

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

More on the enforcement constraint

Value of the firm:

$$V_t(k_t, b_t) = E_t \sum_{j=0}^{\infty} m_{t+j} d_{t+j}$$

Enforcement constraint:

$$\xi_t \cdot \Big(V_t(k_t, b_t) - d_t \Big) \geq F(z_t, k_t, l_t)$$

RECURSIVE PROBLEM

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

subject to:

$$(1-\delta)k_t + F(z,k,l) - wl + \frac{b'}{R} = b + \varphi(d) + k'$$

$$\xi Em'V(\mathbf{s}'; k', b') \geq F(z,k,l)$$

FIRST ORDER CONDITION

$$F_l(z,k,l) \quad = \quad w \cdot \left(\frac{1}{1-\tilde{\mu}} \right)$$

CHARACTERIZATION

Proposition 1. *The no-default constraint binds in a deterministic steady state.*

CHARACTERIZATION

Proposition 2. *With $\kappa = 0$ and $\tau = 0$, credit shocks have no effects on l and k'.*

FUNCTIONAL FORMS

- Utility function: $U(c, l) = \ln(c) + \alpha \cdot \ln(1 - l)$

- Production function: $y_t = z_t k_t^{\theta} l_t^{1-\theta}$

- Process for shocks:

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

CALIBRATION

- Some parameters are calibrated using steady state targets:

  $\beta = 0.9825$, $\alpha = 1.889$, $\theta = 0.36$, $\delta = 0.025$.

  $\tau = 0.35$, $\phi = 0.175$.

- The remaining parameters A and κ cannot be calibrated using steady state targets.

SHOCKS SERIES

- Productivity shocks (from production):

$$y_t = z_t k_t^{\theta} l_t^{1-\theta}$$

- Credit shocks (from enforcement constraint):

$$\xi_t \cdot \overline{V}_t(k_{t+1}, b_{t+1}) = y_t$$

Approximated with:

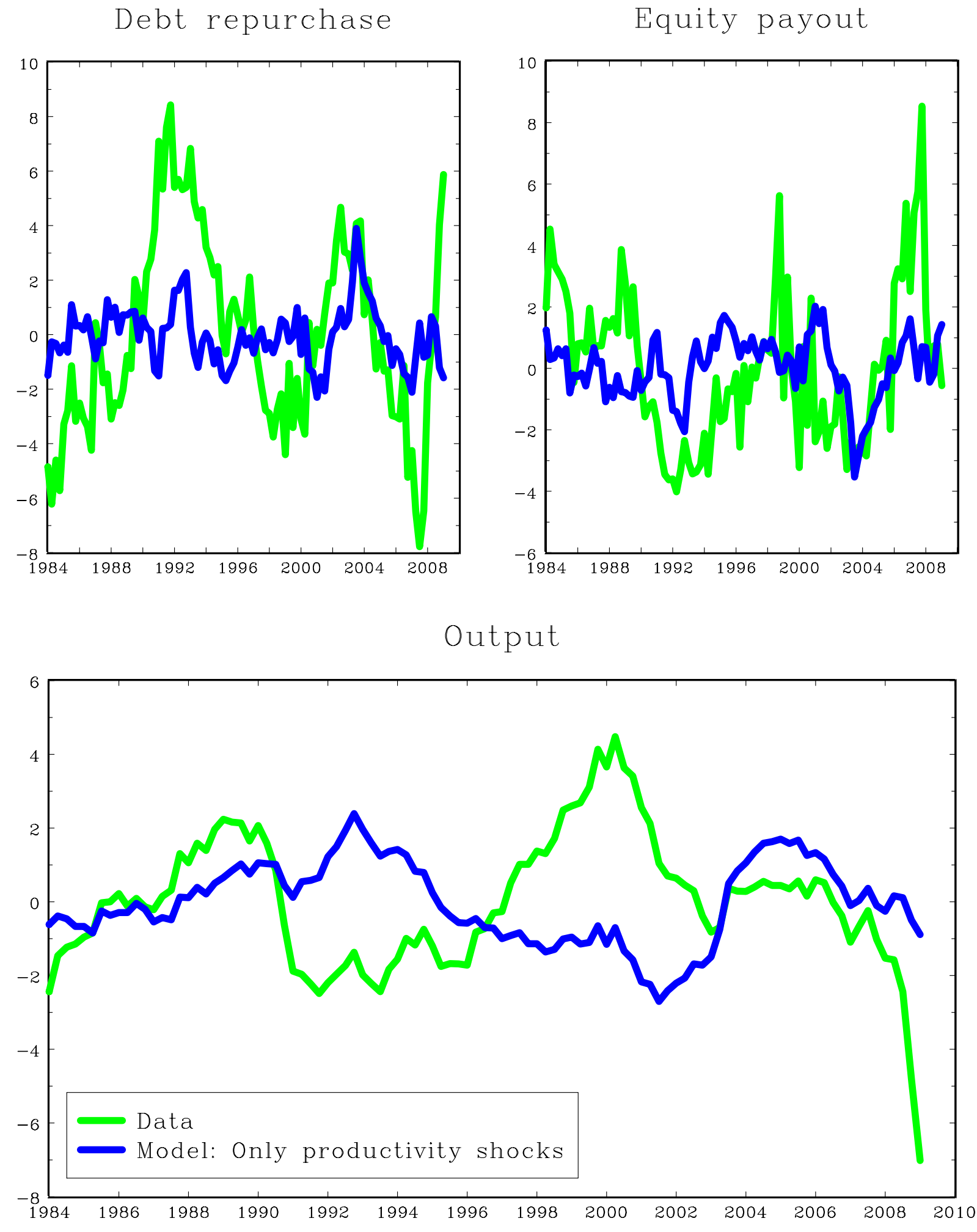
$$\xi_t \cdot \left(k_{t+1} - \frac{b_{t+1}}{R_t} \right) = y_t$$

