Hysteresis and the European Unemployment Problem Revisited

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Figure 1. Unemployment Rate in the Euro Area

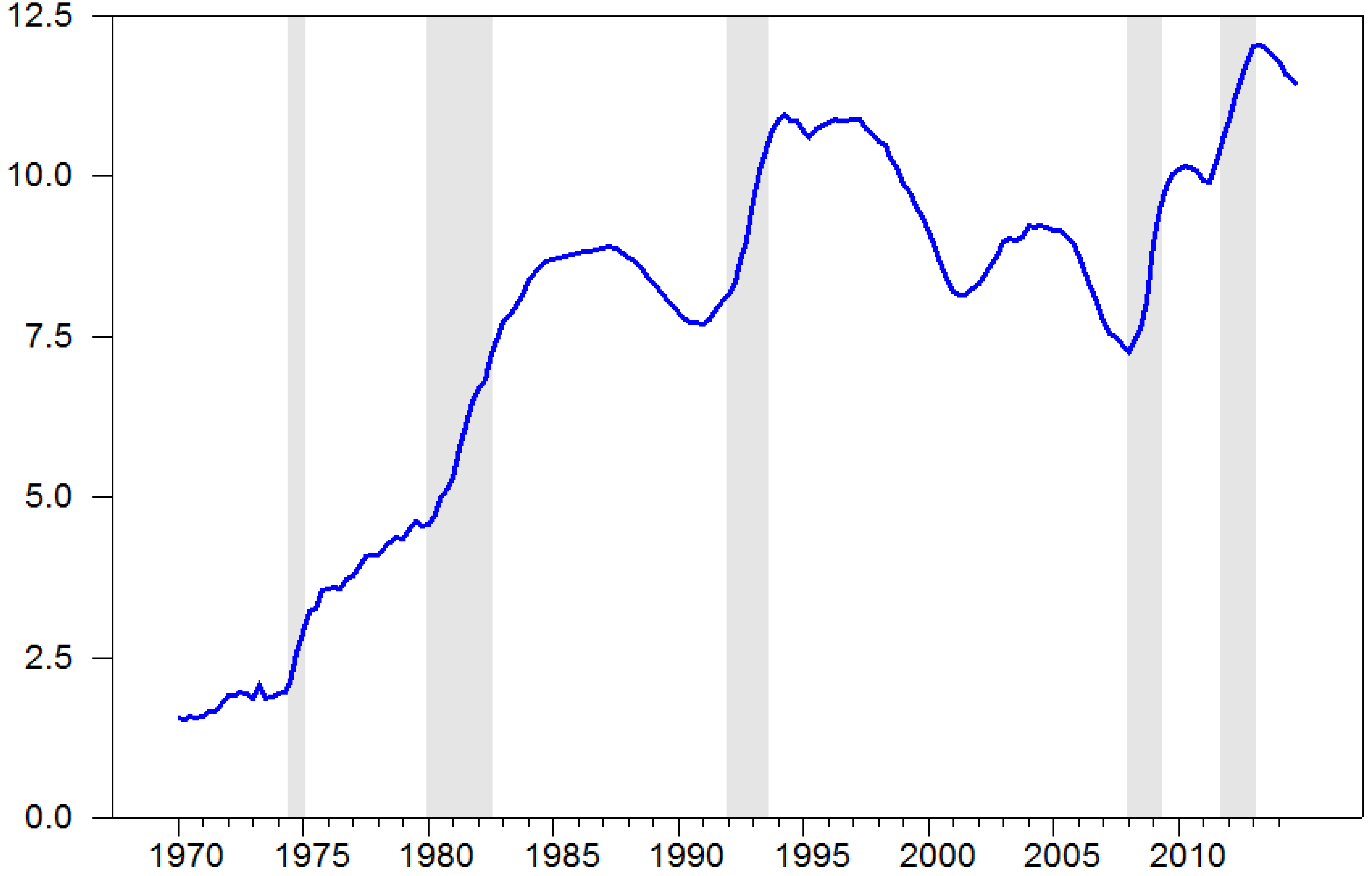
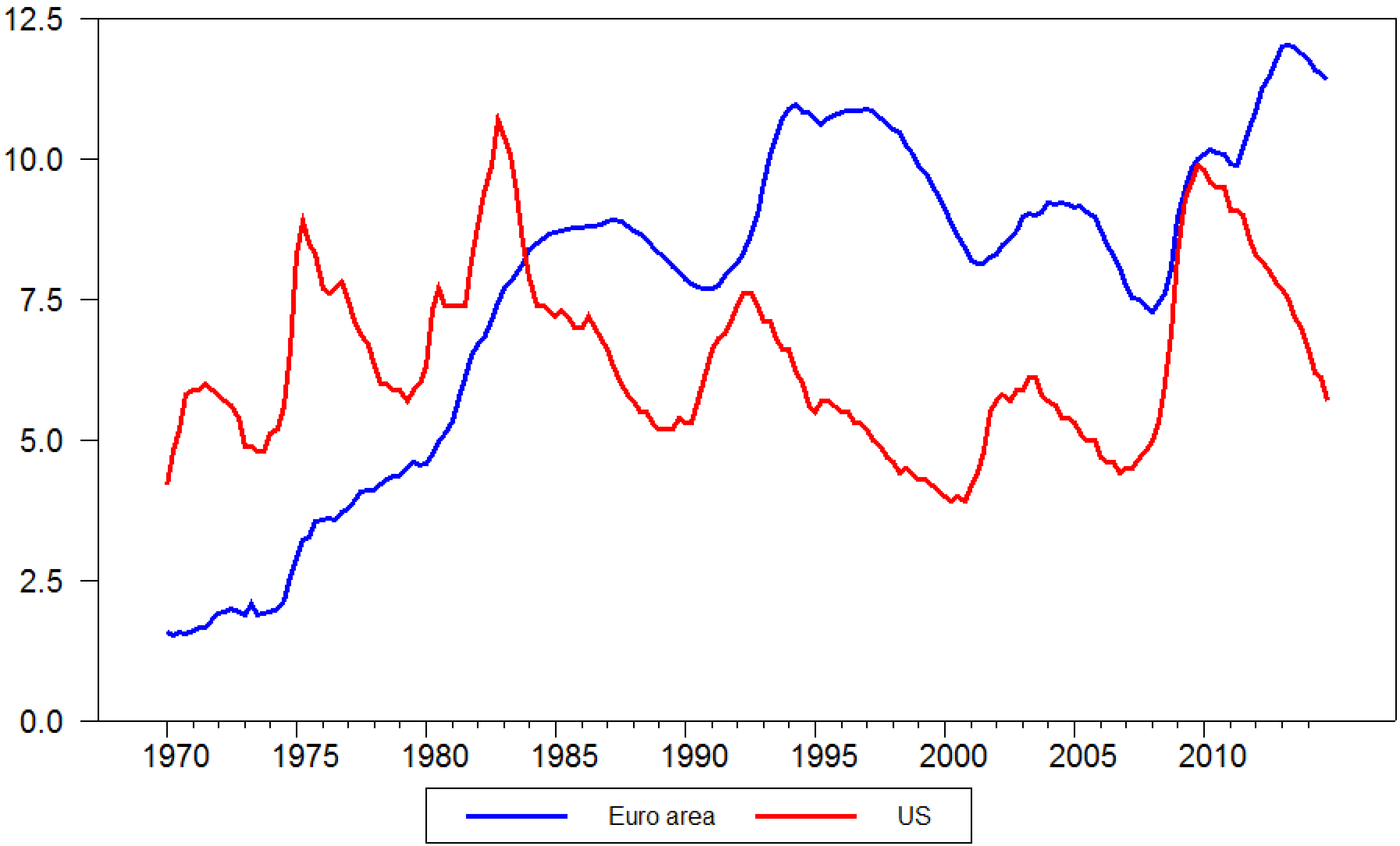


Figure 1. Unemployment Rate: United States vs. Euro Area



Unemployment: Europe vs. United States

- Unit root tests:
  - U.S. unemployment rate $\Rightarrow$ stationary
  - Euro area unemployment rate $\Rightarrow$ nonstationary (unit root)
- Autocorrelations

