Boom-bust Cycles and Monetary Policy

- It has often been argued that there is advanced information about technology shocks.
  - Beaudry-Portier, Michelle Alexopoulos, Jaimovic-Rebelo, Christiano-Ilut-Motto-Rostagno
- In the presence of such advance information, standard monetary policy can create an inefficient boom, followed by a bust.

Objective

- Estimate a model in which technology shocks are partially anticipated
  - ‘Normal’ technology shock:

$$a_t = \rho_a a_{t-1} + \varepsilon_t$$

  - Shock considered here (J Davis):

$$a_t = \rho_a a_{t-1} + \overbrace{\varepsilon_t + \xi^1_{t-1} + \xi^2_{t-2} + \xi^3_{t-3} + \xi^4_{t-4}}^{\text{‘recent information’}} + \overbrace{\xi^5_{t-5} + \xi^6_{t-6} + \xi^7_{t-7} + \xi^8_{t-8}}^{\text{‘earlier information’}}$$

- Evaluate importance of ξ^i_{t-i} for business cycles

- Explore implications of ξ^i_{t-i} for monetary policy.

Outline

- Estimation
  - Results
  - ‘Excessive optimism’ and 2000 recession

- Implications for monetary policy
  - Monetary policy causes economy to over-react to signals....inadvertently creates ‘boom-bust’

Model

- Features (version of CEE)
  - Habit persistence in preferences
  - Investment adjustment costs in change of investment
  - Variable capital utilization
  - Calvo sticky (EHL) wages and prices
    - Non-optimizers: $P_{it} = P_{i,t-1},\ W_{j,t} = \mu_z W_{j,t-1}$
    - Probability of not adjusting prices/wages: $\xi_p,\ \xi_w$

Observables and Shocks

- Six observables:
  - output growth,
  - inflation,
  - hours worked,
  - investment growth,
  - consumption growth,
  - T-bill rate.
- Sample Period: 1984Q1 to 2007Q1

$$E_t^j \sum_{l=0}^{\infty} \left(\frac{1}{1.03^{-1/4}} \right)^l \overbrace{\zeta_{c,t+l}}^{\text{preference shock}} \left\{ \log(C_{t+l} - bC_{t+l-1}) - \psi_L \frac{l_{t+l,j}^2}{2} \right\}$$

$$K_{t+1} = (1 - 0.02)K_t + (1 - S\left(\overbrace{\zeta_{I,t}}^{\text{marginal (in-) efficiency of investment}} \frac{I_t}{I_{t-1}} \right))I_t$$

$$Y_t = \left[\int_0^1 Y_{jt}^{\frac{1}{\lambda_{f,t}}} dj \right]^{\overbrace{\lambda_{f,t}}^{\text{markup shock}}}, \qquad Y_{j,t} = \left[z_t \exp\left(\overbrace{a_t}^{\text{technology shock}} \right) L_{j,t} \right]^{1-\alpha} (u_t K_{j,t})^{\alpha}, \; z_t = \exp(\mu_z t)$$

$$\log\left(\frac{R_t}{R} \right) = \tilde{\rho} \log\left(\frac{R_{t-1}}{R} \right) + (1 - \tilde{\rho}) \frac{1}{R} \left[a_\pi \bar{\pi} \log\left(\frac{\bar{\pi}_{t+1}}{\bar{\bar{\pi}}} \right) + \frac{a_y}{4} \log\left(\frac{y_t}{y} \right) \right] + \varepsilon_t^M$$

Shock representations

markup

$$\log\left(\frac{\lambda_{f,t}}{\lambda_f}\right) = \rho_{\lambda_f}\log\left(\frac{\lambda_{f,t-1}}{\lambda_f}\right) + \varepsilon_{\lambda_f,t}$$

discount rate

$$\log(\zeta_{c,t}) = \rho_{\zeta_c}\log(\zeta_{c,t-1}) + \varepsilon_{\zeta_c,t}$$

efficiency of investment

$$\log(\zeta_{I,t}) = \rho_{\zeta_I}\log(\zeta_{I,t-1}) + \varepsilon_{\zeta_I,t}$$