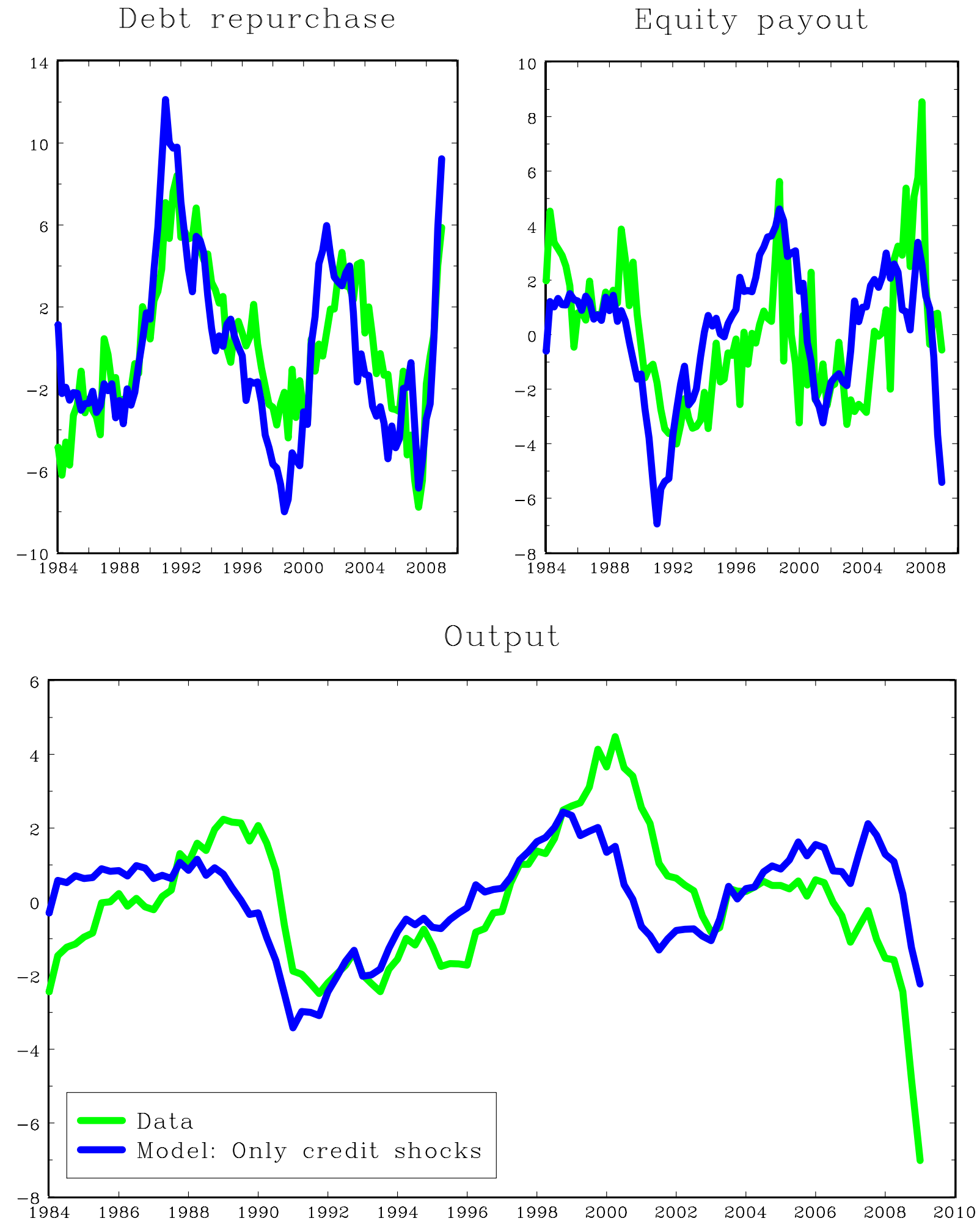
FINAL CALIBRATION STEP

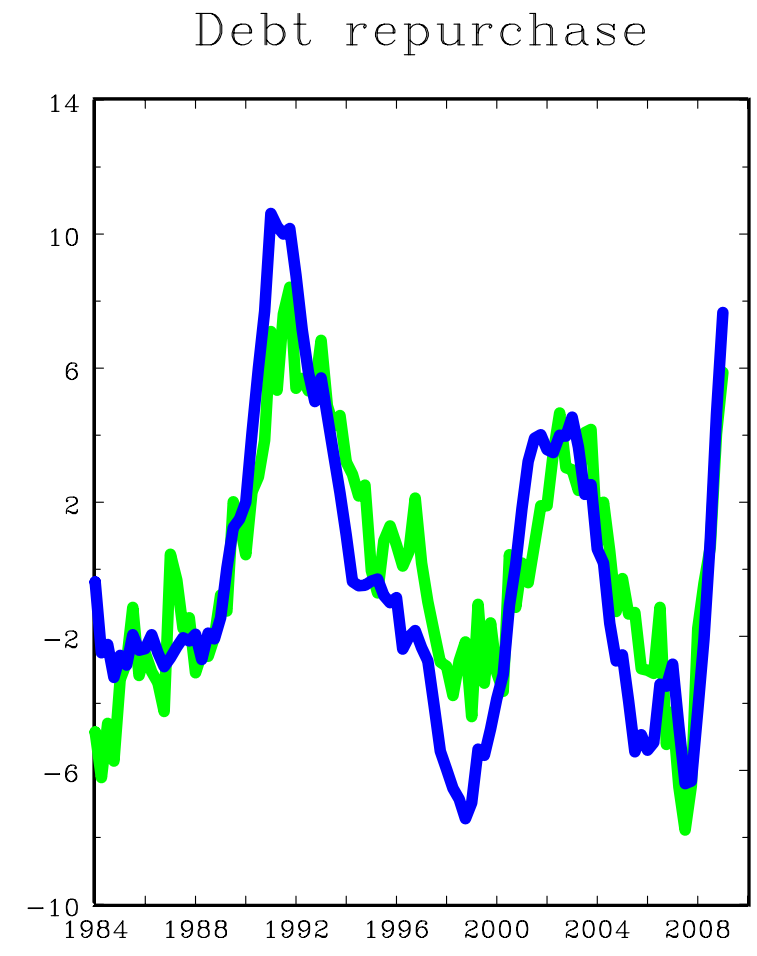
- Using the sequence of shocks we estimate