Unemployment Fluctuations and Stabilization Policies: A New Keynesian Perspective

Lecture III: Unemployment and Monetary Policy Design

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Monetary Policy Design in the New Keynesian Model: Some Background

- The basic New Keynesian model (flexible wages)

  - Optimal policy: strict price inflation targeting
  - Intuition

- The New Keynesian model with sticky prices and wages (EHL model)

  - Erceg-Henderson-Levin, Woodford, Galí
  - Efficient allocation: unattainable
  - Optimal policy: balance between stabilization of output gap, price inflation and wage inflation

But no analysis of unemployment or its possible role in policy...

Monetary Policy Design in the New Keynesian Model: The Role of Unemployment

- Implications of the optimal policy for unemployment fluctuations
- Potential gains from adding the unemployment rate to simple interest rate rules

Exercise motivated by three observations:
- existing literature: near-optimality of stabilization of the output gap
- previous lecture: strong relation between the output gap and the unemployment rate
- advantage of unemployment: observability

A Loss Function for Stabilization Policies

- Inefficiencies resulting from wage and price staggering

$$
\begin{aligned}
C_t &= Y_t \\
&\equiv \left(\int_0^1 Y_t(z)^{1-\frac{1}{\epsilon_p}} dz \right)^{\frac{\epsilon_p}{\epsilon_p - 1}} \\
&= A_t \left(\Delta_t^w \Delta_t^p N_t \right)^{1-\alpha}
\end{aligned}
$$

where $\Delta_t^w \equiv \int_0^1 \left(\frac{W_t(i)}{W_t} \right)^{-\epsilon_w} di \leq 1$ and $\Delta_t^p \equiv \int_0^1 \left(\frac{P_t(i)}{P_t} \right)^{\frac{-\epsilon_p}{1-\alpha}} di \leq 1$

$$
\int_0^1 N_t(i)^{1+\varphi} di = N_t^{1+\varphi} \Delta_t^n
$$

where $\Delta_t^n \equiv \left(\int_0^1 W_t(i)^{-\epsilon_w(1+\varphi)} \; di \right) / \left(\int_0^1 W_t(i)^{-\epsilon_w} di \right)^{1+\varphi} \geq 1$

- Exact expression for the period utility loss

$$\begin{aligned}\mathcal{L}_t &\equiv U_t^e - U_t \\ &= \log(Y_t^e / Y_t) - \left(\frac{1-\alpha}{1+\varphi}\right) \left(1 - \Delta_t^n (N_t / N_t^e)^{1+\varphi}\right) \\ &= -x_t - \left(\frac{1-\alpha}{1+\varphi}\right) \left(1 - \Delta_t^n \Delta_t^{1+\varphi} \exp\left\{\left(\frac{1+\varphi}{1-\alpha}\right) x_t\right\}\right)\end{aligned}$$

where $\Delta_t \equiv \Delta_t^p \Delta_t^w$ and $x_t \equiv y_t - y_t^e$

- Second order approximation of period loss function around the zero inflation, efficient steady state ($\Delta_t^p = \Delta_t^w = x = 0$)

[Implicit assumption: $(1-\tau)\mathcal{M} = 1$]

$$\mathcal{L}_t \simeq \left(\frac{1-\alpha}{1+\varphi}\right) \delta_t^n + (1-\alpha)\delta_t + \frac{1}{2}\left(\frac{1+\varphi}{1-\alpha}\right) x_t^2$$

where $\delta_t^n \equiv \log \Delta_t^n$ and $\delta_t \equiv \delta_t^w + \delta_t^p = \log \Delta_t^w + \log \Delta_t^p$

- Lemma

$$\delta_t^p \simeq \frac{\epsilon_p}{2(1-\alpha)\Theta} \; var_z\{p_t(z)\}$$

$$\delta_t^w \simeq \frac{\epsilon_w}{2} \; var_i\{w_t(i)\}$$

$$\delta_t^n \simeq \frac{\epsilon_w^2(1+\varphi)\varphi}{2} \; var_i\{w_t(i)\}$$

$$\sum_{t=0}^{\infty} \beta^t var_z\{p_t(z)\} = \frac{\theta_p}{(1-\beta\theta_p)(1-\theta_p)} \sum_{t=0}^{\infty} \beta^t (\pi_t^p)^2$$

$$\sum_{t=0}^{\infty} \beta^t var_i\{w_t(i)\} = \frac{\theta_w}{(1-\beta\theta_w)(1-\theta_w)} \sum_{t=0}^{\infty} \beta^t (\pi_t^w)^2$$

- Resulting loss function

$$\frac{1}{2}E_0\sum_{t=0}^{\infty}\beta^t\left[\left(\frac{1+\varphi}{1-\alpha}\right)x_t^2+\left(\frac{\epsilon_p}{\lambda_p}\right)(\pi_t^p)^2+\left(\frac{\epsilon_w(1-\alpha)}{\lambda_w}\right)(\pi_t^w)^2\right]$$

- Expected average loss

$$\left(\frac{1+\varphi}{1-\alpha}\right)var(x_t)+\left(\frac{\epsilon_p}{\lambda_p}\right)var(\pi_t^p)+\left(\frac{\epsilon_w(1-\alpha)}{\lambda_w}\right)var(\pi_t^w)$$

- Discussion

Optimal Monetary Policy

- The central bank's problem

$$\min \frac{1}{2} E_0 \sum_{t=0}^{\infty} \beta^t \left[\left(\frac{1+\varphi}{1-\alpha} \right) x_t^2 + \left(\frac{\epsilon_p}{\lambda_p} \right) (\pi_t^p)^2 + \left(\frac{\epsilon_w (1-\alpha)}{\lambda_w} \right) (\pi_t^w)^2 \right]$$

subject to:

$$\pi_t^p = \beta E_t\{\pi_{t+1}^p\} + \kappa_p x_t + \lambda_p \widetilde{\omega}_t$$

$$\pi_t^w = \beta E_t\{\pi_{t+1}^w\} + \kappa_w x_t - \lambda_w \widetilde{\omega}_t$$

$$\widetilde{\omega}_t = \widetilde{\omega}_{t-1} + \pi_t^w - \pi_t^p - \Delta \omega_t^n$$

where $\omega_t^n = a_t + \left(\frac{\alpha}{1+\varphi} \right) \xi_t$

Optimal Monetary Policy

- Optimality conditions

$$\left(\frac{1+\varphi}{1-\alpha}\right) x_t + \kappa_p \xi_{1,t} + \kappa_w \xi_{2,t} = 0$$

$$\frac{\epsilon_p}{\lambda_p} \pi_t^p - \Delta \xi_{1,t} + \xi_{3,t} = 0 \quad (1)$$

$$\frac{\epsilon_w (1-\alpha)}{\lambda_w} \pi_t^w - \Delta \xi_{2,t} - \xi_{3,t} = 0 \quad (2)$$

$$\lambda_p \xi_{1,t} - \lambda_w \xi_{2,t} + \xi_{3,t} - \beta E_t \{\xi_{3,t+1}\} = 0 \quad (3)$$