technology

$$a_t = \rho_a a_{t-1} + \overbrace{\varepsilon_t}^{iid} + \overbrace{\xi_{t-1}^1}^{iid} + \overbrace{\xi_{t-2}^2}^{iid} + \overbrace{\xi_{t-3}^3}^{iid} + \overbrace{\xi_{t-4}^4}^{iid} + \overbrace{\xi_{t-5}^5}^{iid} + \overbrace{\xi_{t-6}^6}^{iid} + \overbrace{\xi_{t-7}^7}^{iid} + \overbrace{\xi_{t-8}^8}^{iid}$$

monetary policy

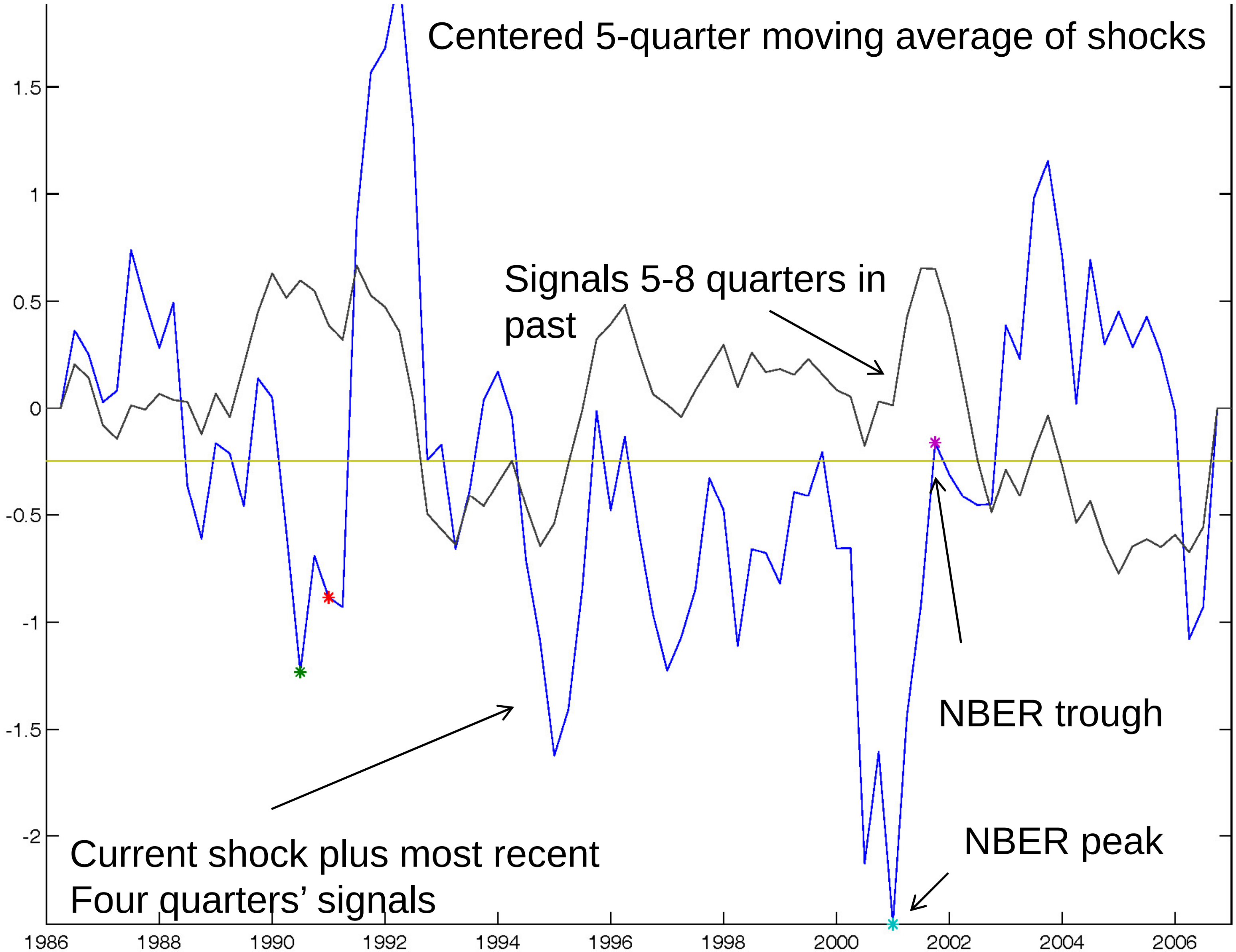
$$\varepsilon_t^M = \rho_M \varepsilon_{t-1}^M + \varepsilon_{u,t}.$$