the VAR system, providing A and Σ.

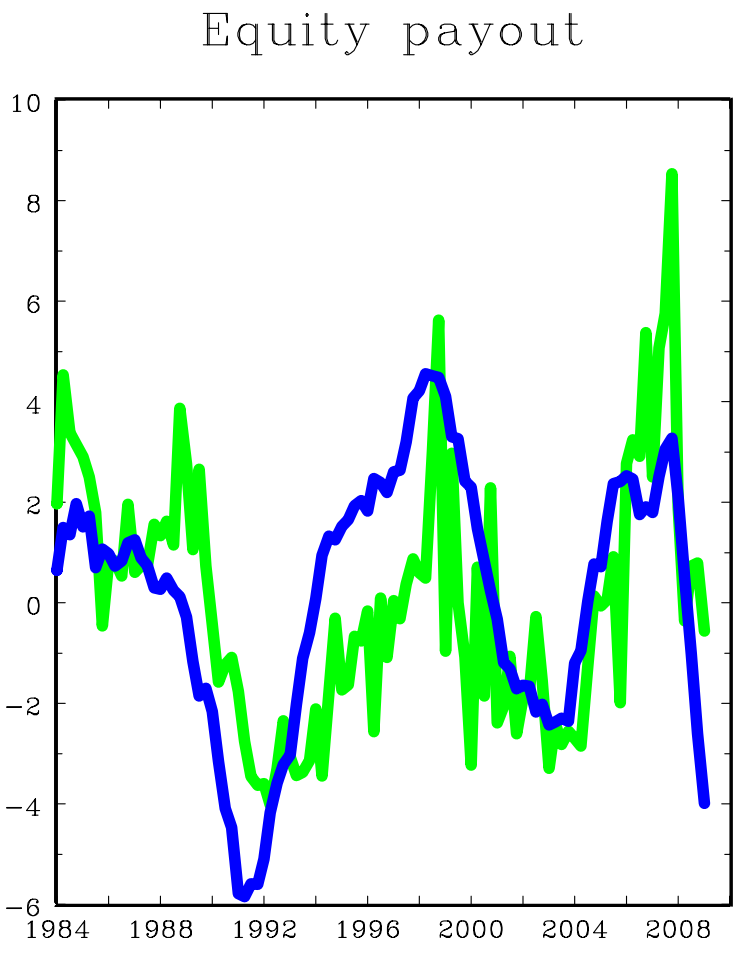
$$A = \begin{bmatrix} 0.895 & -0.007 \\ -0.171 & 0.974 \end{bmatrix}$$