Figure 2. Unemployment Rate: Autocorrelations

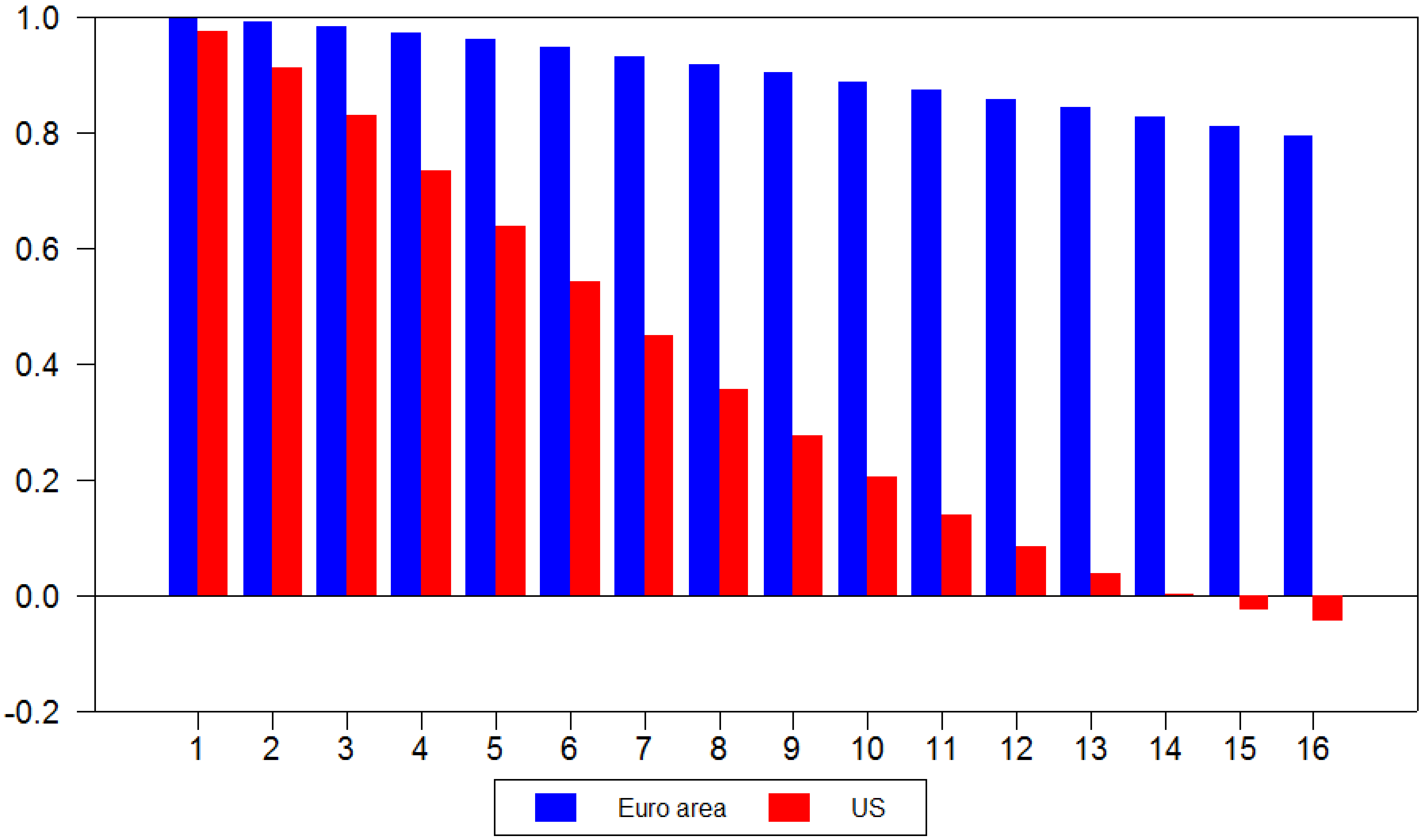
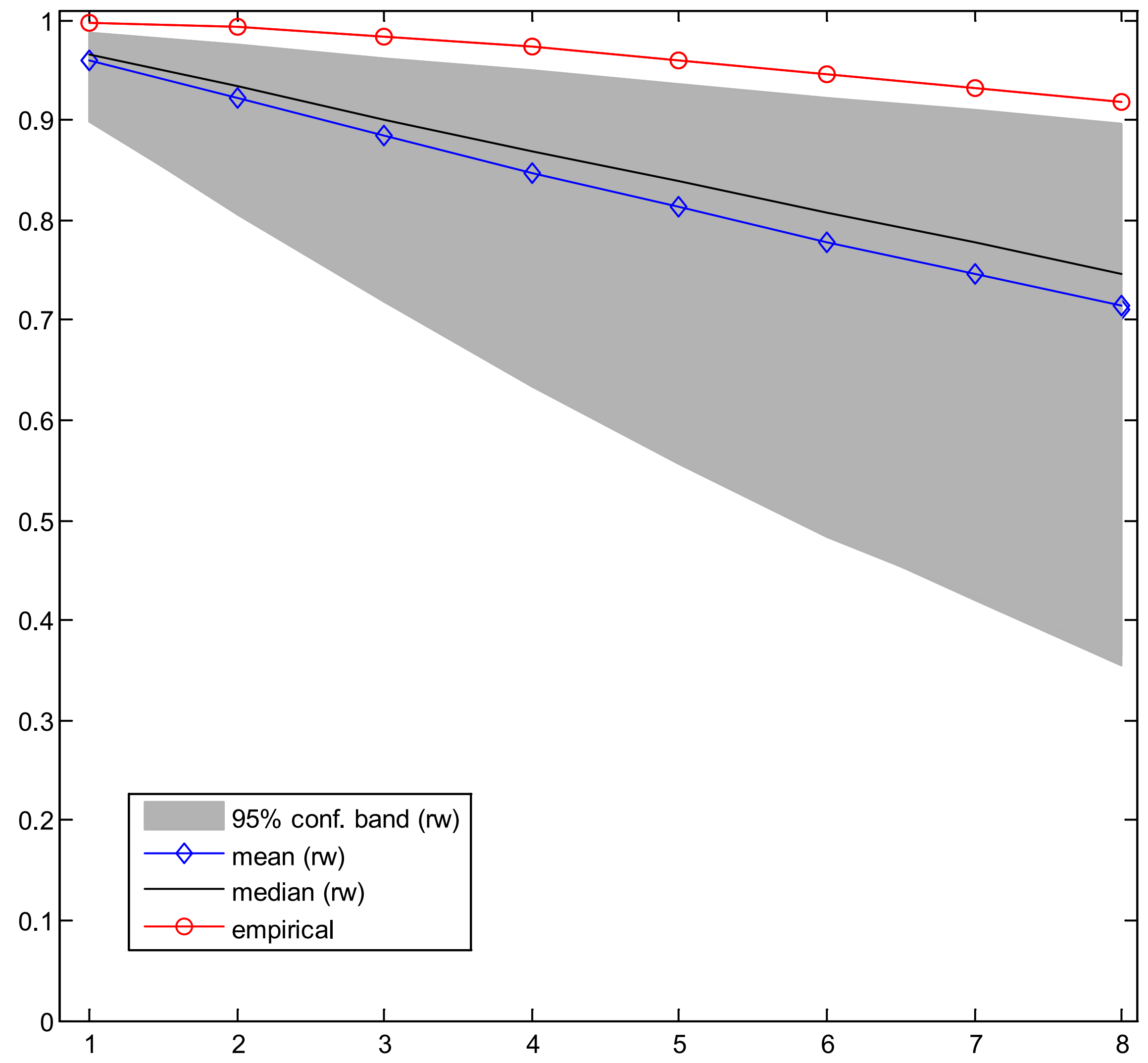


Figure 2.a Euro Area Unemployment: Autocorrelation

1970Q1-2014Q4 (180 obs.)



Outline

- What is the source of the unit root in European unemployment?
- Reference framework: a New Keynesian model with unemployment
- Three hypotheses:

  (i) the *natural rate* hypothesis
  (ii) the *long run tradeoff* hypothesis
  (iii) the *hysteresis* hypothesis

- Empirical assessment
- What are the implications for monetary policy? (follow up paper)

A Benchmark Framework

- Based on Galí (2011) and Galí-Smets-Wouters (2012)
- Monopolistic competition and nominal rigidities in goods and labor markets
- Representative household with large number of members
- Heterogeneity within each household: (i) occupational, (ii) disutility from work
- Three possible statuses: employed, unemployed, non-participant

A Benchmark Framework

- Staggered wage setting à la Calvo:

$$w_t = \theta_w w_{t-1} + (1-\theta_w) w_t^*$$

- Optimal wage setting rule:

$$w_t^* = \mu^w + (1-\beta\theta_w)\sum_{k=0}^{\infty}(\beta\theta_w)^k E_t\left\{\underline{w}_{t+k|t}\right\}$$

  where $\underline{w}_{t+k|t} \equiv p_{t+k} + c_{t+k} + \varphi n_{t+k|t}$ and $\mu^w \equiv \log \frac{\epsilon_w}{\epsilon_w - 1}$

- Implied wage dynamics equation

$$\pi_t^w = \beta E_t\{\pi_{t+1}^w\} - \lambda_w(\mu_t^w - \mu^w)$$

  where $\mu_t^w \equiv w_t - p_t - (c_t + \varphi n_t)$ is the *average* wage markup.

- Aggregate participation:

$$w_t - p_t = c_t + \varphi l_t$$

- Unemployment rate:

$$u_t \equiv l_t - n_t$$

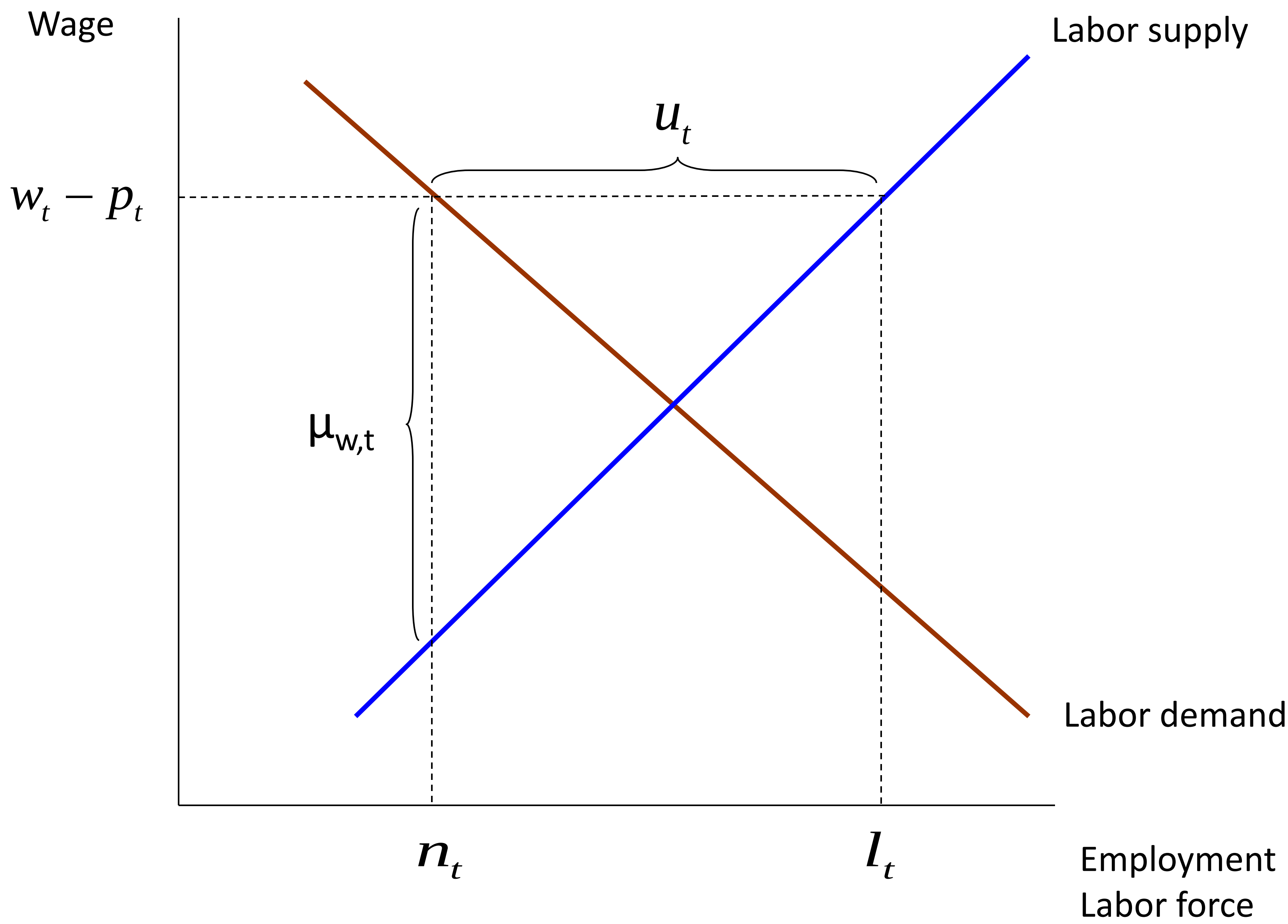
- Key relation:

$$\mu_t^w = \varphi u_t$$

- Natural rate of unemployment:

$$\mu^w = \varphi u^n$$

Figure 6. The Wage Markup and the Unemployment Rate



A Benchmark Framework

- Implied wage Phillips curve (Galí (2011)):

$$\pi_t^w = \beta E_t\{\pi_{t+1}^w\} - \lambda_w \varphi(u_t - u^n)$$

- Extension with indexation:

$$\pi_t^w = \pi_{t-1}^p + \beta E_t\{\pi_{t+1}^w - \pi_t^p\} - \lambda_w \varphi(u_t - u^n)$$

- Monetary policy

$$\widehat{i}_t = \phi_i \widehat{i}_{t-1} + (1 - \phi_i)[\phi_\pi(\pi_t^p - \pi^*) + \phi_y \Delta y_t]$$

where $\widehat{i}_t \equiv i_t - (\rho + \pi^*)$

A Benchmark Framework

- Equilibrium

$$u_t \sim I(0)$$

A Benchmark Framework

- Equilibrium

$$u_t \sim I(0)$$

- Source of stationarity: optimal wage setting $\Rightarrow$

$$(1-\beta\theta_w)\sum_{k=0}^{\infty}(\beta\theta_w)^k E_t\left\{\mu^w_{t+k|t}\right\} = \mu^w$$

where $\mu^w_{t+k|t} \equiv w^*_t - \underline{w}_{t+k|t}$

$$\Rightarrow \mu^w_t \sim I(0) \Rightarrow u_t \sim I(0)$$

- How can we modify that benchmark model to generate a unit root in the unemployment rate?