- Impulse Responses and Conditional Second Moments: Optimal policy vs. Taylor rule

Figure 8a . Dynamic Responses to a Technology Shock: Optimal vs. Taylor

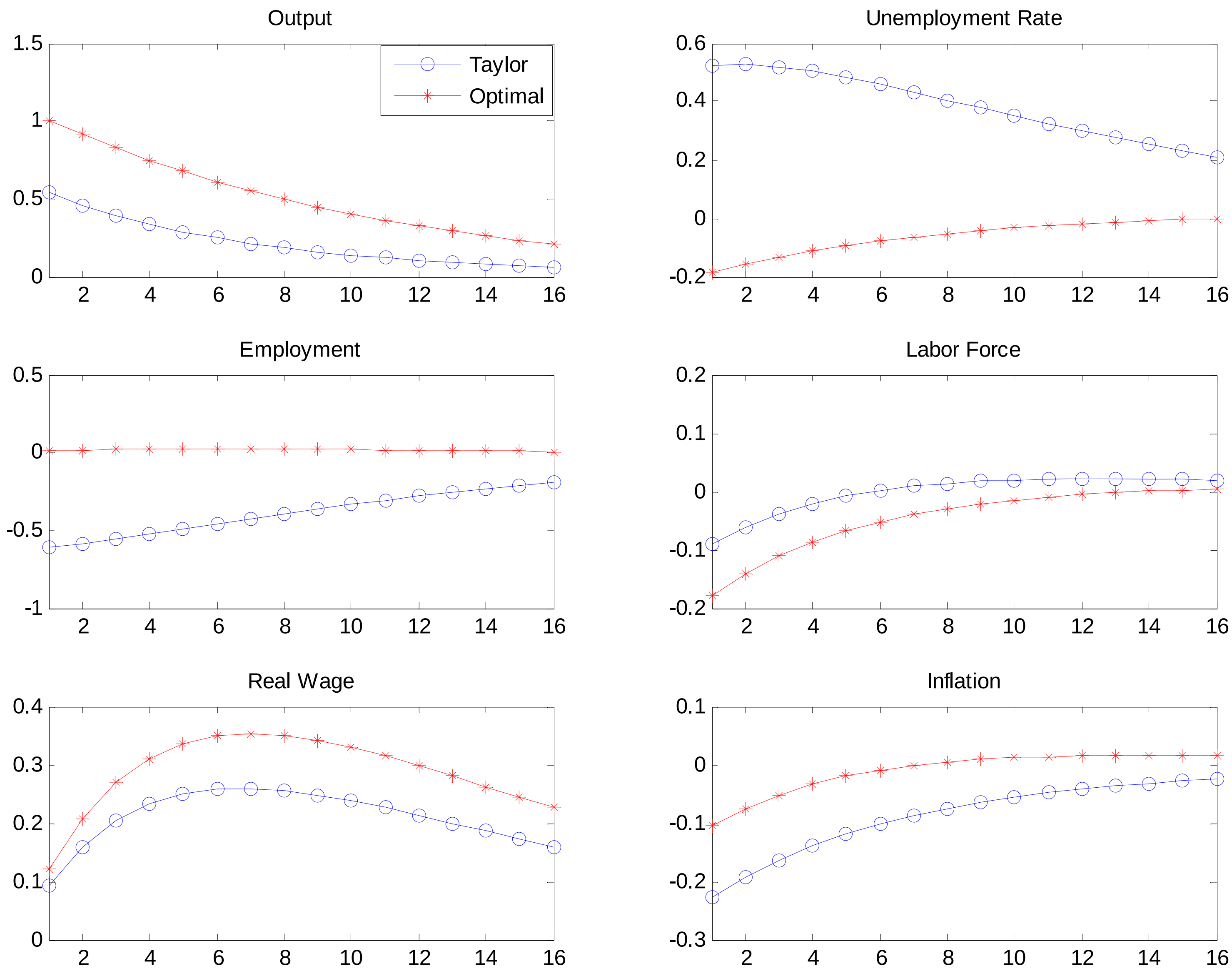


Figure 8b . Dynamic Responses to a Labor Supply Shock: Optimal vs. Taylor

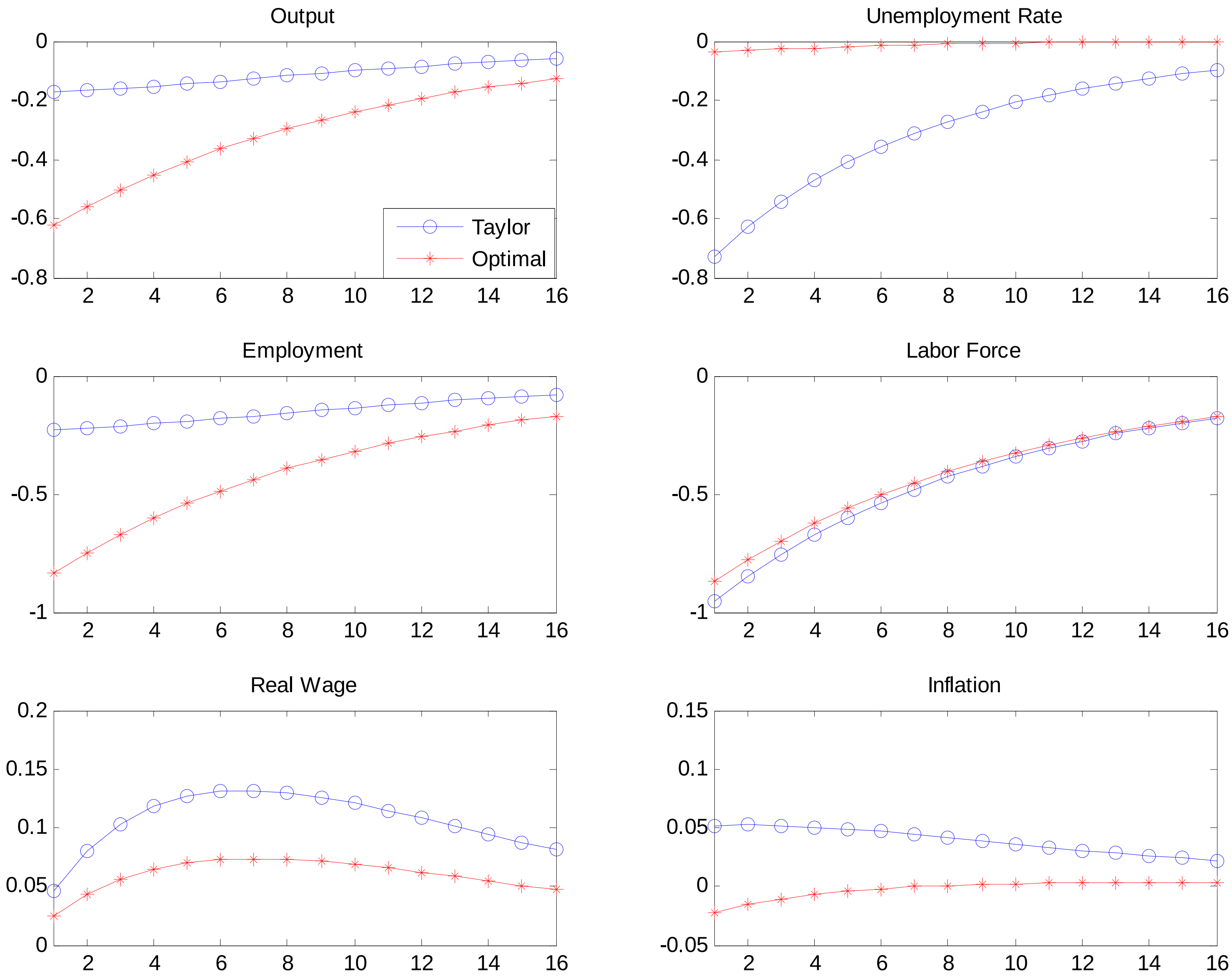


Table 5. Second Moments: Taylor Rule vs. Optimal Policy (HP-Filtered)

	Technology				*Labor Supply*			
	Taylor		Optimal		Taylor		Optimal	
	$\sigma(x)$	$\rho(x,y)$	$\sigma(x)$	$\rho(x,y)$	$\sigma(x)$	$\rho(x,y)$	$\sigma(x)$	$\rho(x,y)$
Output	0.66	1.0	1.30	1.0	0.23	1.0	0.79	1.0
Unemployment	0.75	0.96	0.23	−0.98	0.91	0.95	0.05	0.98
Employment	0.83	−0.98	0.04	0.68	0.31	0.99	1.06	1.00
Labor force	0.11	−0.92	0.21	−0.95	1.21	0.97	1.11	1.00
Real Wage	0.31	0.53	0.42	0.62	0.16	−0.75	0.08	−0.60
Inflation	0.28	−0.99	0.12	−0.86	0.07	−0.99	0.03	0.87

Simple Interest Rate Rules