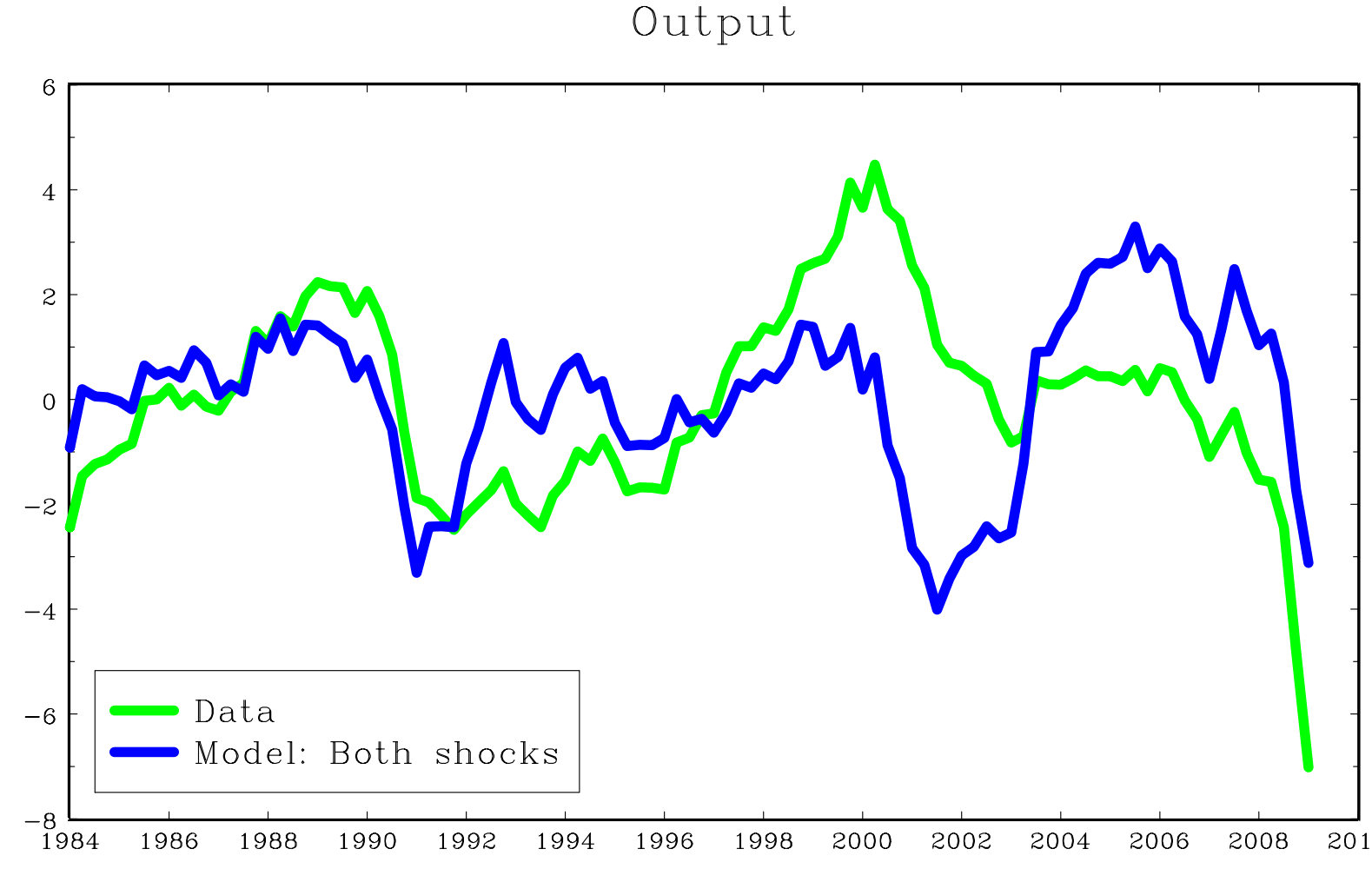
- Finally, κ is chosen to replicate the empirical standard deviation of 'Equity Payout'.