The Natural Rate Hypothesis

- Assumption:

$$u_t^n \sim \textit{ random walk}$$

- Source: non-stationarity in the desired markup

$$\mu_{w,t}^n \sim \textit{ random walk}$$

- Natural rate of unemployment:

$$\mu_{w,t}^n = \varphi u_t^n$$

- Implication:

$$u_t \sim I(1)$$

The Natural Rate Hypothesis

- Empirical assesment

$$u_t = u_t^n + \widetilde{u}_t$$

$$\pi_t^w = \pi_{t-1}^p - \lambda_w \varphi \sum_{k=0}^{\infty} \beta^k E_t\{\widetilde{u}_{t+k}\}$$

$$\pi_t^{w,*} = \pi_{t-1}^p - \lambda_w \varphi \sum_{k=0}^{\infty} \beta^k E\{\widetilde{u}_{t+k} | \mathbf{x}_t, \mathbf{x}_{t-1,...}\}$$

where $\mathbf{x}_t \equiv [\widetilde{u}_t, \pi_t^w - \pi_{t-1}^p, \widetilde{u}_{t-1}, \pi_{t-1}^w - \pi_{t-2}^p, ...]$

$\widetilde{u}_t \sim$ cyclical component of a MBN decomposition of $\{u_t\}$

- Under the null that the model is "true":

$$\pi_t^{w,*} = \pi_t^w$$

- Evidence

Figure 8. The Natural Rate of Unemployment and the Unemployment Gap under the Natural Rate Hypothesis

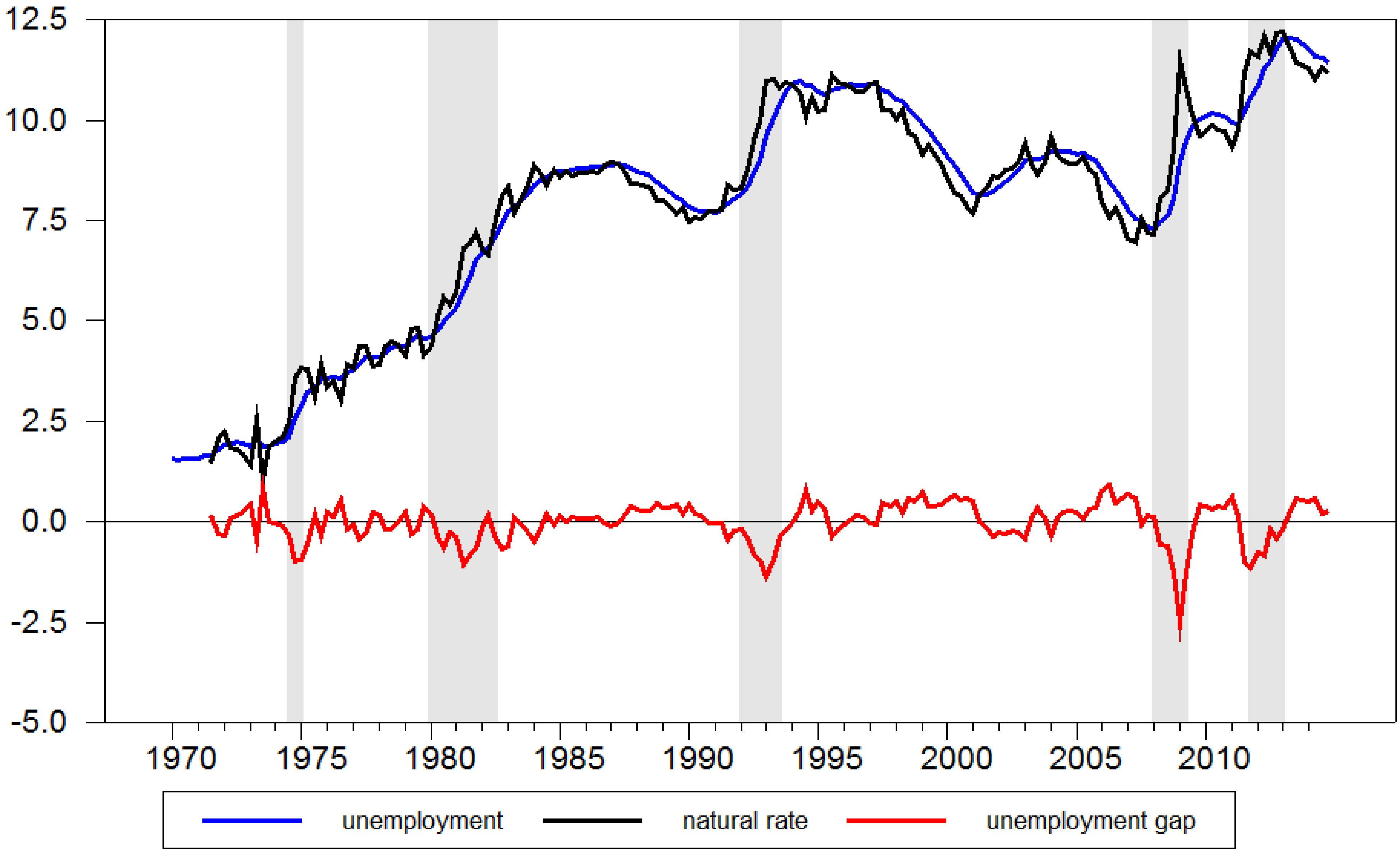


Figure 9a. Wage Inflation: Actual vs. Predicted under the Natural Rate Hypothesis (1970-2014)

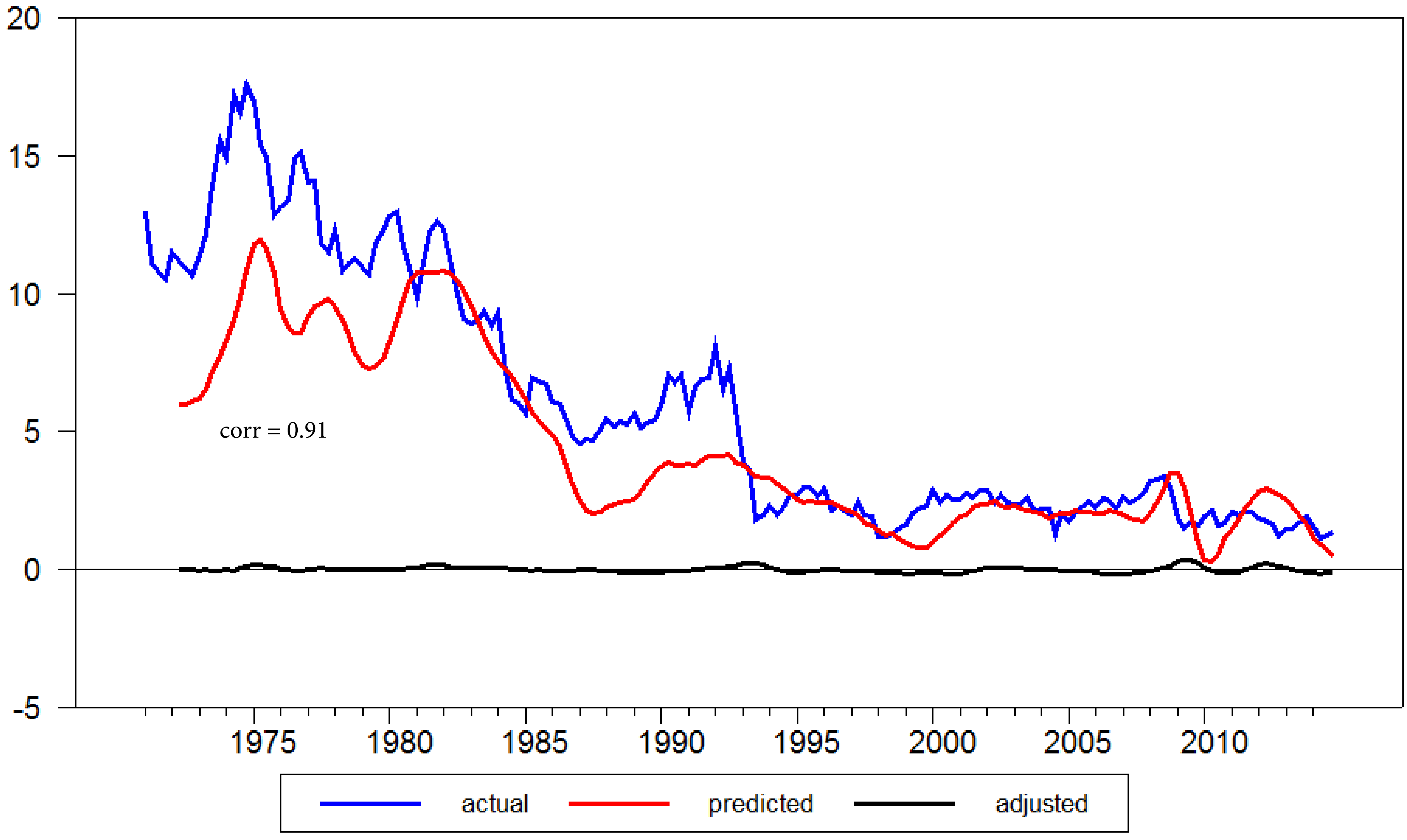
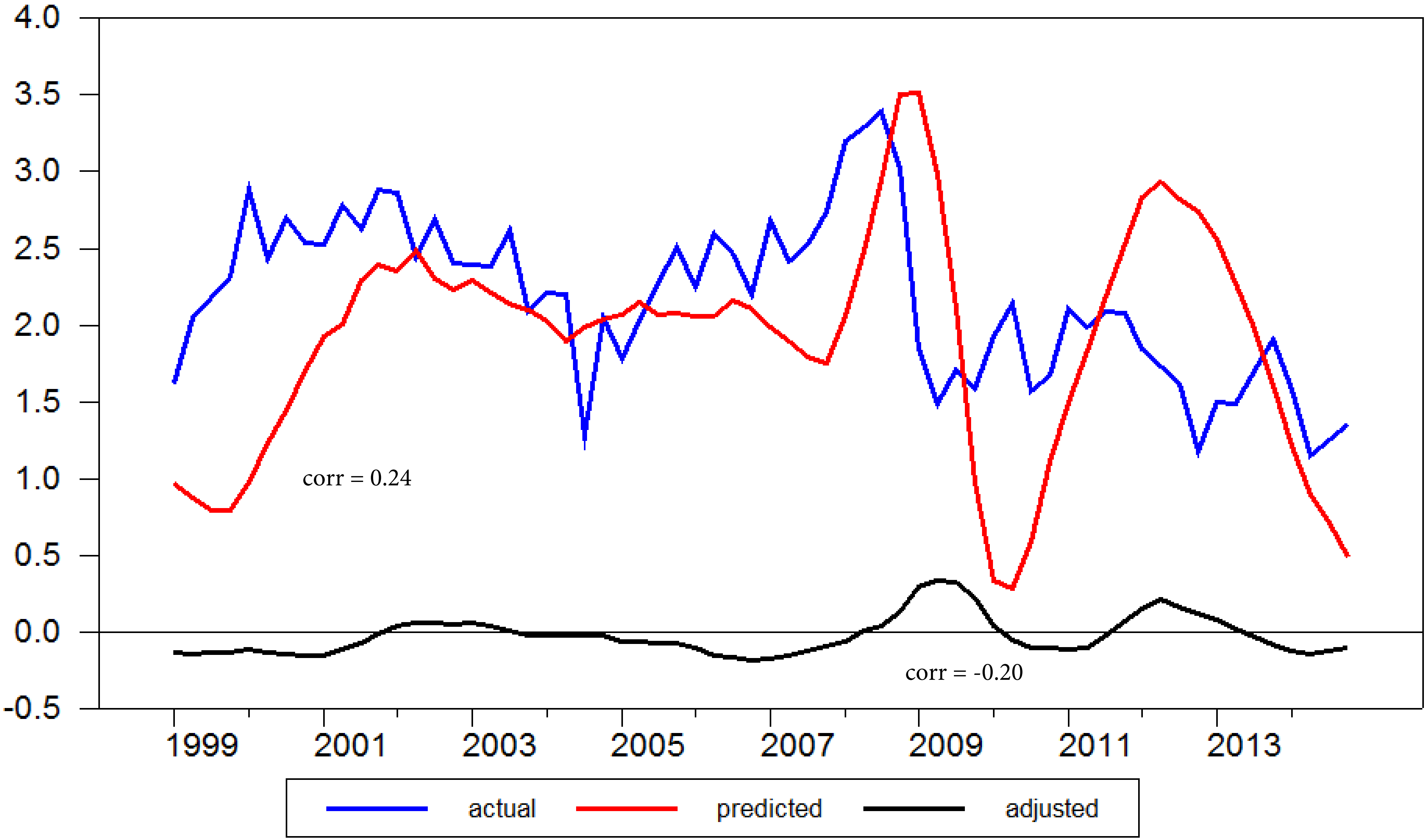