Variance Decomposition, Technology Shocks

variable	$\varepsilon_t + \sum_{i=1}^{8} \xi_{t-i}^{i}$	$\varepsilon_t + \sum_{i=1}^{4} \xi_{t-i}^{i}$	$\sum_{i=5}^{8} \xi_{t-i}^{i}$
consumption growth	46.6	24.1	22.5
investment growth	16.1	8.2	7.9
output growth	45.4	23.1	22.3
log hours	45.3	20.0	25.3
inflation	49.0	23.8	25.2
interest rate	52.1	24.9	27.2

- Estimated technology shock process:

$$\overbrace{a_t}^{\text{log, technology shock}} = \rho_a a_{t-1} + \overbrace{\varepsilon_t + \xi^1_{t-1} + \xi^2_{t-2} + \xi^3_{t-3} + \xi^4_{t-4}}^{\text{`recent information'}} + \overbrace{\xi^5_{t-5} + \xi^6_{t-6} + \xi^7_{t-7} + \xi^8_{t-8}}^{\text{`earlier information'}}$$



Centered 5-quarter moving average of shocks
Signals 5-8 quarters in past
NBER trough
NBER peak
Current shock plus most recent
Four quarters' signals
1.5
1
0.5
0
-0.5
-1
-1.5
-2
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006

Implications for Monetary Policy

- Estimated monetary policy rule induces over-reaction to signal shock

- Problem:
  - positive signal induces expectation that consumption will be high in the future

  - Ramsey-efficient (‘natural’) real rate of interest jumps

  - Under Taylor rule, real rate not allowed to jump, so monetary policy is expansionary

- Intuition easy to see in Clarida-Gali-Gertler model

The standard New-Keynesian Model

$$a_t = \rho a_{t-1} + \varepsilon_t + \xi_{t-p} \; (a_t = \text{log, technology})$$

$$rr_t^* = rr - (1-\rho)a_t + \xi_{t+1-p} \; \text{(natural (Ramsey) rate)}$$

$$\pi_t = \beta E_t \pi_{t+1} + \kappa x_t - \pi_t \; \text{(Calvo pricing equation)}$$