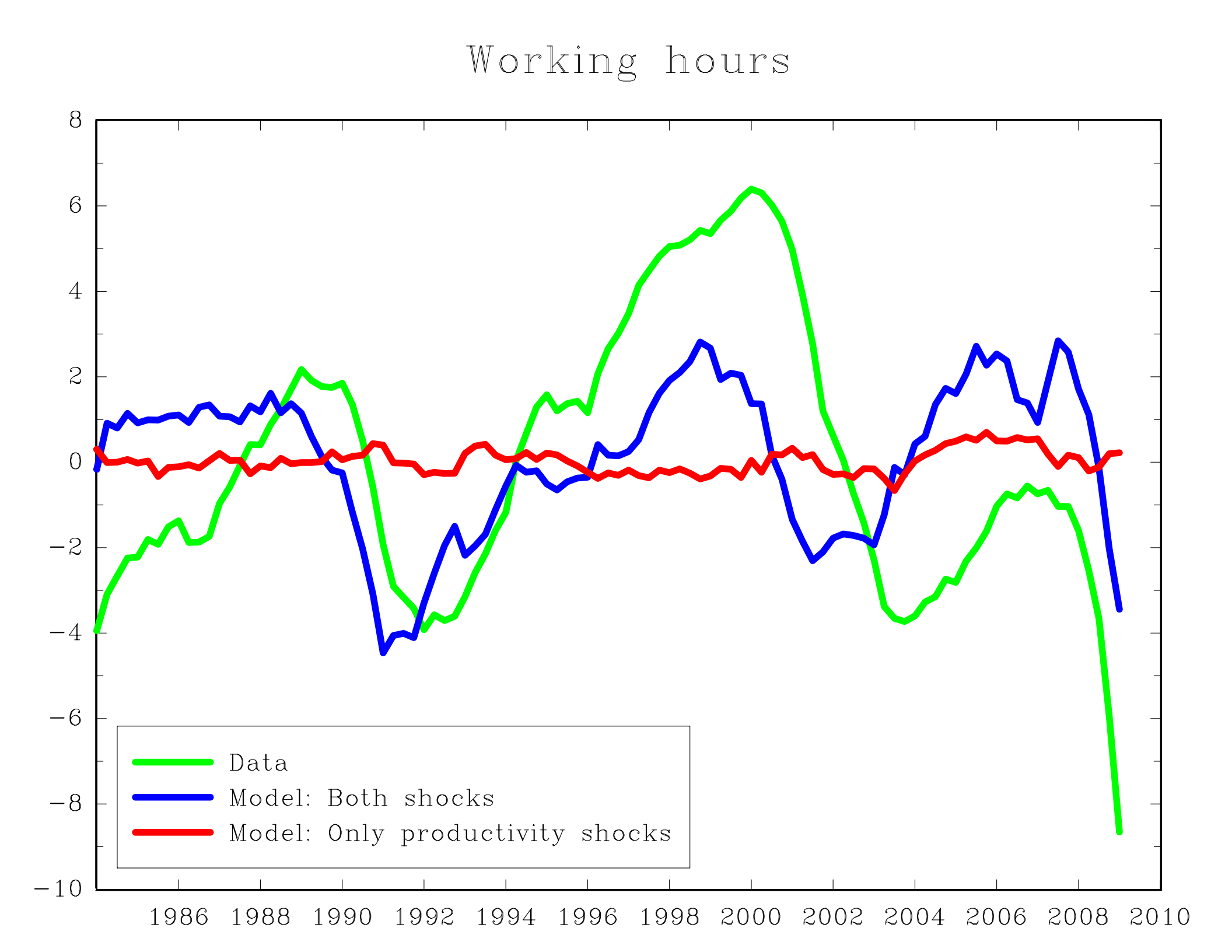

Debt repurchase
Equity payout
Output
10
8
6
4
2
0
−2
−4
−6
−8
1984
1988
1992
1996
2000
2004
2008
1986
1990
1994
1998
2002
2006
2010
Data
Model: Only productivity shocks