Figure 9b. Wage Inflation: Actual vs. Predicted under the Natural Rate Hypothesis (1999-2014)



The Long Run Tradeoff Hypothesis

- Assumption:

$$\pi_t^* \sim \textit{ random walk}$$

- Implications:

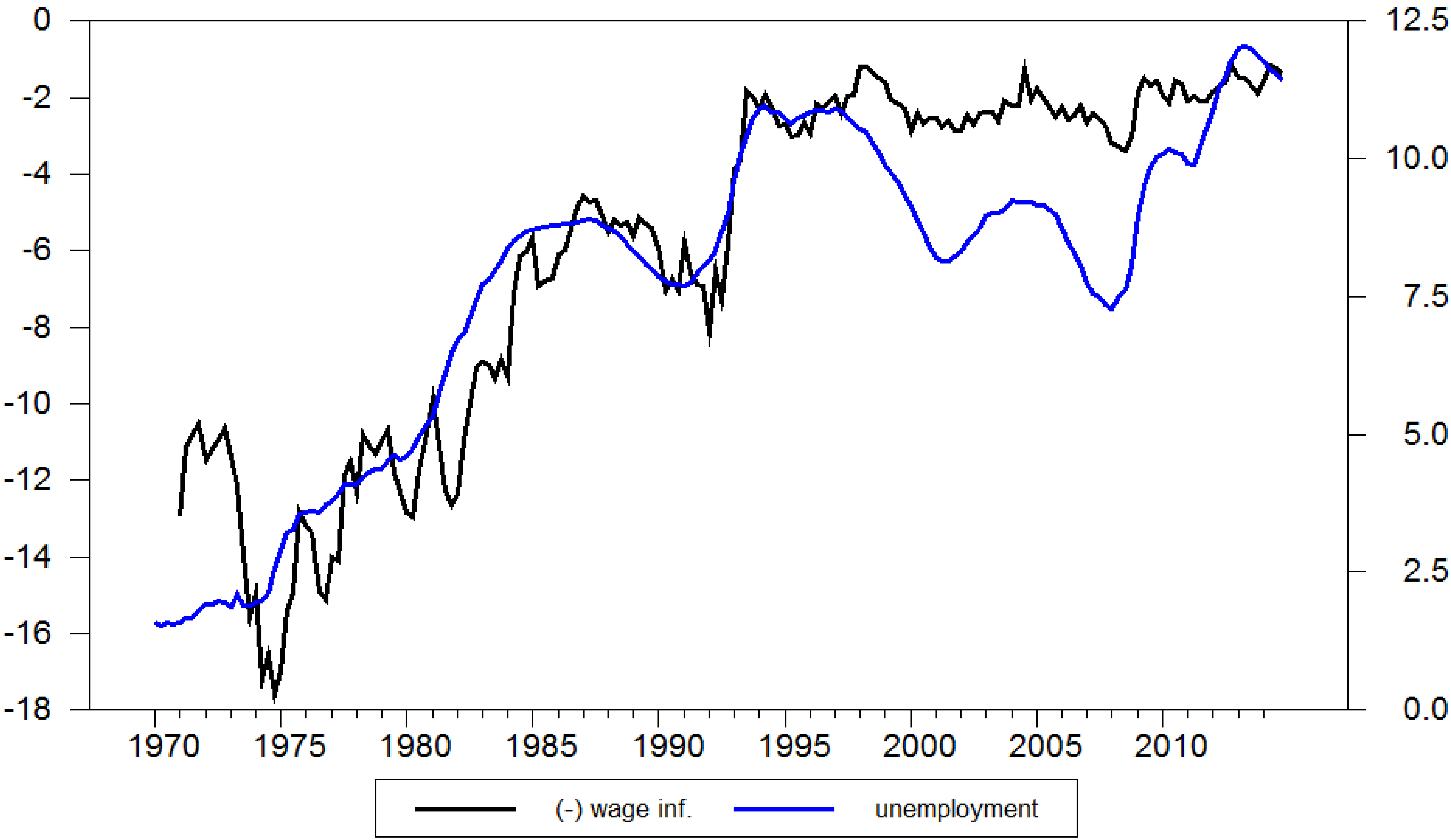
$$\pi_t^w \sim I(1)$$

$$u_t \sim I(1)$$

in the absence of (full) indexation, given

$$\pi_t^w = \beta E_t\{\pi_{t+1}^w\} - \lambda_w \varphi(u_t - u^n)$$

Figure 11. A Long Run Tradeoff between Wage Inflation and Unemployment?



The Long Run Tradeoff Hypothesis

- Empirical assessment:

  Cointegrating relation:

$$u_t = u^n - \frac{1-\beta}{\lambda_w \varphi} \pi_t^w$$

  Baseline calibration ($\varphi = 5$) $\Rightarrow -\frac{1-\beta}{\lambda_w \varphi} = -0.52$ (lower if indexation)

  Evidence: cointegrating coefficient of -2

- Alternative calibration: $\varphi = 0.08 \quad \Rightarrow \quad s.d.(u_t) = 22\ \%$

The Hysteresis Hypothesis

- *Insider-outsider model* of the labor market: Blanchard-Summers, Gottfries-Horn, Lindbeck-Snower,...
- Key feature: wages set with a view to ensuring the jobs of insiders
- Wage setting rule: set $w_t^*(j)$ such that

$$(1-\beta\theta_w)\sum_{k=0}^{\infty}(\beta\theta_w)^k E_t\left\{n_{t+k|t}(j)\right\} = n_t^*(j)$$

- Insiders' evolution:

$$n_t^*(j) = n_{t-1}(j)$$

The Hysteresis Hypothesis

- Implied wage inflation Phillips curve:

$$\pi_t^w = \beta E_t\{\pi_{t+1}^w\} + \lambda_n \Delta n_t$$

where $\lambda_n \equiv \frac{1-\theta_w}{\theta_w \epsilon_w}$

- Equilibrium:

$$u_t \sim I(1)$$

The Hysteresis Hypothesis

- Empirical assessment:

$$\pi_t^w = \pi_{t-1}^p + \lambda_n \sum_{k=0}^{\infty} \beta^k E_t\{\Delta n_{t+k}\}$$

$$\pi_t^{w,*} = \pi_{t-1}^p + \lambda_n \sum_{k=0}^{\infty} \beta^k E\{\Delta n_{t+k} | \mathbf{x}_t, \mathbf{x}_{t-1,...}\}$$

where $\mathbf{x}_t \equiv [\Delta n_t, \pi_t^w - \pi_{t-1}^p, \Delta n_{t-1}, \pi_{t-1}^w - \pi_{t-2}^p, ...]$

Figure 13a. Wage Inflation in the Insider-Outsider NK Model (1970-2014)