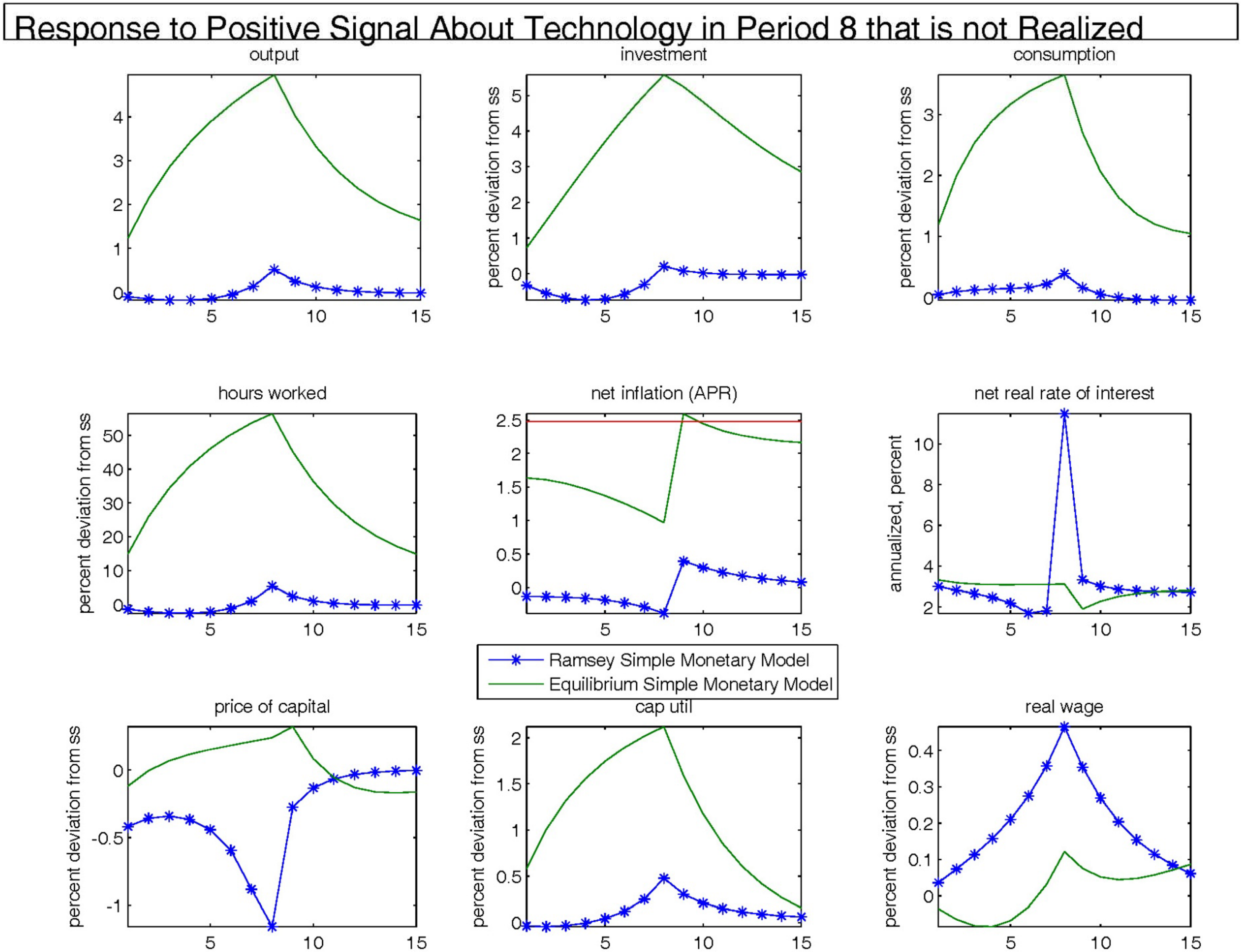
$$x_t = -[r_t - E_t \pi_{t+1} - rr_t^*] + E_t x_{t+1} \; \text{(intertemporal equation)}$$

$$r_t = \phi_\pi E_t \pi_{t+1} + \phi_x x_t \; \text{(policy rule)}$$

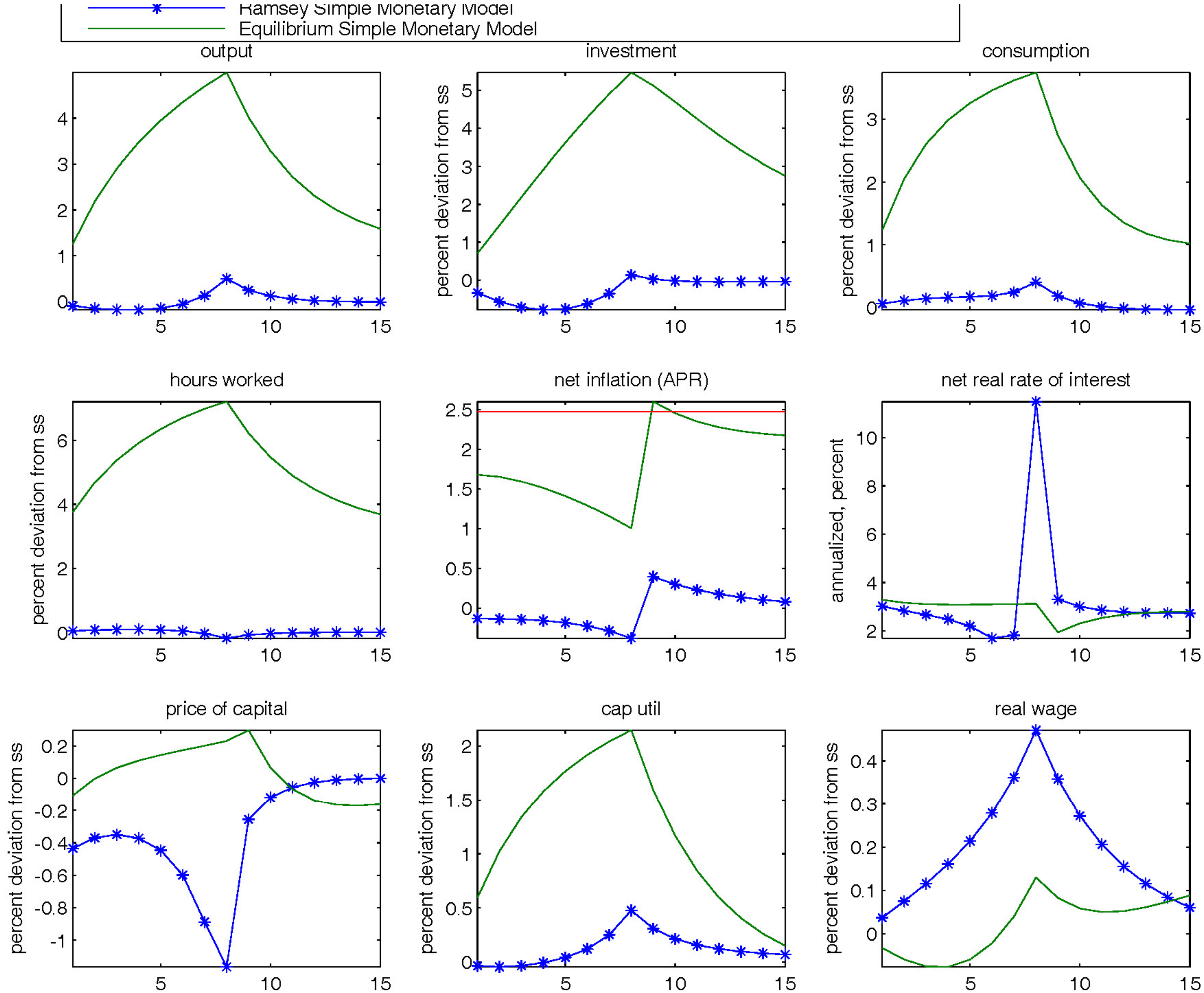
Response to signal that technology will expand 1% in period 1