Debt repurchase
Equity payout
Output
14
10
6
2
−2
−6
−10
10
8
6
4
2
0
−2
−4
−6
−8
6
4
2
0
−2
−4
−6
−8
1984
1988
1992
1996
2000
2004
2008
1986
1990
1994
1998
2002
2006
2010
Data
Model: Only credit shocks


Debt repurchase
14
10
6
2
−2
−6
−10
1984
1988
1992
1996
2000
2004
2008


Equity payout
10
8
6
4
2
0
−2
−4
−6
1984
1988
1992
1996
2000
2004
2008

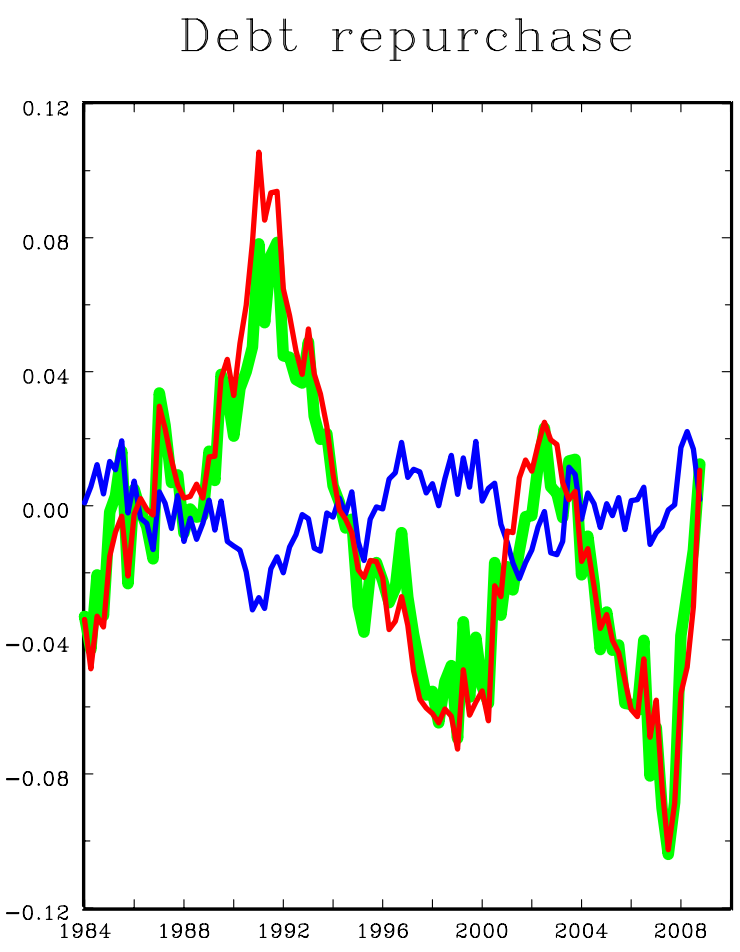

Output
6
4
2
0
−2
−4
−6
−8
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
Data
Model: Both shocks

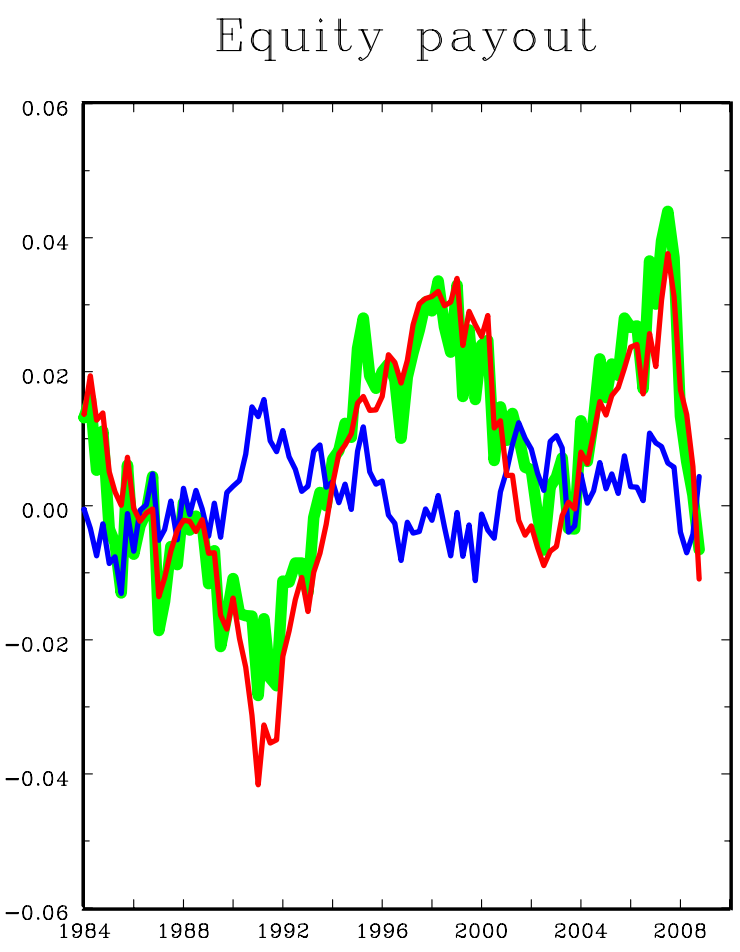

Working hours
8
6
4
2
0
−2
−4
−6
−8
−10
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
Data
Model: Both shocks
Model: Only productivity shocks