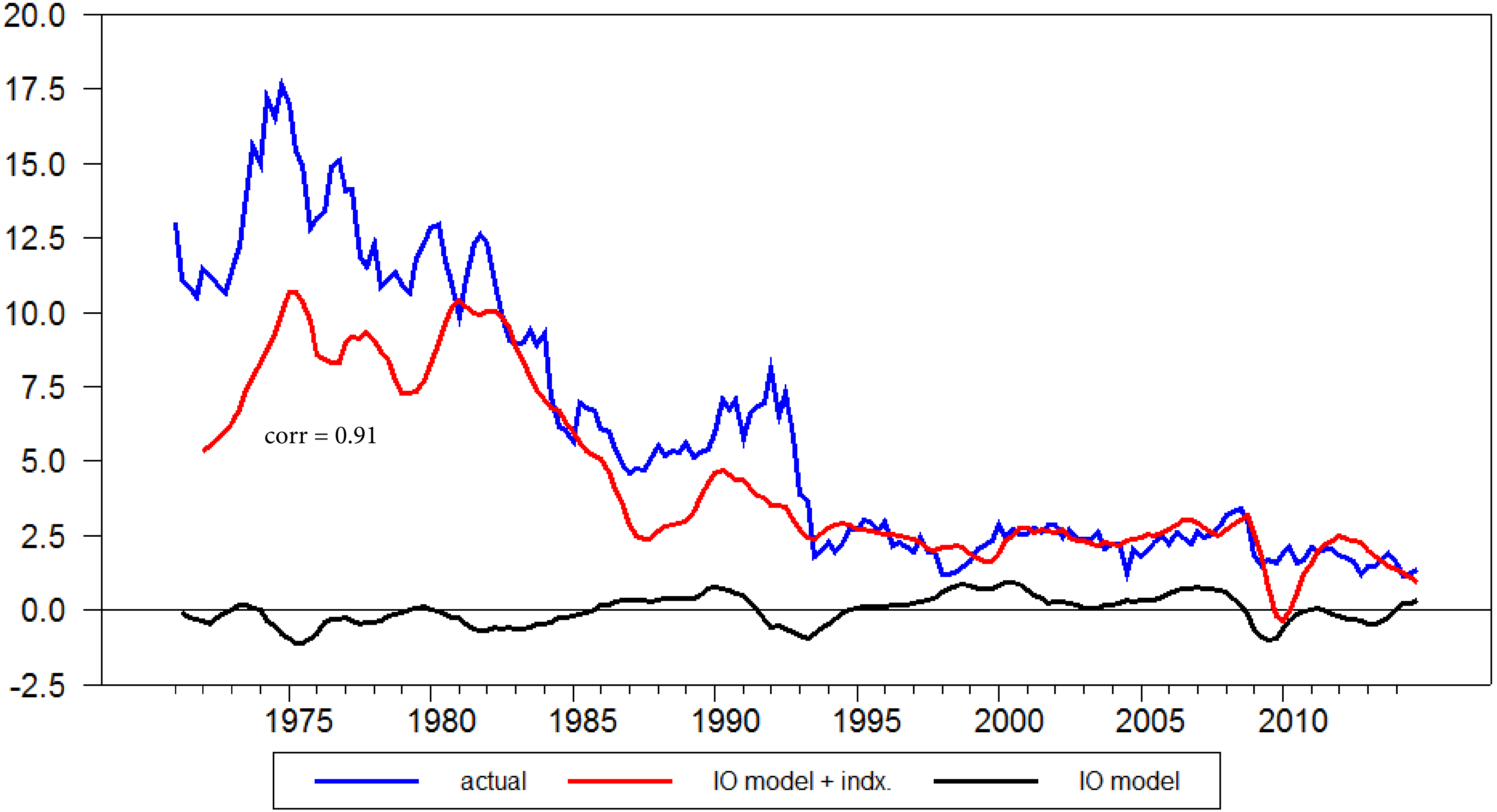
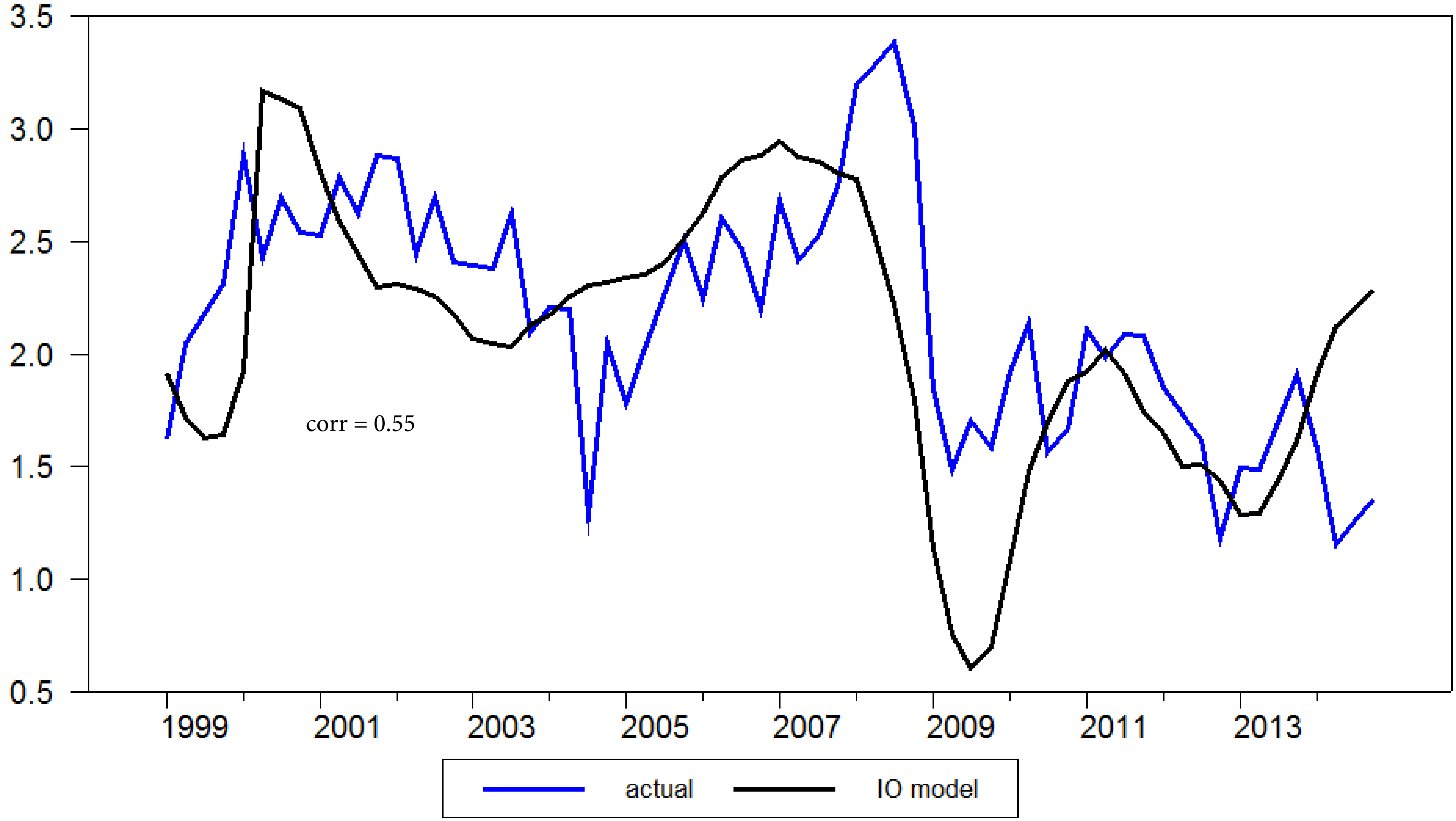


Figure 13b. Wage Inflation in the Insider-Outsider NK Model (1999-2014)



The Hysteresis Hypothesis

- Empirical assessment:

$$\pi_t^w = \pi_{t-1}^p + \lambda_n \sum_{k=0}^{\infty} \beta^k E_t\{\Delta n_{t+k}\}$$

$$\pi_t^{w,*} = \pi_{t-1}^p + \lambda_n \sum_{k=0}^{\infty} \beta^k E\{\Delta n_{t+k} | \mathbf{x}_t, \mathbf{x}_{t-1,...}\}$$

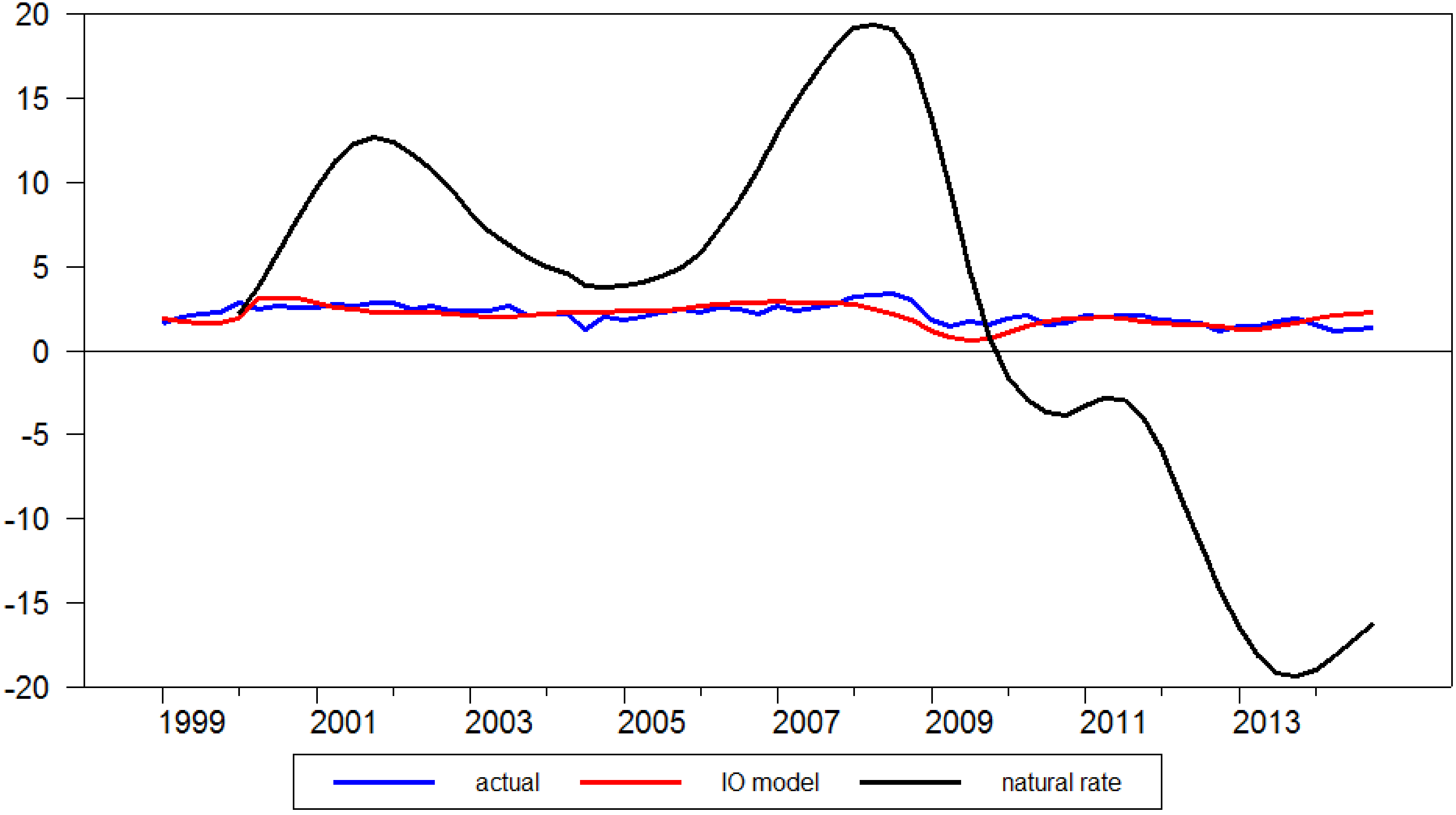
where $\mathbf{x}_t \equiv [\Delta n_t, \pi_t^w - \pi_{t-1}^p, \Delta n_{t-1}, \pi_{t-1}^w - \pi_{t-2}^p, ...]$

- Comparison with benchmark model with constant natural rate:

$$\pi_t^{w,*} = \pi_{t-1}^p - \lambda_w \varphi \sum_{k=0}^{\infty} \beta^k E\{\widehat{u}_{t+k} | \mathbf{x}_t, \mathbf{x}_{t-1,...}\}$$

where $\mathbf{x}_t \equiv [\widehat{u}_t, \pi_t^w - \pi_{t-1}^p, \widehat{u}_{t-1}, \pi_{t-1}^w - \pi_{t-2}^p, ...]$

Figure 13c. Wage Inflation:
Insider-Outsider vs. Constant Natural Rate Models



Monetary Policy Design with Insider-Outsider Labor Markets and Hysteresis

- Optimal monetary policy

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

subject to

$$\pi_t^p = \beta E_t\{\pi_{t+1}^p\} + \lambda_p \alpha \widehat{n}_t + \lambda_p \widetilde{\omega}_t$$

$$\pi_t^w = \beta E_t\{\pi_{t+1}^w\} + \lambda_n \Delta \widehat{n}_t$$

$$\widetilde{\omega}_{t-1} \equiv \widetilde{\omega}_t - \pi_t^w + \pi_t^p + \Delta a_t - \Delta x_t$$

for $t = 0, 1, 2, ..$where $\widetilde{\omega}_t \equiv \omega_t - (a_t - \alpha n + \log(1-\alpha) - x_t)$