- General specification

$$\widehat{i}_t = \phi_i \widehat{i}_{t-1} + (1 - \phi_i)(\phi_\pi \pi_t^p + \phi_y \widehat{y}_t + \phi_u \widehat{u}_t + \phi_w \pi_t^w)$$

- Optimized coefficients and performance against fully optimal policy

- A Simple Rule

$$\widehat{i}_t = 1.5\ \pi_t^p - 0.5\ \widehat{u}_t$$

- Performance against optimal policy

Table 6. Optimal Simple Rules

	Technology Shocks						*Labor Supply Shocks*					
	ϕ_i	ϕ_p	ϕ_y	ϕ_u	ϕ_w	*Loss*	ϕ_i	ϕ_p	ϕ_y	ϕ_u	ϕ_w	*Loss*
(a)		2.55	−0.06			4.15		3.22	−0.07			6.93
(b)	0.85	1.02	−0.06			1.31	0.60	1.11	−0.08			3.98
(c)		1.45	−0.13	−0.45		1.006		1.66	−0.08	−0.60		1.007
(d)	0.33	1.46	−0.12	−0.45		1.004	−0.22	1.33	−0.09	−0.31		1.006
(e)		1.46	−0.13	−0.46	−0.005	1.006		1.66	−0.08	−0.60	0.00	1.007
(f)	0.33	1.46	−0.12	−0.45	−0.01	1.004	−0.22	1.33	−0.09	−0.31	0.00	1.006
(g)		1.50		−0.50		1.106		1.50		−0.50		1.83