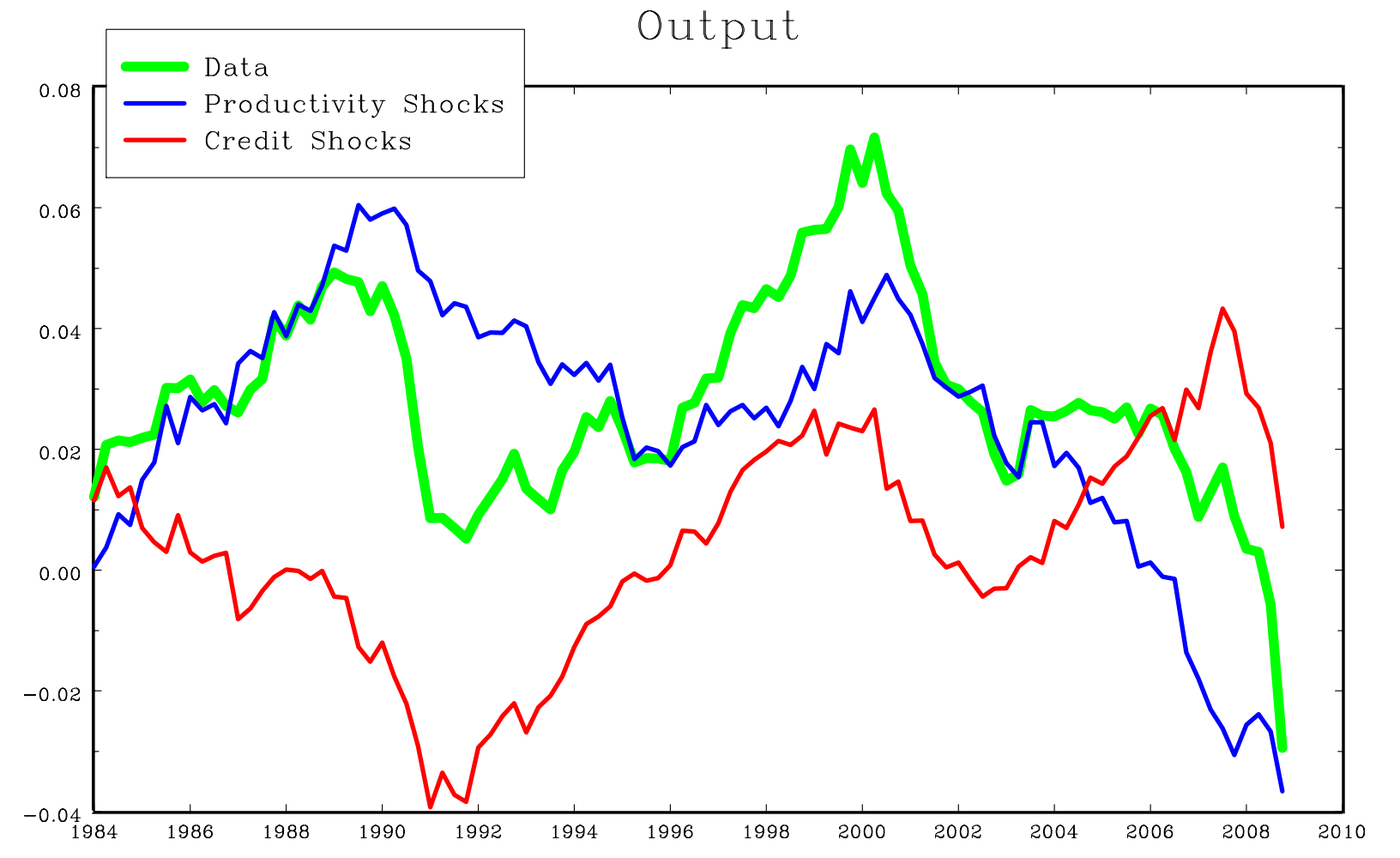
CONCLUSION

- The model with financial frictions, credit and productivity shocks replicates business cycles for real variables and financial flows reasonably well.

