Lectures in Monetary Economics

Lecture 6

Empirical evaluation of the baseline NK model

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Empirical evaluation of the baseline NK model

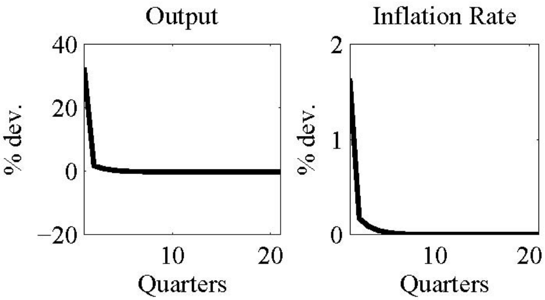
It does not seem to do that well. It cannot be taken seriously as a laboratory for the study of the effects of monetary policy.

1. Implications for credible disinflation

$$\pi_t = \beta E_t \pi_{t+1} + \kappa \hat{y}_t \tag{1}$$

2. The dynamics of output and inflation following a monetary policy shock.
The absence of inertia.

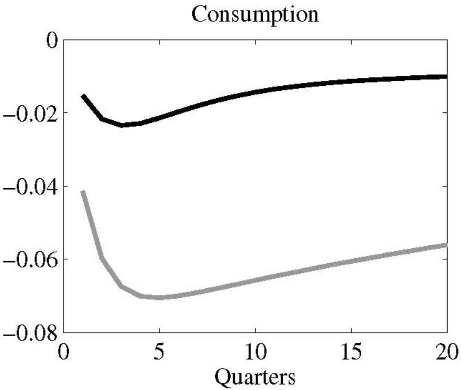
Figure: The baseline NK model



3. The effects of fiscal shocks on consumption

Consumption decreases with an increase in government spending

Figure: IRF to a Fiscal Shock under Fixed and Flexible Exchange Rates



Note: dark line: Benchmark flexible (Post–1980),
Gray line: Benchmark fixed (Pre–1980)

4. Does the purely forward looking Phillips curve fit the data?

$$\pi_{t+1} - \pi_t = -\kappa x_t + e_{t+1}$$

where $e_{t+1} = \pi_{t+1} - E_t \pi_{t+1}$, $\beta \approx 1$. GG estimate $\kappa = -0.081(0.040)$ where x_t is detrended log(GDP), a measure of the output gap.
A rise in unemployment (a decrease in the output gap) leads to higher inflation!

GG (1999): The problem lies with the output gap measure. Using a better proxy of marginal cost ((log) labor income share in the non-farm business sector) and estimating by GMM gives:

$$\pi_t = \quad 0.023(0.012)x_t + 0.942(0.045)E_t\pi_{t+1}$$

Using detrended GDP instead

$$\pi_t = \quad -0.016(0.005)x_t + 0.988(0.030)E_t\pi_{t+1}$$

But when trying to obtain direct estimates of the structural parameters, the estimated value of κ implies too much stickiness (5-6 quarters).

Figure: Phillips curve: CGG

Table 1
Estimates of the new Phillips curve

	θ	β	λ
GDP deflator			
(1)	0.829	0.926	0.047
	(0.013)	(0.024)	(0.008)
(2)	0.884	0.941	0.021
	(0.020)	(0.018)	(0.007)
Restricted β			
(1)	0.829	1.000	0.035
	(0.016)		(0.007)
(2)	0.915	1.000	0.007
	(0.035)		(0.006)
NFB deflator			
(1)	0.836	0.957	0.038
	(0.015)	(0.018)	(0.008)
(2)	0.884	0.967	0.018
	(0.023)	(0.016)	(0.008)

Note: $\theta = 1$–prob. of price resetting, $\lambda =$ coeff. on output gap.

An additional problem:

Estimated Phillips curves that also allow for lagged inflation show a significant and substantial (often dominant) lagged inflation term (hybrids).

With standard measure of output gap (Rudenbusch: EJ April 2002): The lagged term is dominant (about 0.7).

With a proxy for marginal cost. Estimating the Phillips curve using the measure of marginal cost suggested by theory (CGG).

Figure: Hybrid Phillips curve: CGG

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Table 2
Estimates of the new hybrid Phillips curve

	ω	θ	β	γ_b	γ_f	λ
GDP deflator						
(1)	0.265	0.808	0.885	0.252	0.682	0.037
	(0.031)	(0.015)	(0.030)	(0.023)	(0.020)	(0.007)
(2)	0.486	0.834	0.909	0.378	0.591	0.015
	(0.040)	(0.020)	(0.031)	(0.020)	(0.016)	(0.004)
Restricted β						
(1)	0.244	0.803	1.000	0.233	0.766	0.027
	(0.030)	(0.017)		(0.023)	(0.015)	(0.005)
(2)	0.522	0.838	1.000	0.383	0.616	0.009
	(0.043)	(0.027)		(0.020)	(0.016)	(0.003)
NFB deflator						
(1)	0.077	0.830	0.949	0.085	0.871	0.036
	(0.030)	(0.016)	(0.019)	(0.031)	(0.018)	(0.008)
(2)	0.239	0.866	0.957	0.218	0.755	0.015
	(0.043)	(0.025)	(0.021)	(0.031)	(0.016)	(0.006)

Note: θ = 1-prob. of price resetting, λ = coeff. on output gap, ω = share of myopic agents, γ_b = coeff. on the backward, γ_f = coeff. on the forward component.

Still a substantial lagged term and also too much price stickiness!

Where could the lagged inflation come from? Is its presence spurious?