Figure 9a . Dynamic Responses to a Technology Shock: Optimal Simple Rule

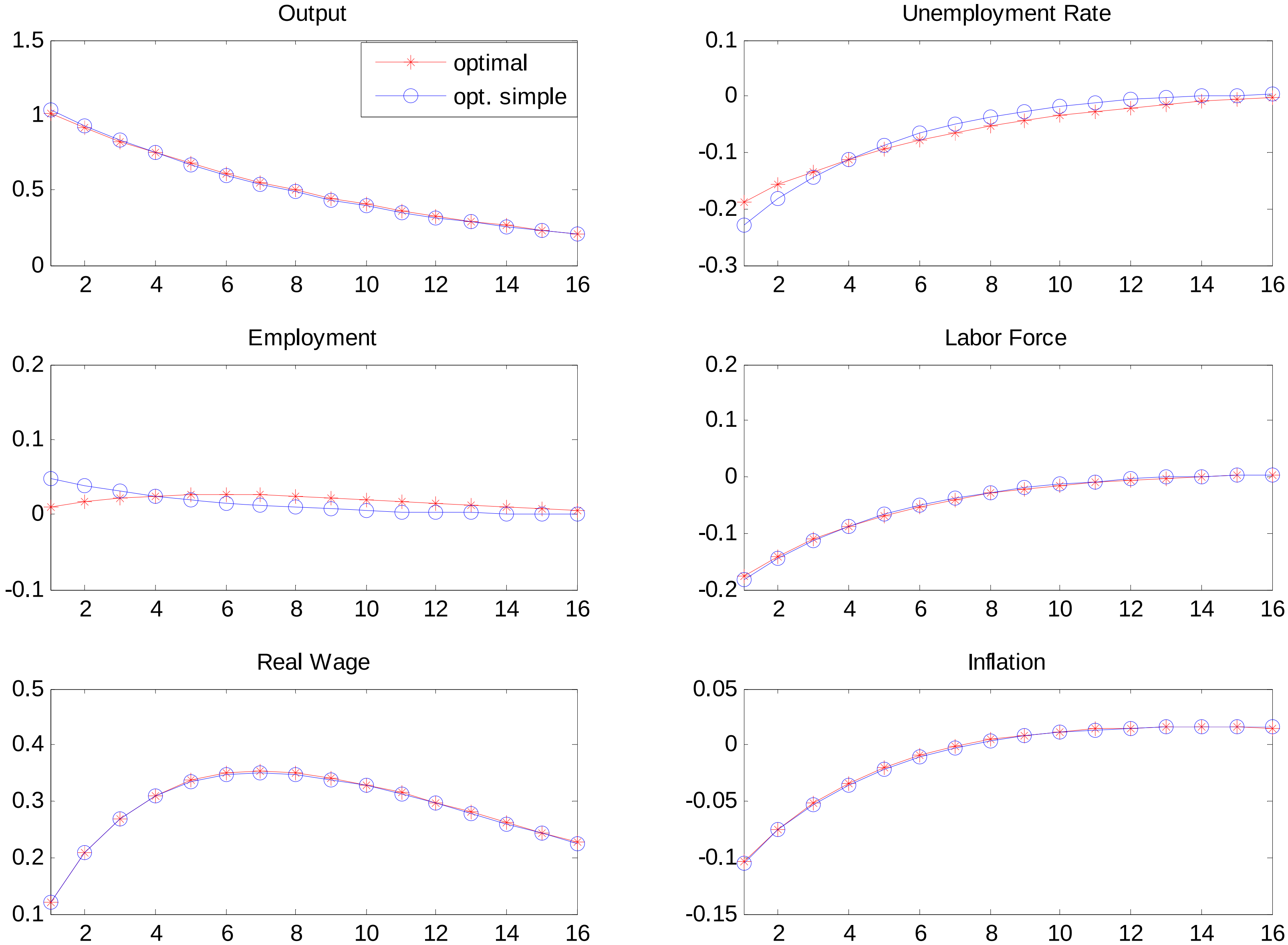


Figure 9b . Dynamic Responses to a Labor Supply Shock: Optimal Simple Rule