	Equilibrium				Ramsey			
	Period				Period			
Case Where Signal is False								
	0	1	2	3	0	1	2	3
$4\pi_t$	-1	0	0	0	0	0	0	0
$\log A_t$	0	0	0	0	0	0	0	0
$\log h_t$	0.7	0	0	0	0	0	0	0
$\log y_t$	0.7	0	0	0	0	0	0	0
Case Where Signal is True								
	0	1	2	3	0	1	2	3
$4\pi_t$	-1				0	0	0	0
$\log A_t$	0	1	.95	.9025	0	1	.95	.9025
$\log h_t$	0.7	-0.04	-0.04	-0.04	0	0	0	0
$\log y_t$	0.7	1.0	0.9	0.9	0	1	.95	.9025

- Let’s see how a signal that turns out to be false works in the full, estimated model.


Response to Positive Signal About Technology in Period 8 that is not Realized
output
investment
consumption
hours worked
net inflation (APR)
net real rate of interest
price of capital
cap util
real wage
percent deviation from ss
annualized, percent
Ramsey Simple Monetary Model
Equilibrium Simple Monetary Model

- The following slide corrects the hours worked response in the previous slides, which was graphed incorrectly.


Ramsey Simple Monetary Model
Equilibrium Simple Monetary Model
output
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percent deviation from ss
annualized, percent

Why is the Boom-Bust So Big?

- Most of boom-bust reflects suboptimality of monetary policy.

- What's the problem?

  – Monetary policy ought to respond to the natural (Ramsey) rate of interest.

  – Relatively sticky wages and inflation targeting exacerbate the problem

Policy solution

- Modify the Taylor rule to include:
  - Natural rate of interest (probably not feasible)
  - Credit growth
  - Stock market
  - Wage inflation instead of price inflation.
- Explored consequences of adding credit growth and/or stock market by adding Bernanke-Gertler-Gilchrist financial frictions.

Conclusion

- Estimated a model in which agents receive advance information about technology shocks.

- Advance information seems to play an important role in business cycle dynamics

  – Important in variance decompositions

  – Boom-bust of late 1990s seems to correspond to a period in which there was a lot of initial optimism about technology, which later came to be seen as excessive

- Monetary policy appears to be overly expansionary in response to signal shocks

  – Ramsey-efficient allocations require sharp rise in rate of interest, which `standard monetary policy does not deliver'.

  – Problem is most severe when wages are sticky relative to prices.