- Random coefficients (Tavlas and Swamy, 2006)
- Policy shifts (Cogley and Sbordone, 2005)
  Trend inflation has been historically quite variable. If the measures of the inflation gap ignore this drift they may show an artificially high level of persistence, forcing a role for past inflation in the standard Calvo model. Once shifts in trend inflation are properly taken into account a purely forward looking version of the NKPC fits post WWII U.S. data very well.
- Aggregation problems

5. Euler equation interest rates

Preferences

$$u(C_t) = \frac{C_t^{1-\sigma}}{1-\sigma}$$

The Euler equation is given by

$$\frac{1}{1+i_t} = \beta E_t \frac{C_{t+1}^{-\sigma}}{C_t^{-\sigma}\pi_{t+1}}$$

Assuming log–normality of consumption and inflation

$$\frac{1}{1+i_t} = \beta \exp\left[-\sigma(\mathbb{E}_t c_{t+1} - c_t) - E_t \pi_{t+1} + \frac{\sigma^2}{2}\mathbb{V}_t c_{t+1} + \frac{1}{2} V_t \pi_{t+1} + \sigma \mathbb{C}_t(c_{t+1}, \pi_{t+1})\right]$$

Or,

$$\frac{1}{1+i_t} = \beta \exp\left[-\sigma \mathbb{E}_t \gamma_{t+1} - \mathbb{E}_t \pi_{t+1} + \frac{\sigma^2}{2}\mathbb{V}_t \gamma_{t+1} + \frac{1}{2}\mathbb{V}_t \pi_{t+1} + \sigma \mathbb{C}_t(\gamma_{t+1}, \pi_{t+1})\right]$$

where $\gamma_t \equiv \log(C_t/C_{t-1})$.

The dynamics of consumption, employment and inflation can be captured by a VAR model

$$A(L)Y_t = u_t$$

$$Y_t = \{c_t, \pi_t, \ell_t, crb_t, rdi_t, ymc_t, ffr_t\}$$

or

$$Y_t = \{\Delta c_t, \pi_t, \Delta\ell_t, \Delta crb_t, \Delta rdi_t, \Delta ymc_t, ffr_t\}$$

Table: Euler equation: Selected Moments

	Data	Separ	Separ-Hab	NonSepar	NonSepar-Hab
Real Interest Rate					
Mean	2.25	6.73	6.88	5.46	5.03
Std	2.37	2.15	32.17	1.21	2.35
Corr	–	0.08	-0.03	0.27	0.22
Nominal Interest Rate					
Mean	6.31	10.89	11.03	9.61	9.17
Std	3.02	1.77	32.25	1.75	2.51
Corr	–	0.23	0.04	0.64	0.53

Note: Separ = Separable (c-h) utility; Separ-Hab = Separable utility with Fuhrer Habit; NonSep= Non separable utility; NonSep-Hab=Non separable utility with Fuhrer Habit.

Figure 1: Real Interest Rates
Ex Post and CRRA Euler Equation

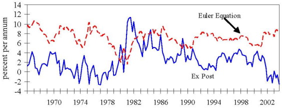


Figure 2: Real Interest Rates
Ex Post and Fuhrer Euler Equation

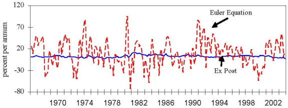


Figure 3: Real Interest Rates
Ex Post and C-E-E Euler Equation

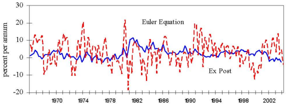
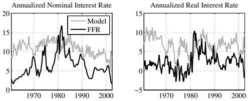
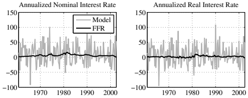


Figure: Euler equation: Data vs Model, General

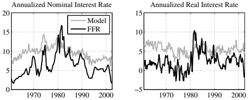
(a) Separ



(b) Separ-Hab



(c) NonSep



(d) NonSep-Hab

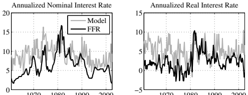
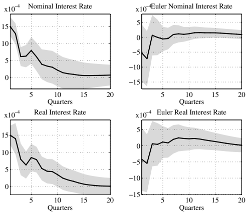
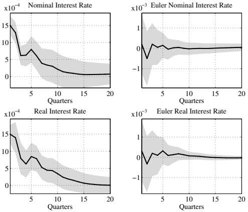


Figure: Euler equation: IRFs

(a) Separ



(b) NonSepar-Hab



The Euler equation rate and the real world policy rate are not related!!

Intuition

Hump shaped response of consumption and inflation to a monetary policy shock.

Consider, monetary tightening. Consumption is known to respond sluggishly (see Christiano et al., 2005), so expected consumption growth declines. The Euler equation real interest rate is negatively related to expected consumption growth, consequently, it declines too. But monetary tightening in the real world is typically associated with an increase in the money market real rate. Hence, policy induced changes in the Euler equation real rate and the money market real rate are negatively correlated.

Can non-separability of consumption and leisure save the day?

Monetary tightening in the Keynesian model. Employment is known to respond sluggishly (see Christiano et al., 2005), so expected employment growth declines. The Euler equation real interest rate is positively related to employment growth. Hence, expected consumption and expected employment growth move the real interest rate in opposite directions. If the latter effect dominates then the Euler equation and the money market real rates will be positively related following a change in monetary policy.

More generally: Central banks can practically set the interbank rate as they please (and keep it unchanged for long periods), but central banks seem to have much less immediate leverage over consumption and inflation. Any equation that links the interest rate to the conditional expectation of some function of consumption and inflation seems unlikely to capture the transmission mechanism of monetary policy.