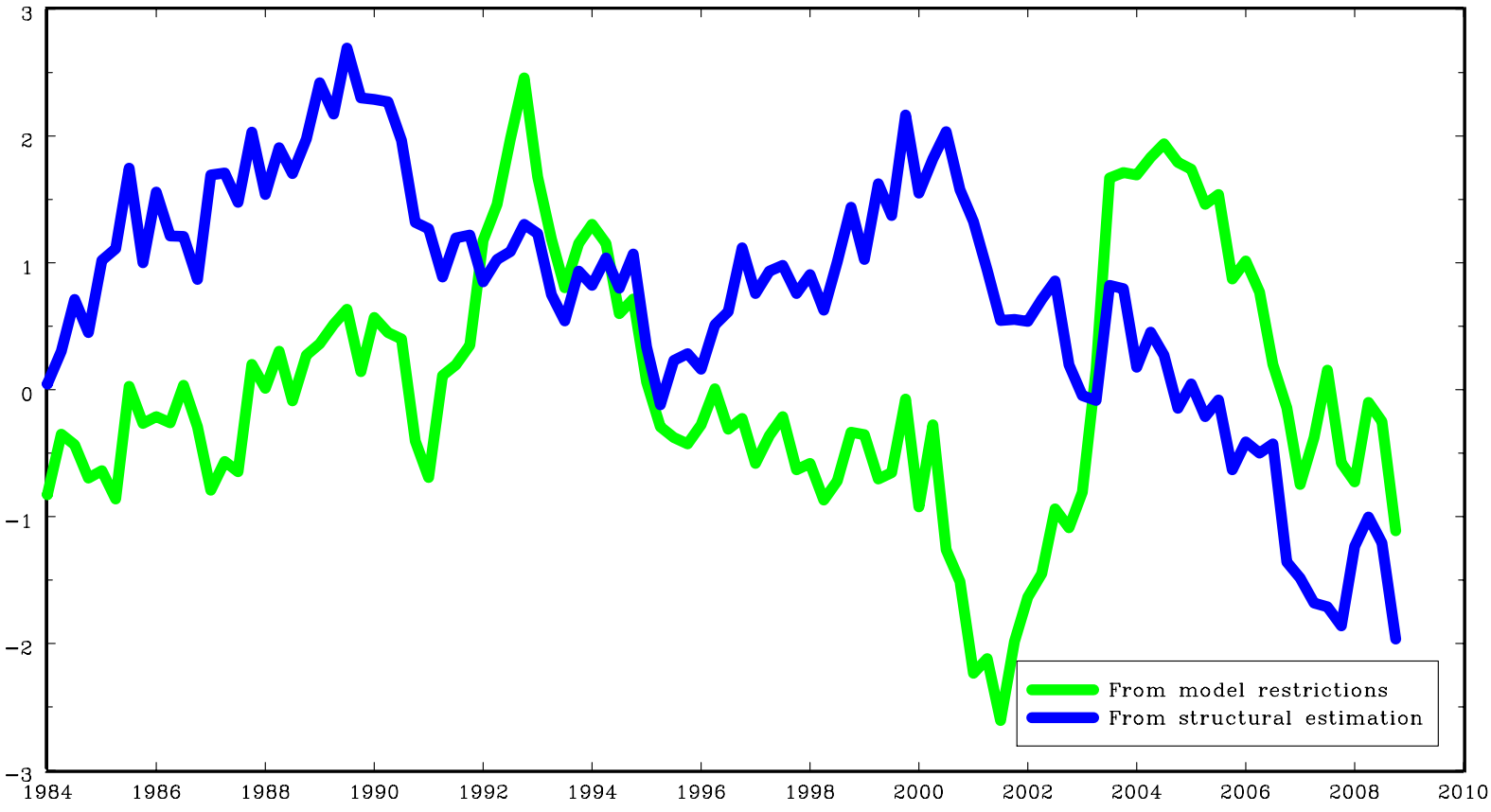
- The simulated model displays significant financial tightening in the recessions of 1991, 2001 and 2008, suggesting that credit shocks have played an important role in economic downturns.


Debt repurchase
0.12
0.08
0.04
0.00
−0.04
−0.08
−0.12
1984
1988
1992
1996
2000
2004
2008


Equity payout
0.06
0.04
0.02
0.00
−0.02
−0.04
−0.06
1984
1988
1992
1996
2000
2004
2008


Output
Data
Productivity Shocks
Credit Shocks
0.08
0.06
0.04
0.02
0.00
−0.02
−0.04
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010

Productivity Shocks



Credit Shocks