Monetary Policy Design with Insider-Outsider Labor Markets and Hysteresis

- Optimal policy vs. baseline simple rule

$$i_t = 0.9 i_{t-1} + 0.1 \left(1.5 \pi_t^p + 0.5 \Delta y_t\right)$$

Figure 4.a   Optimal Policy vs. Simple Rule: Technology Shocks

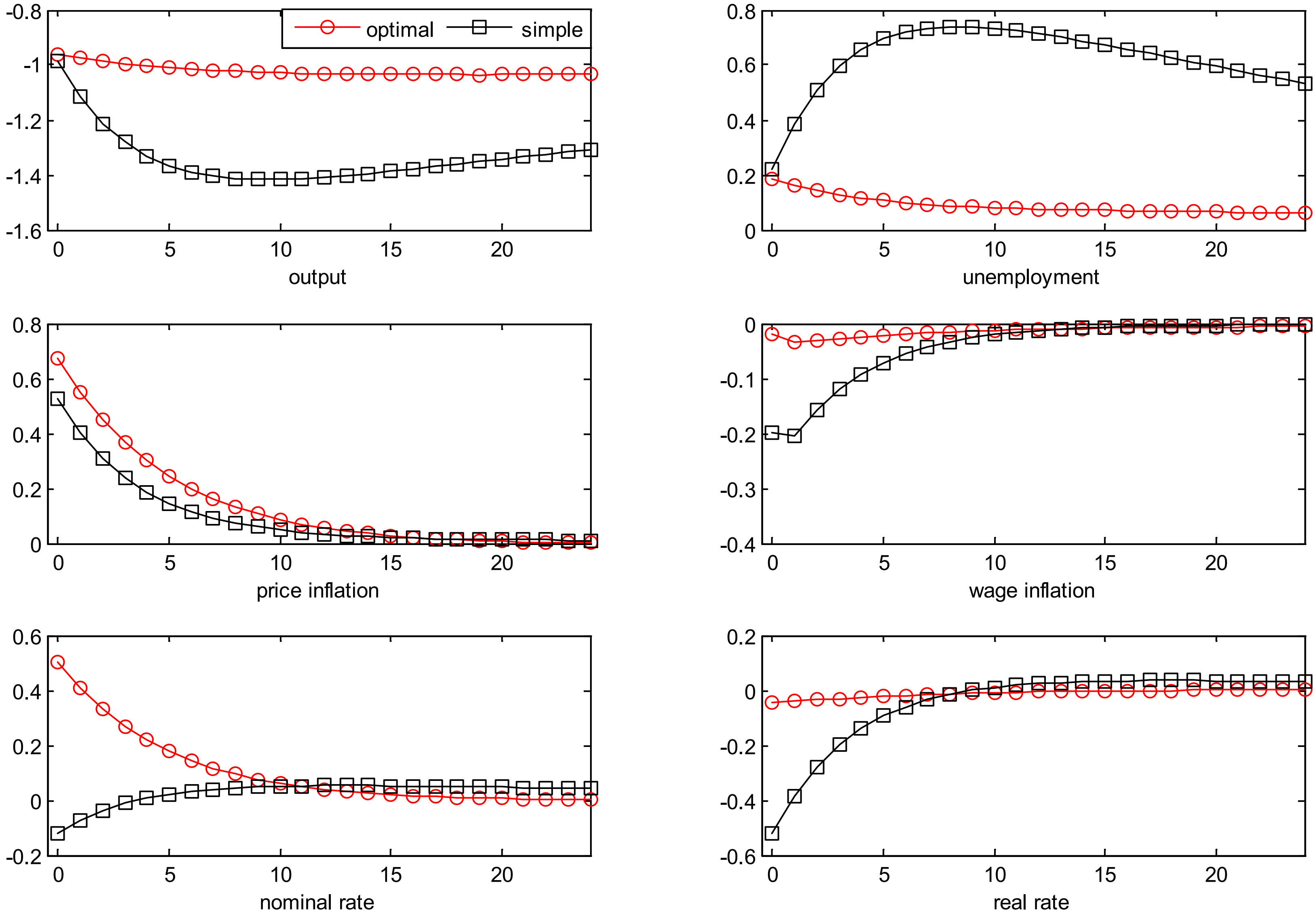


Figure 4.b Optimal Policy vs. Simple Rule: Markup Shocks

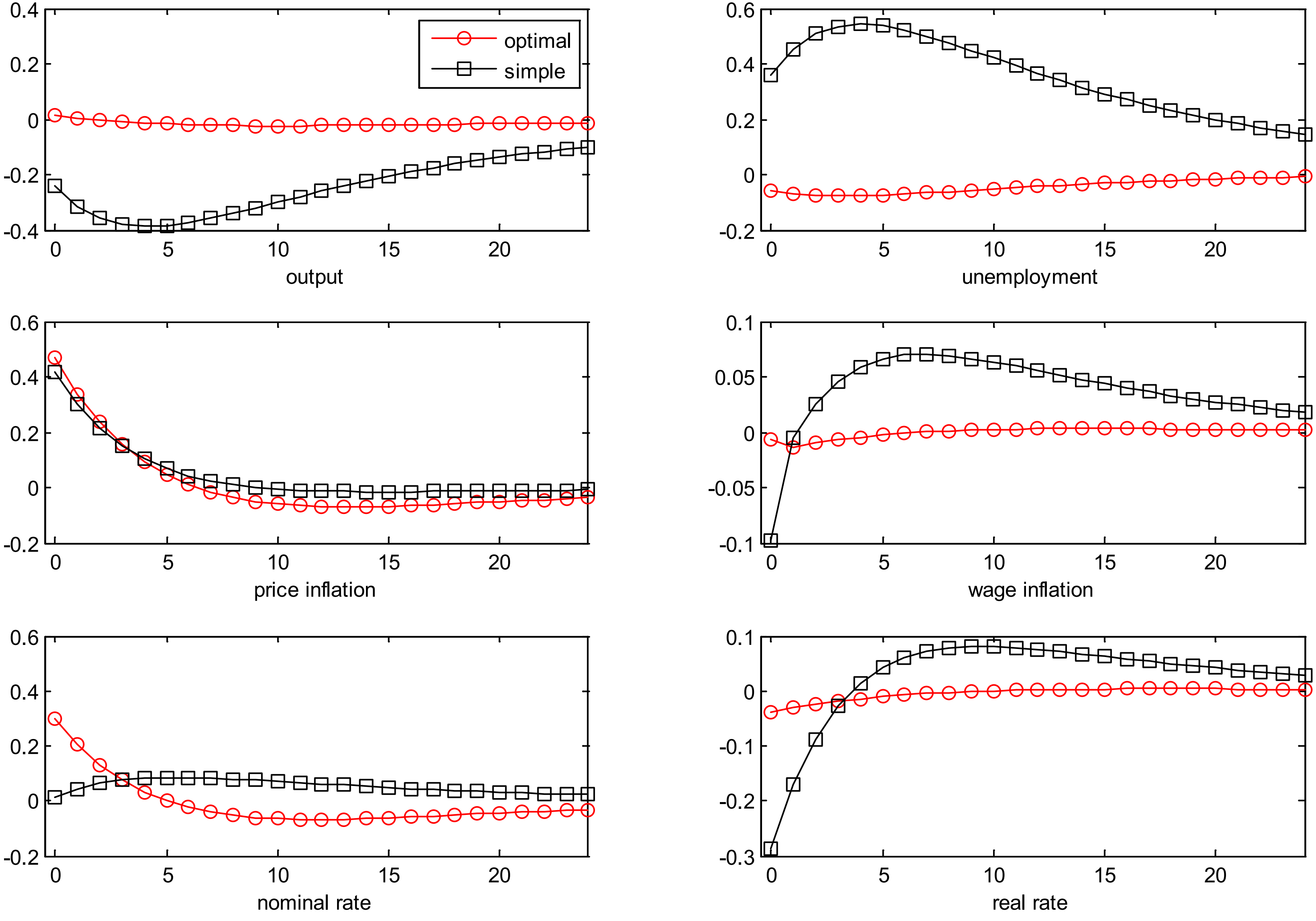
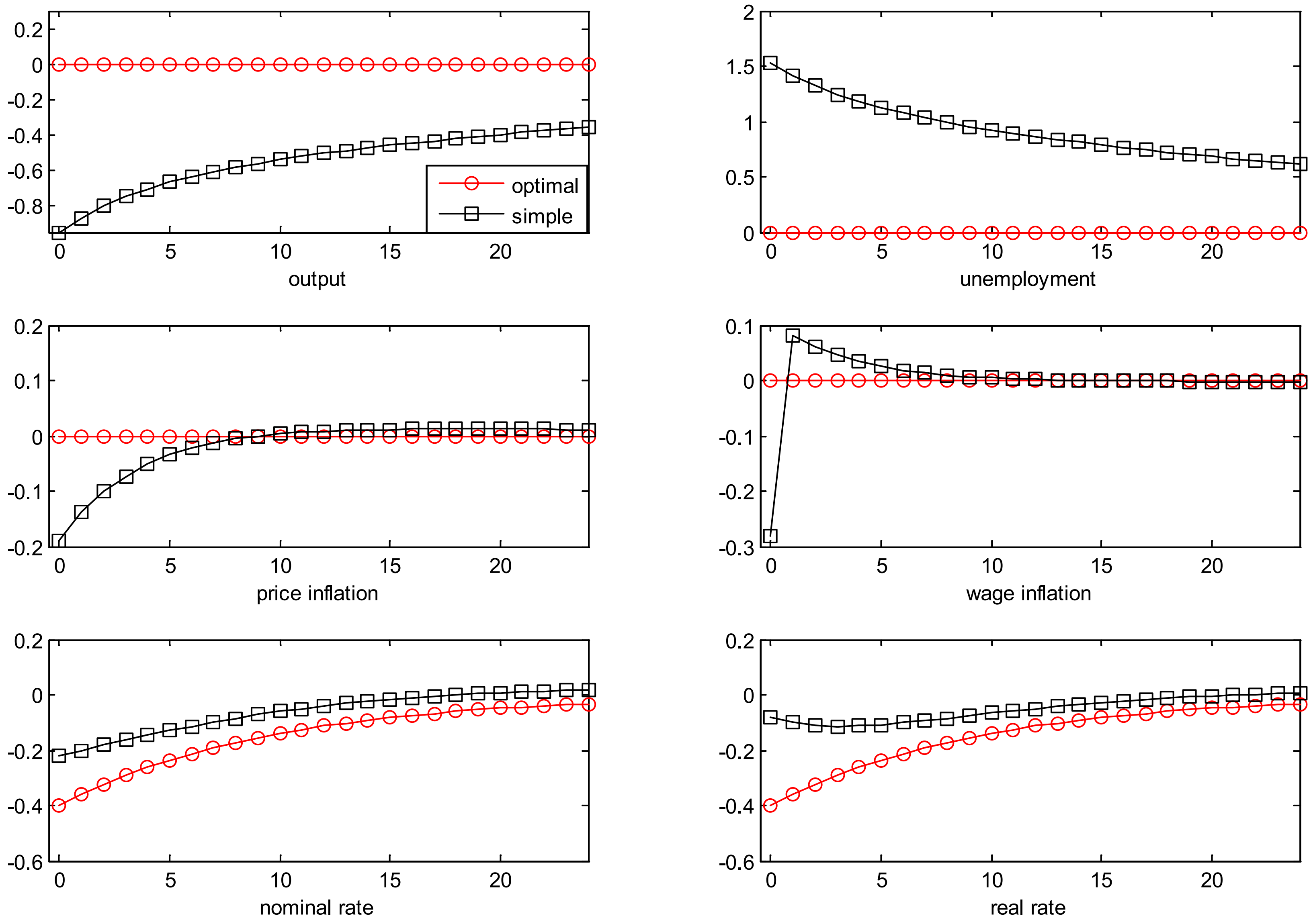