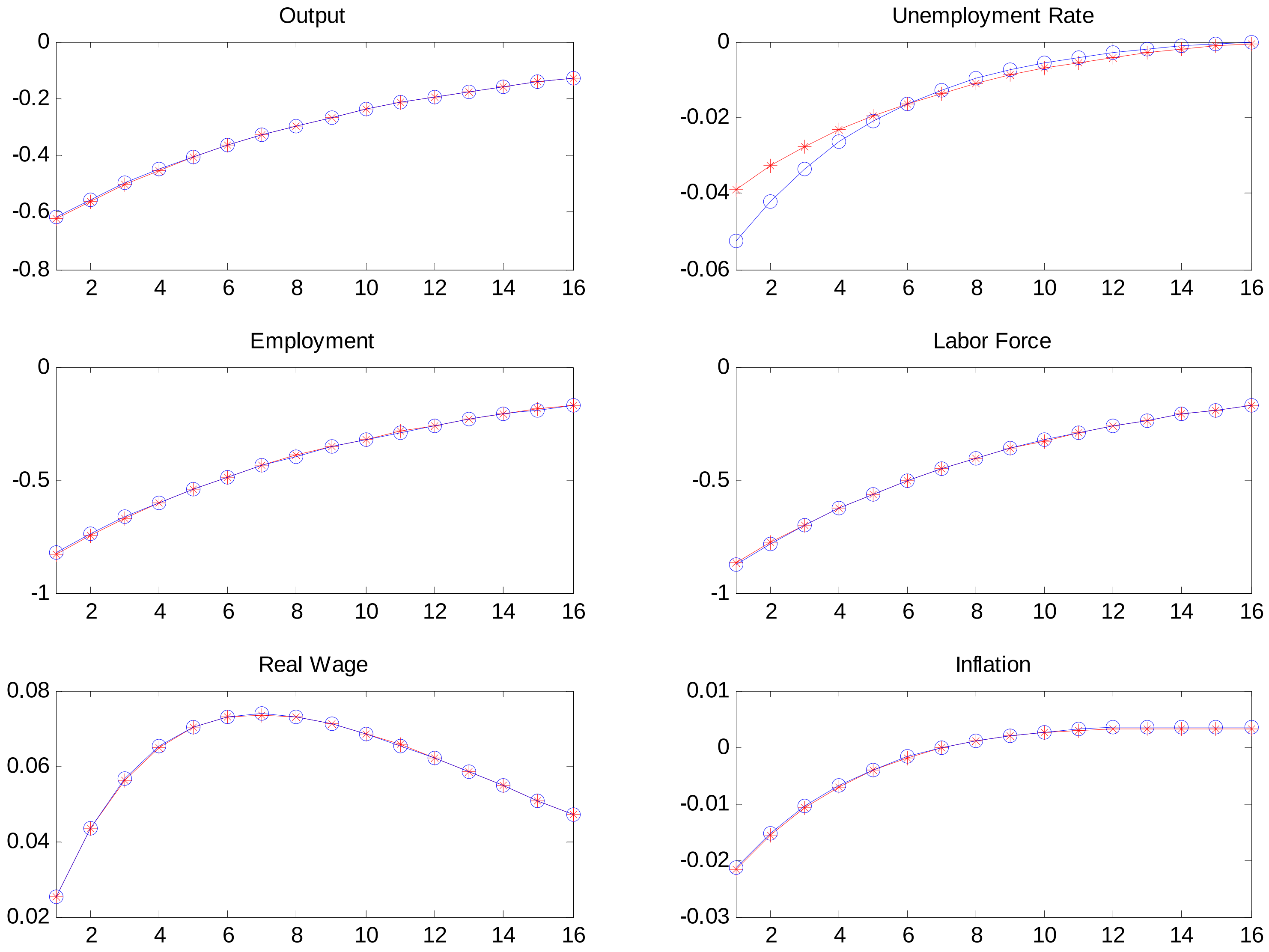


Figure 10a . Dynamic Responses to a Technology Shock: Simple Rule

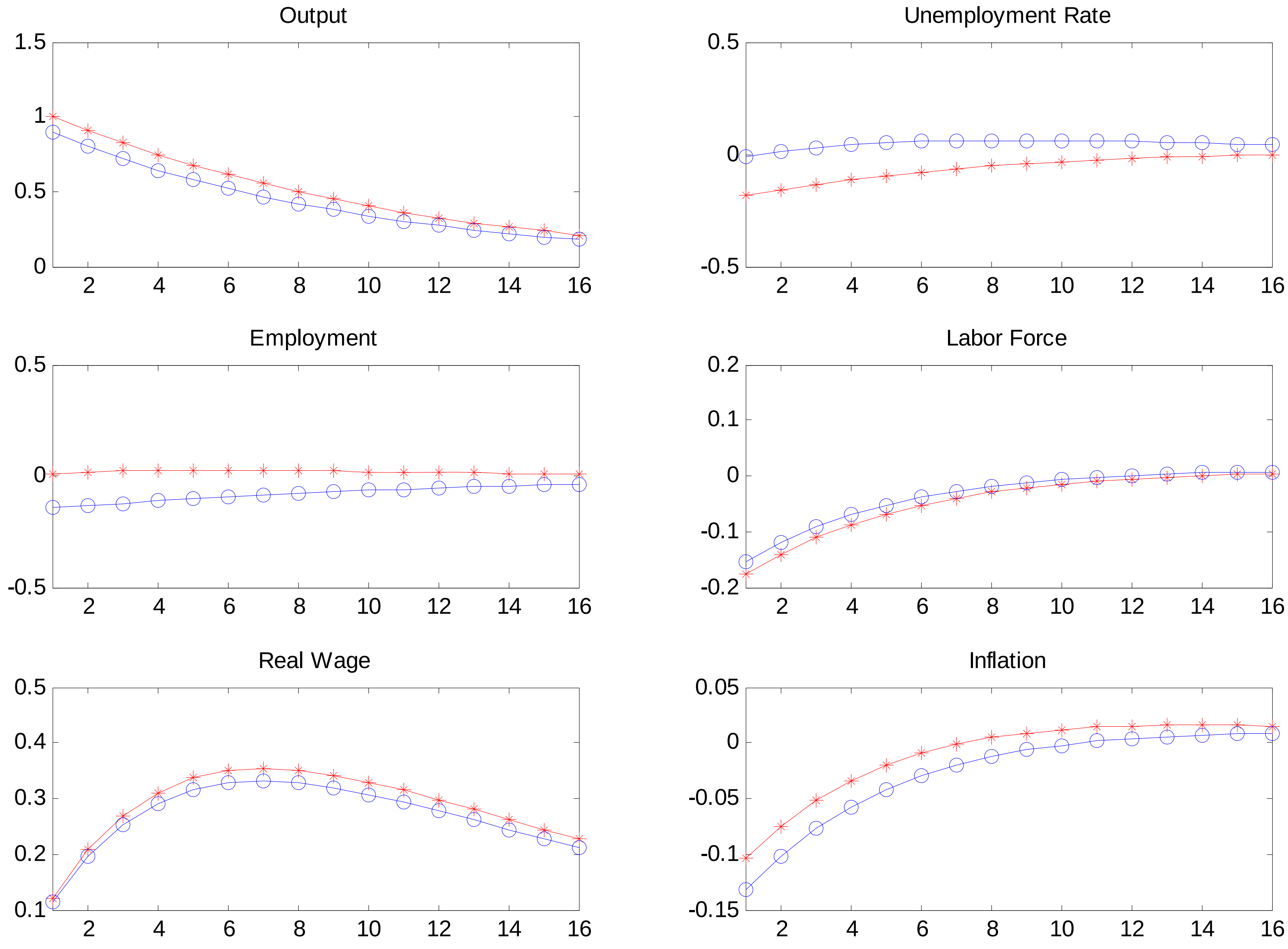
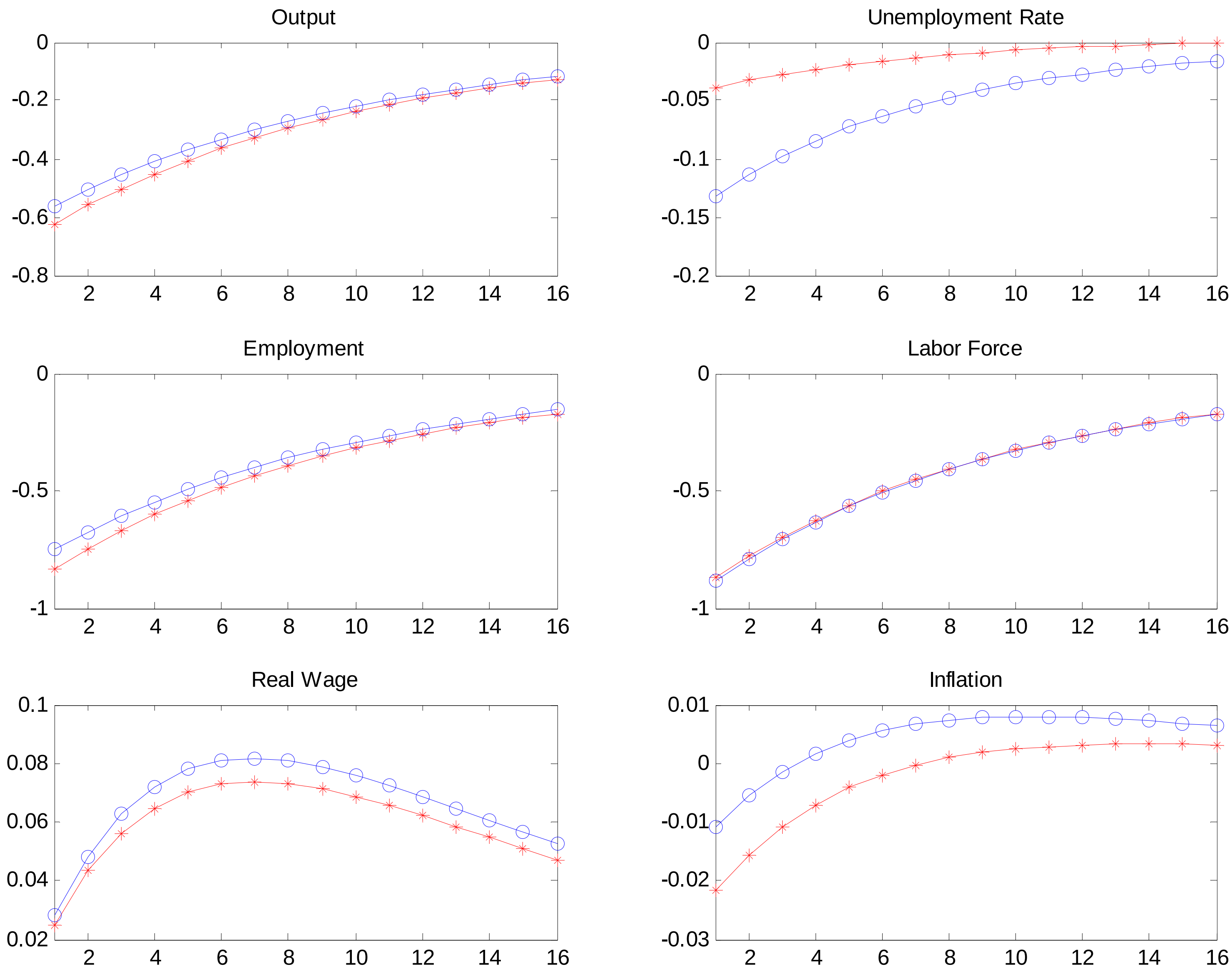


