MACRO-LINKAGES, OIL PRICES AND DEFLATION WORKSHOP
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Boom-bust Cycles and Monetary Policy

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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):

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

- Evaluate importance of ξ_{t-i}^i for business cycles
- Explore implications of ξ_{t-i}^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

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

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

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

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

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

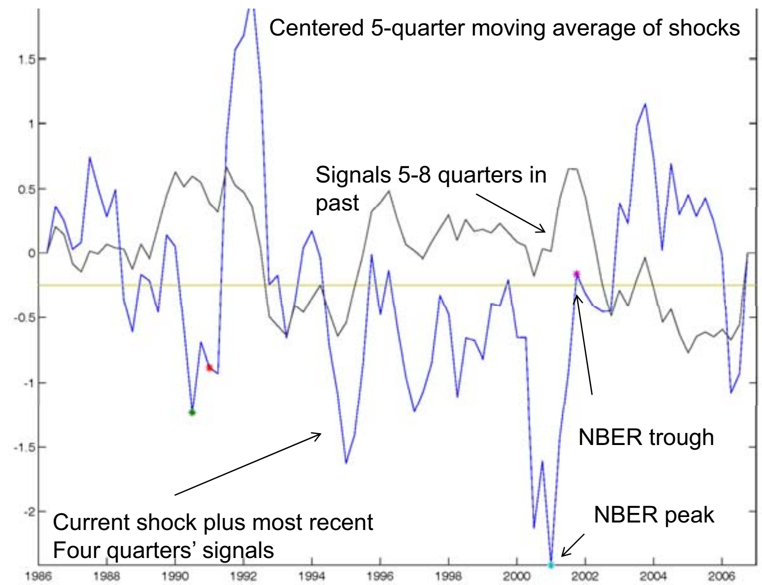
$$\varepsilon_t^M = \rho_M \varepsilon_{t-1}^M + \varepsilon_{u,t}.$$

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:

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



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

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

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

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

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

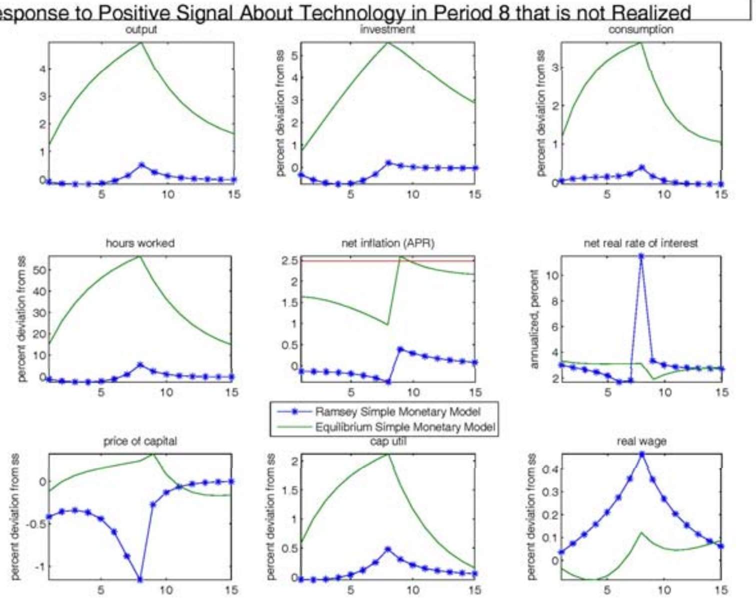
$$r_t = \phi_\pi E_t \pi_{t+1} + \phi_x x_t \; (\text{policy rule})$$

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

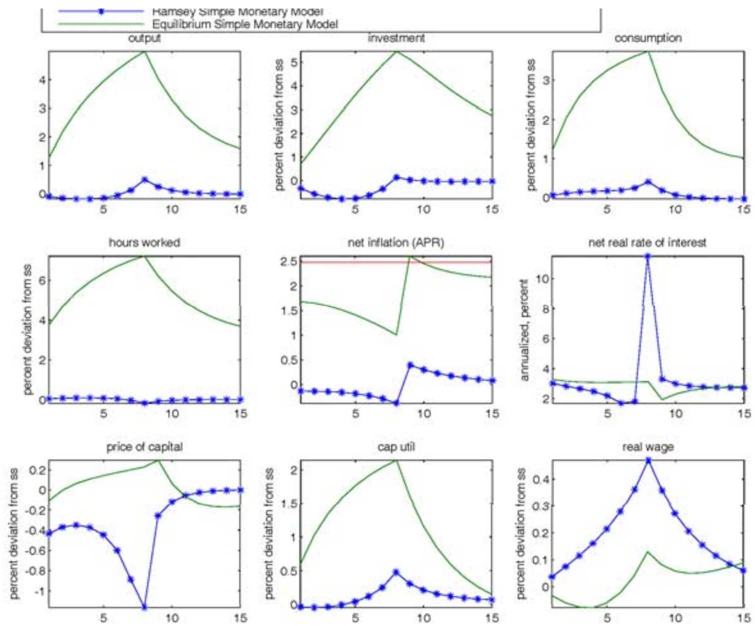
	Equilibrium Period				Ramsey Period			
Case Where Signal is False								
	0	1	2	3	0	1	2	3
$4\pi_t$	-1	0	0	0	0	0	0	0
$\log A_t$	0	0	0	0	0	0	0	0
$\log h_t$	0.7	0	0	0	0	0	0	0
$\log y_t$	0.7	0	0	0	0	0	0	0
Case Where Signal is True								
	0	1	2	3	0	1	2	3
$4\pi_t$	-1				0	0	0	0
$\log A_t$	0	1	.95	.9025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



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



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.