Figure 4.c   Optimal Policy vs. Simple Rule: Demand Shocks



Monetary Policy Design with Insider-Outsider Labor Markets and Hysteresis

- Optimal policy vs. baseline simple rule

$$i_t = 0.9 i_{t-1} + 0.1 \left(1.5 \pi_t^p + 0.5 \Delta y_t\right)$$

- Optimal policy vs. augmented simple rule

$$i_t = 0.9 i_{t-1} + 0.1 \left(1.5 \pi_t^p + 0.5 \Delta y_t - 0.5 u_t\right)$$

Figure 5.a Optimal vs. Augmented Rule: Technology Shocks

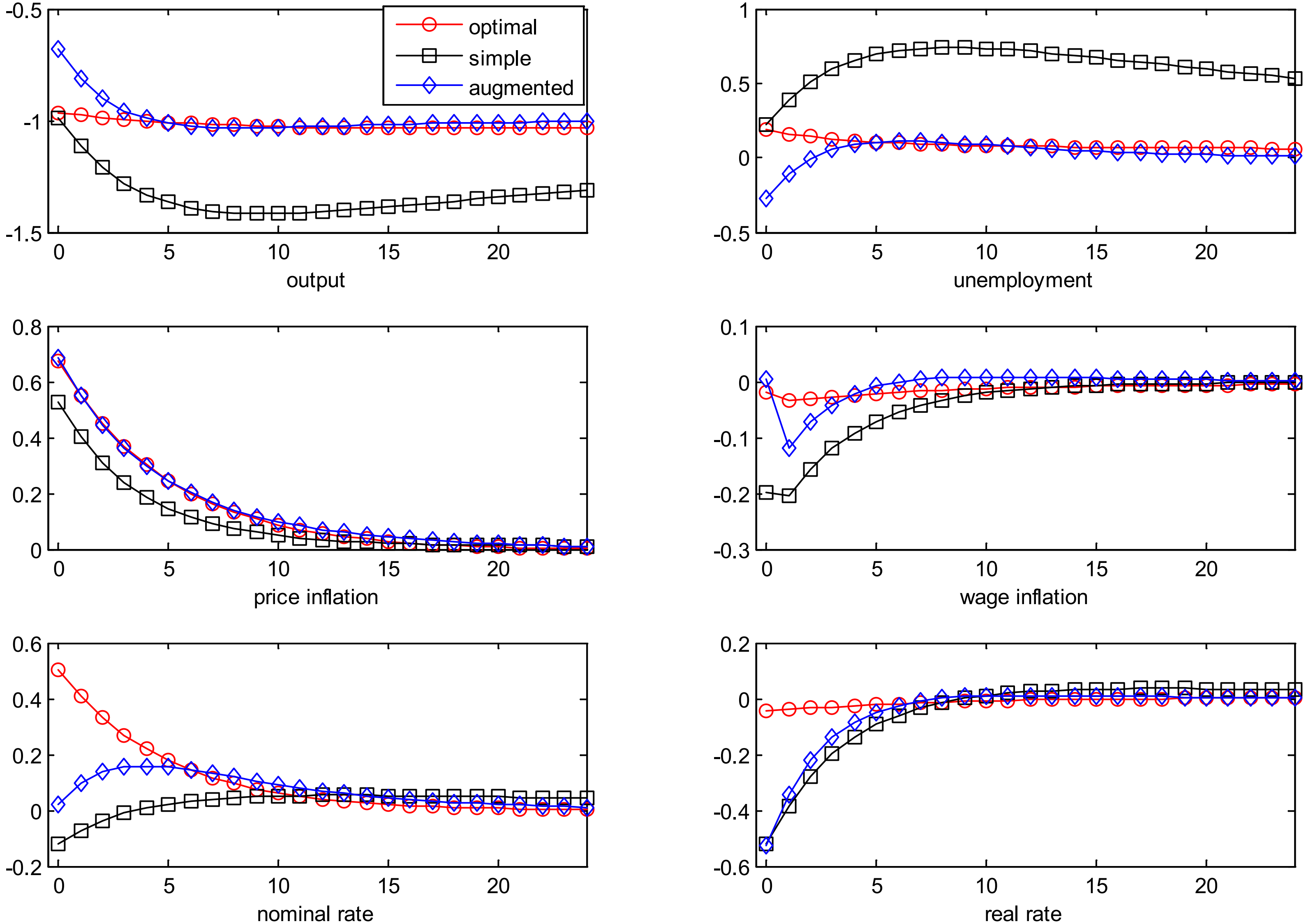


Figure 5.b Optimal vs. Augmented Rule: Markup Shocks

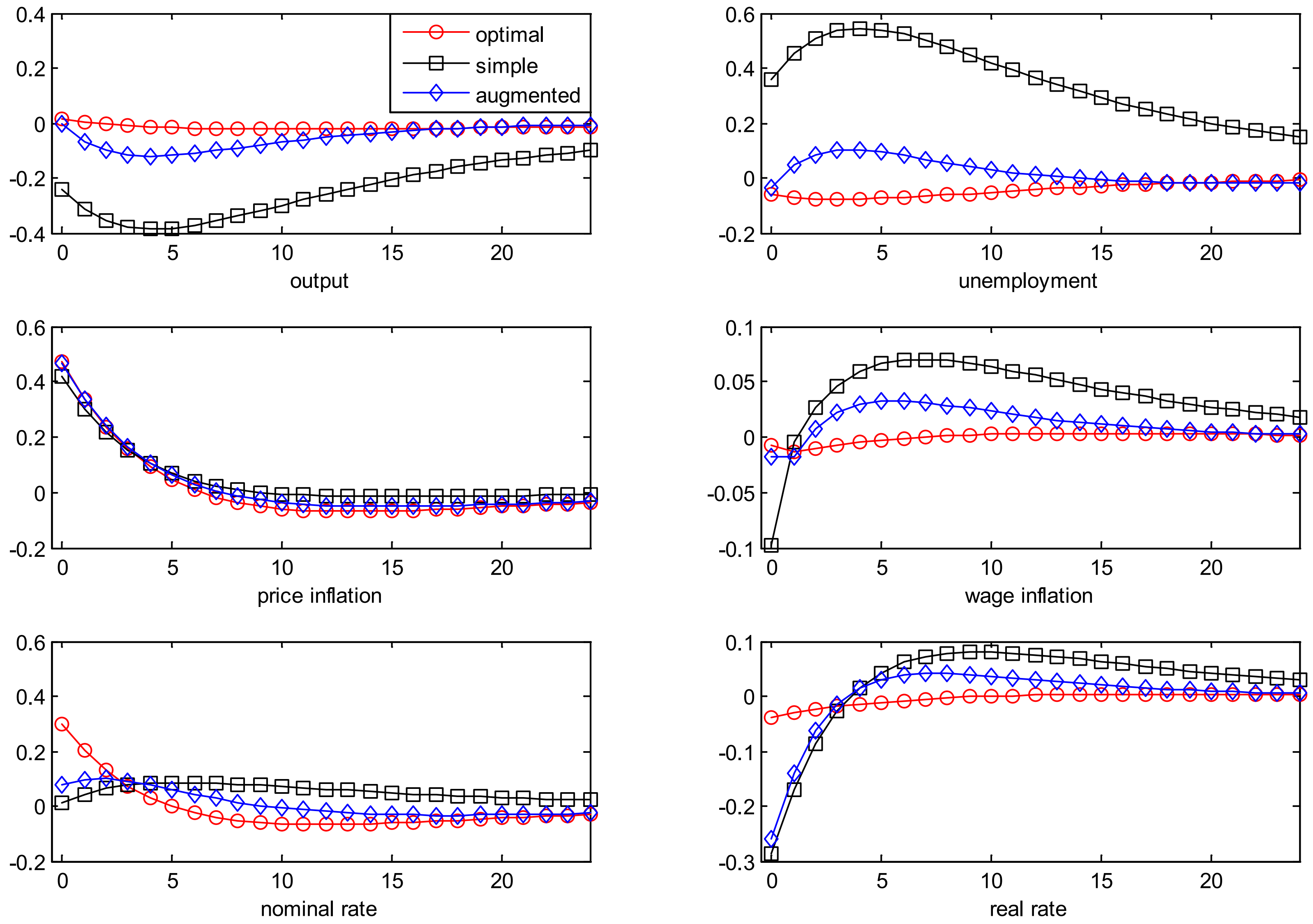
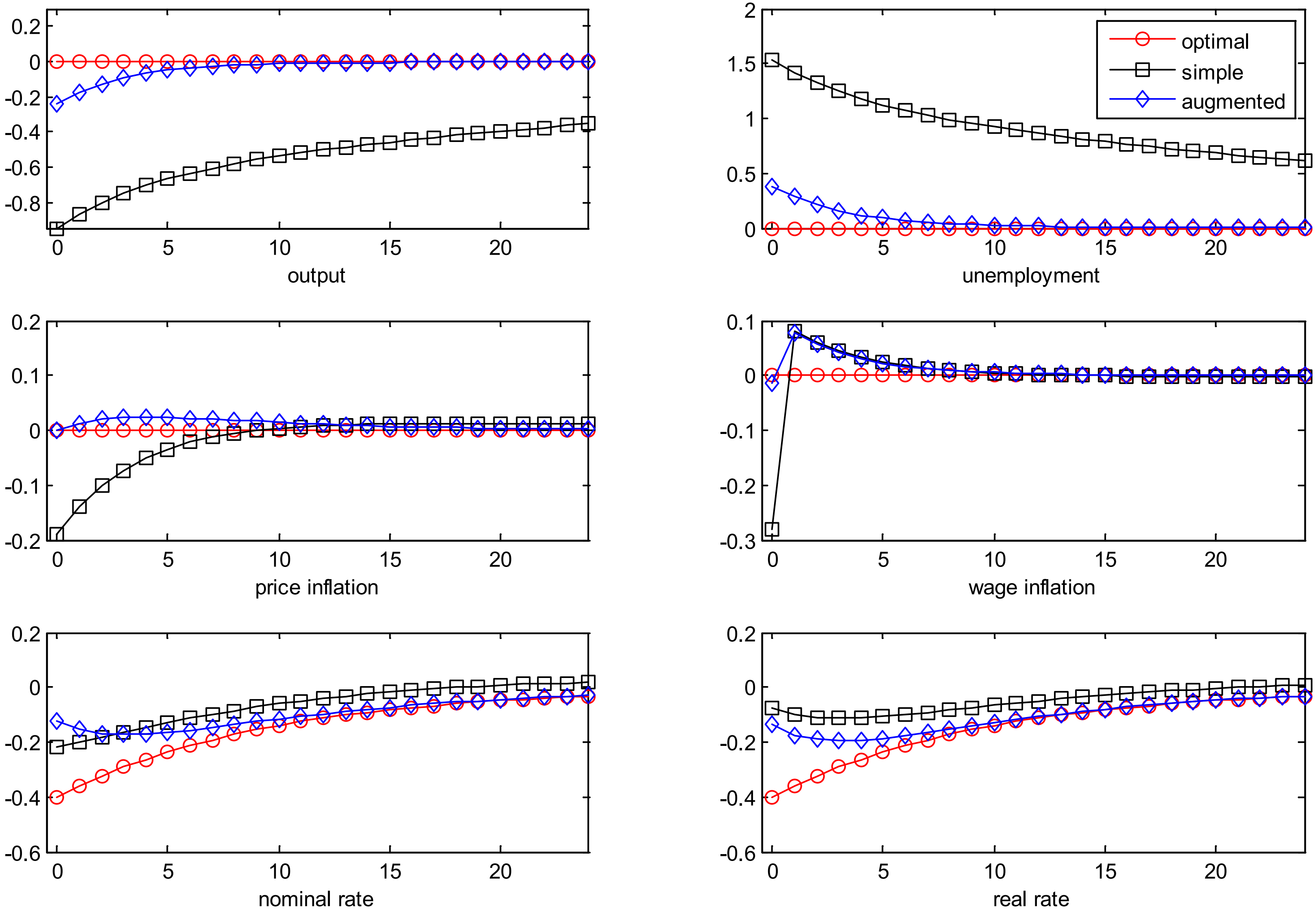