Figure 10b . Dynamic Responses to a Labor Supply Shock: Simple Rule



Empirical Performance of the Simple Rule

- Empirical Performance of a Simple Rule

$$i_t = r + \pi^* + 1.5\ (\pi_t^p - \pi^*) - 2\ (u_t - u^*)$$

- Calibration:

$r = 2\%$ $\qquad \pi^* = 1.5\%$
$u^* = 6\%$ (U.S., 1987Q3-1998Q4)
$u^* = 5\%$ (U.S., 1999Q1-2009Q4)
$u^* = 8.5\%$ (Euro area, 1999Q1-2009Q4)

- Benchmark: The Taylor rule

$$i_t = 4 + 1.5\ (\pi_t^p - 2) + 0.5\ \widehat{y}_t$$

Figure 11a . Monetary Policy in the Greenspan-Bernanke Era (1987Q3-2009Q4)

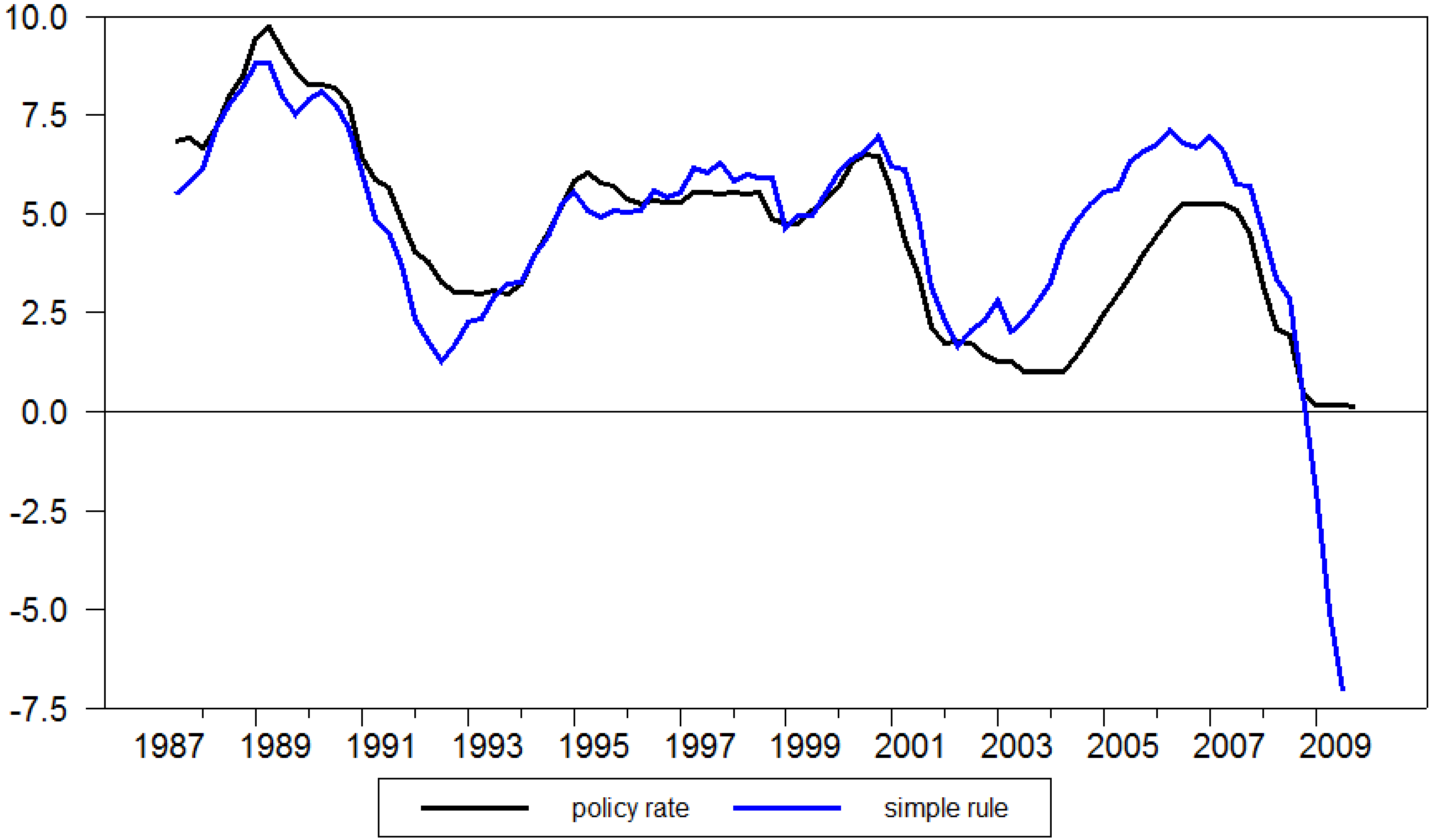


Figure 11b . Monetary Policy in the Greenspan-Bernanke Era (1987Q3-2008Q4)

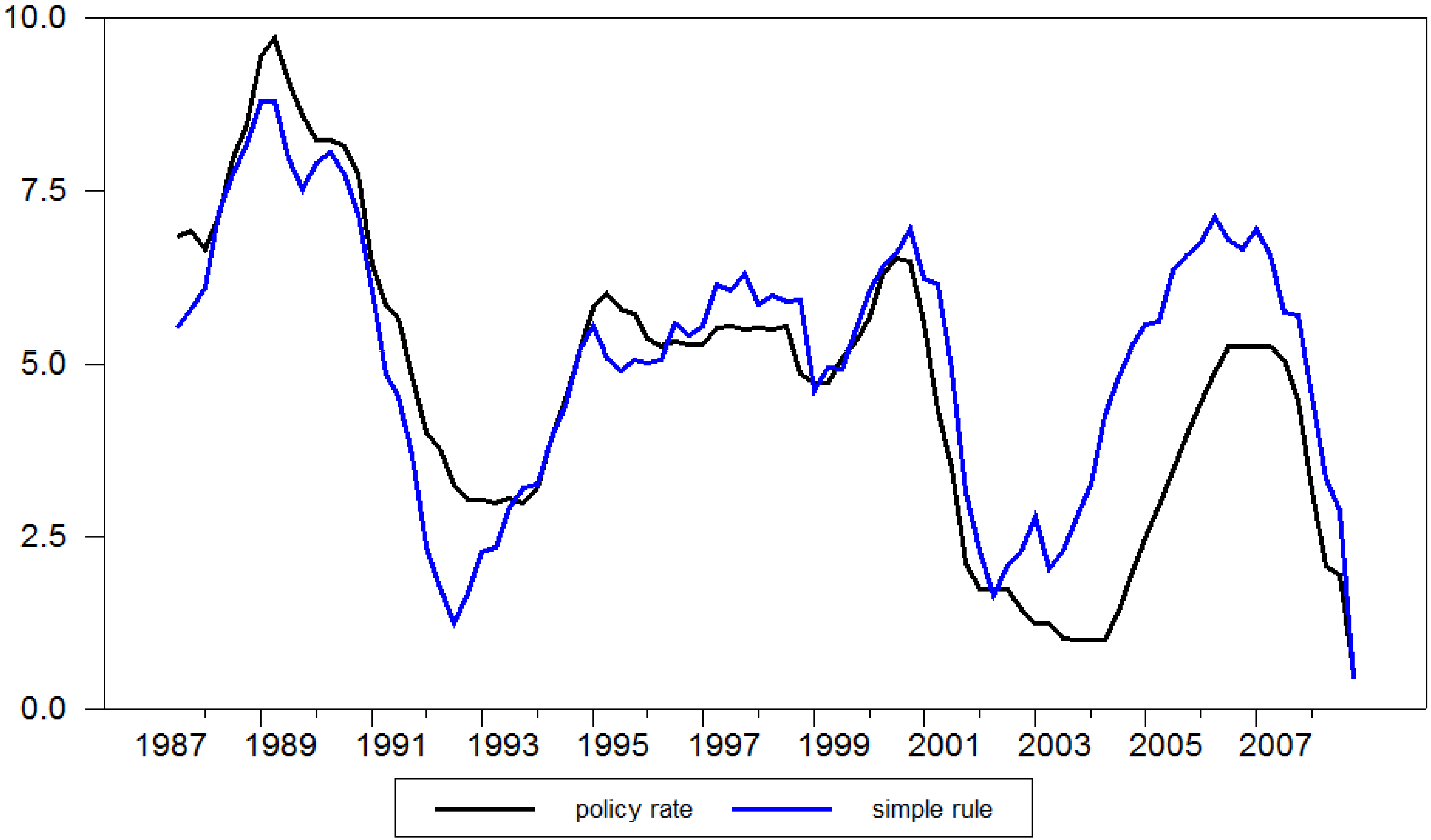


Figure 11c . Monetary Policy in the Greenspan-Bernanke Era (1987Q3-2008Q4)

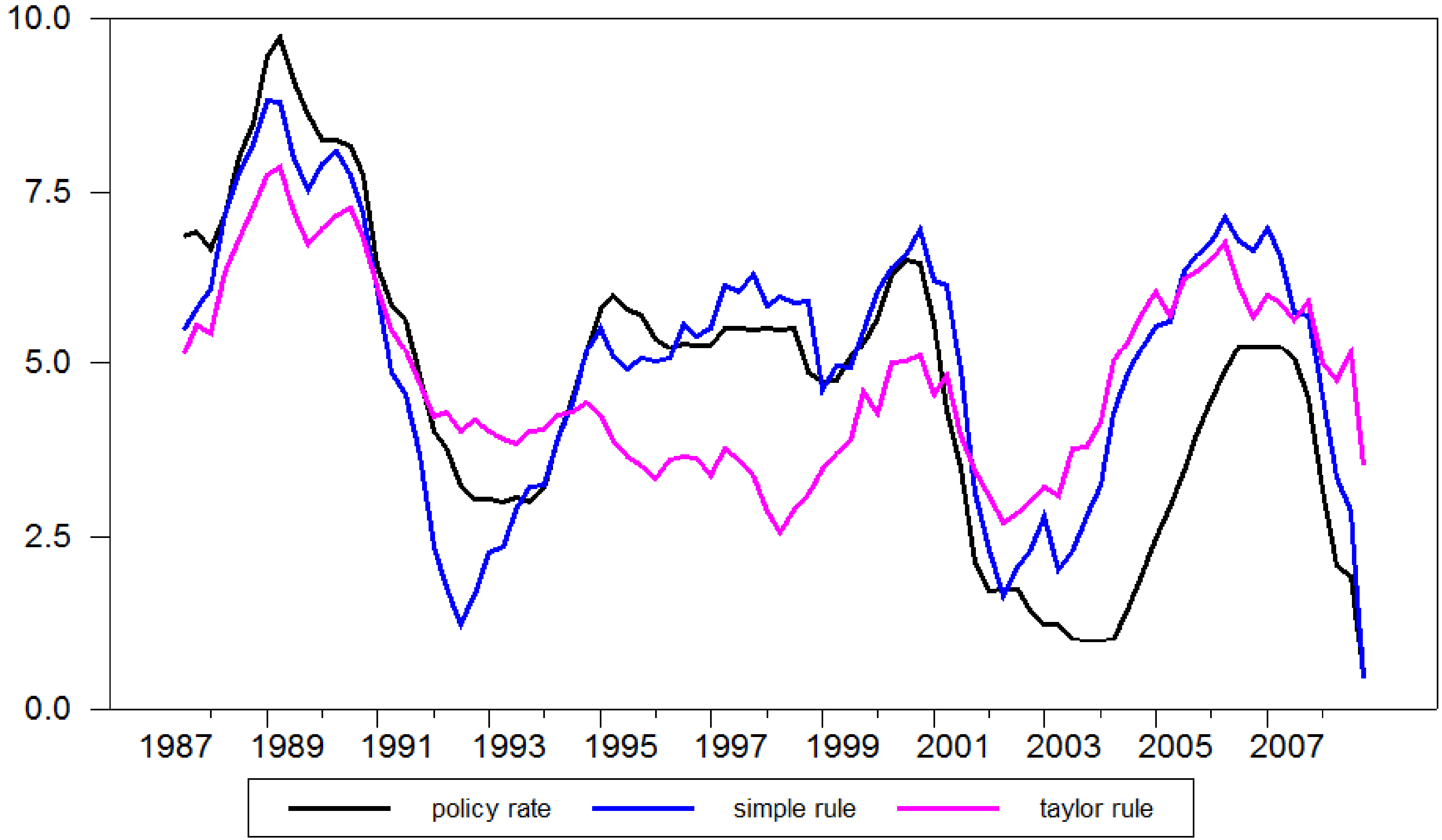
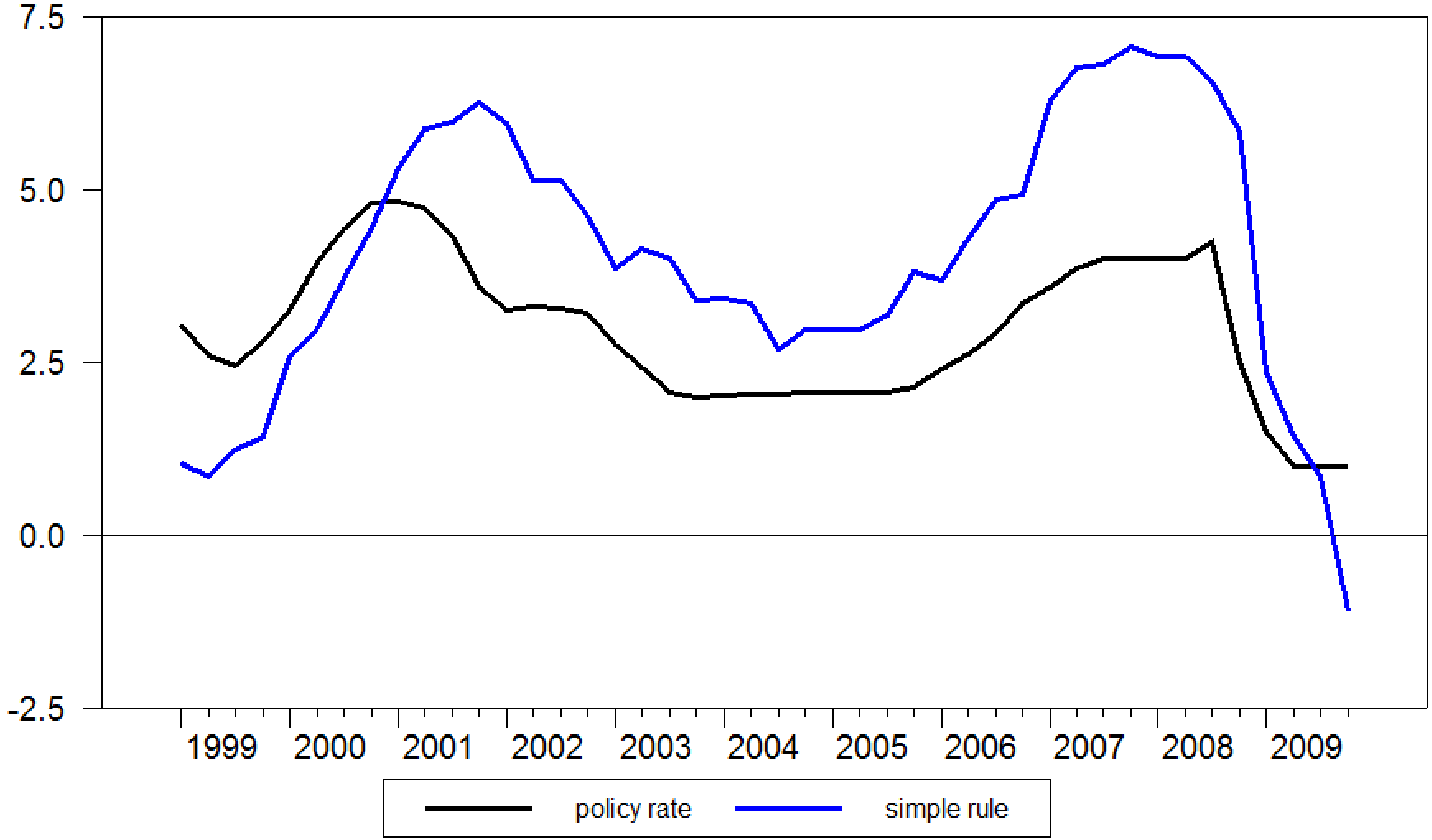


Figure 12 . Monetary Policy in the Euro Area (1999Q1-2008Q4)



Summary and Conclusions

- Optimal monetary policy involves more stability in unemployment than implied by the standard Taylor rule
- Simple interest rate rules that respond to inflation and the unemployment rate can approximate very well the optimal policy
- A simple, unconditional rule of the form

$$i_t = r + \pi^* + 1.5\ (\pi_t^p - \pi^*) - 2\ (u_t - u^*)$$

  captures surprisingly well the Fed interest rate policy until the early 2000s, though less so ECB policy.
- Message: unemployment's role in monetary policy may have been underplayed by the academic literature, more than by central bank practice.