Figure 5.c Optimal vs. Augmented Rule: Demand Shocks



Monetary Policy Design with Insider-Outsider Labor Markets and Hysteresis

- Optimal policy vs. baseline simple rule

$$i_t = 0.9 i_{t-1} + 0.1 \left(1.5 \pi_t^p + 0.5 \Delta y_t \right)$$

- Optimal policy vs. augmented simple rule

$$i_t = 0.9 i_{t-1} + 0.1 \left(1.5 \pi_t^p + 0.5 \Delta y_t - 0.5 u_t \right)$$

- Welfare

Table 5
Monetary Policy and Welfare in the NK-IO Model

	Hysteresis Parameter					
	$\gamma = 0$		$\gamma = 0.9$		$\gamma = 1$	
Technology						
Simple	0.085	1.0	0.158	1.0	1.003	1.0
Optimal	0.041	0.48	0.044	0.27	0.045	0.04
Augmented	0.049	0.58	0.050	0.31	0.051	0.05
Markup						
Simple	0.036	1.0	0.071	1.0	0.267	1.0
Optimal	0.014	0.38	0.015	0.21	0.015	0.05
Augmented	0.027	0.74	0.019	0.26	0.021	0.07
Demand						
Simple	0.128	1.0	0.281	1.0	1.765	1.0
Optimal	0.0	0.0	0.0	0.0	0.0	0.0
Augmented	0.007	0.05	0.006	0.02	0.007	< 0.01

Summary and Concluding Remarks

- Sources of the unit root in European unemployment

  - unit root in the natural rate? unlikely
  - changes in inflation target? unlikely (by itself)
  - hysteresis: more plausible

- Implications of insider-outsider model for monetary policy

  $\Rightarrow$ rationale for a dual mandate, with strong weight on unemployment stabilization

- Further research: embed insider-outsider setup in a empirical medium scale DSGE model

Figure 2.b Euro Area Unemployment: Autocorrelation

1985Q1-2014Q4 (120 obs.)

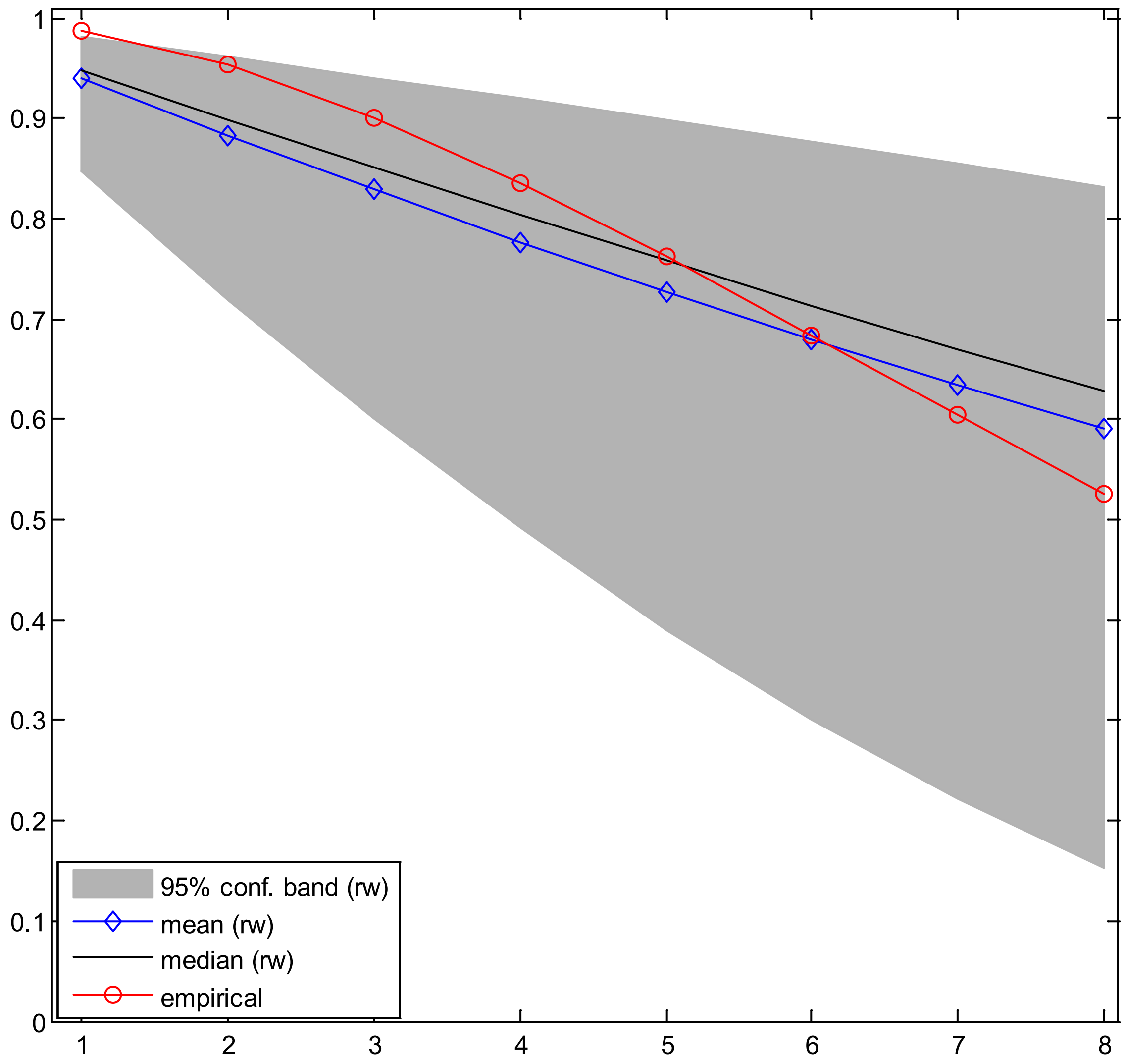


Figure 2.c Euro Area Unemployment: Autocorrelation
1999Q1-2014Q4 (64 obs.)

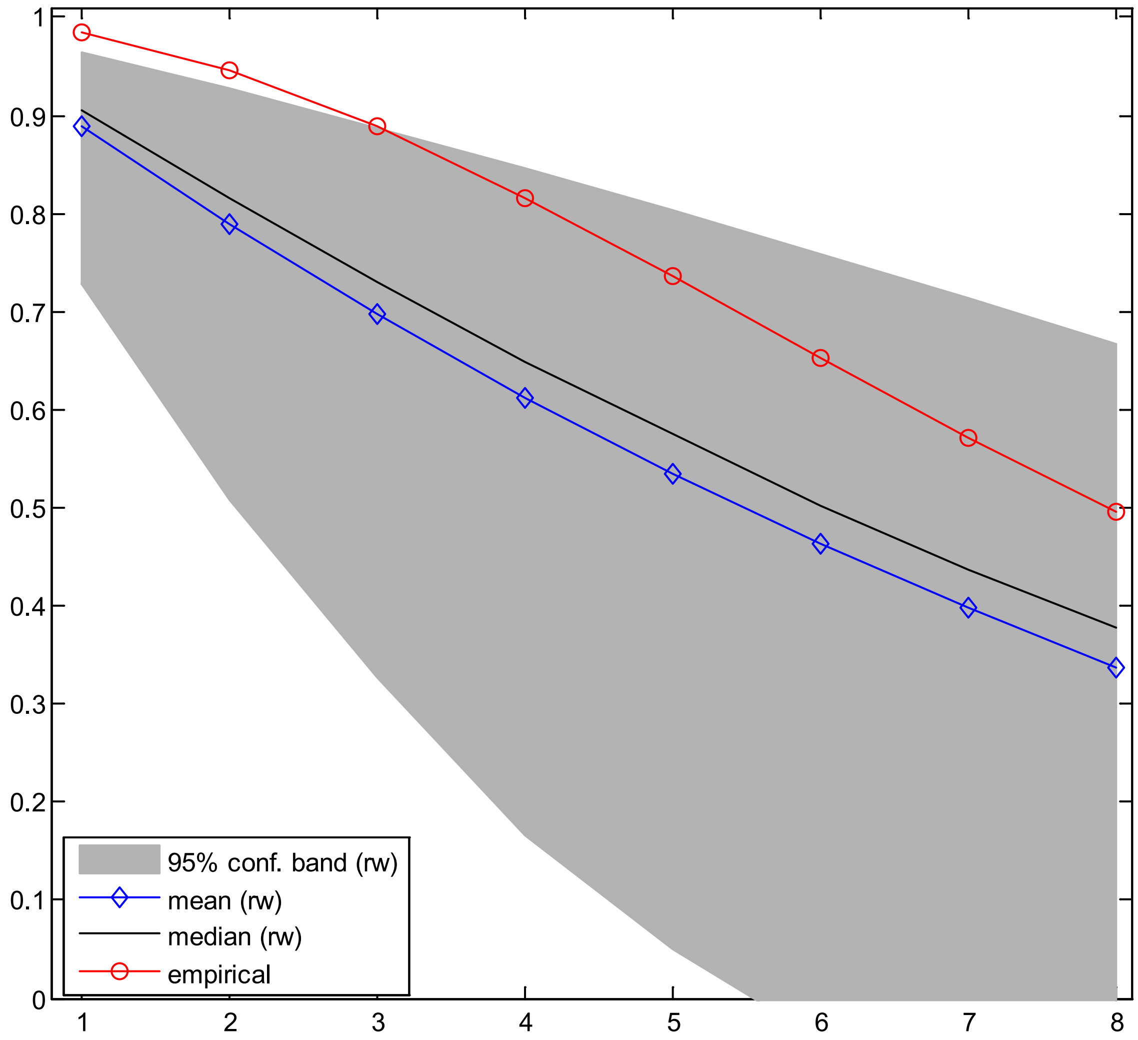


Figure 3. Dynamic Response of the Unemployment Rate

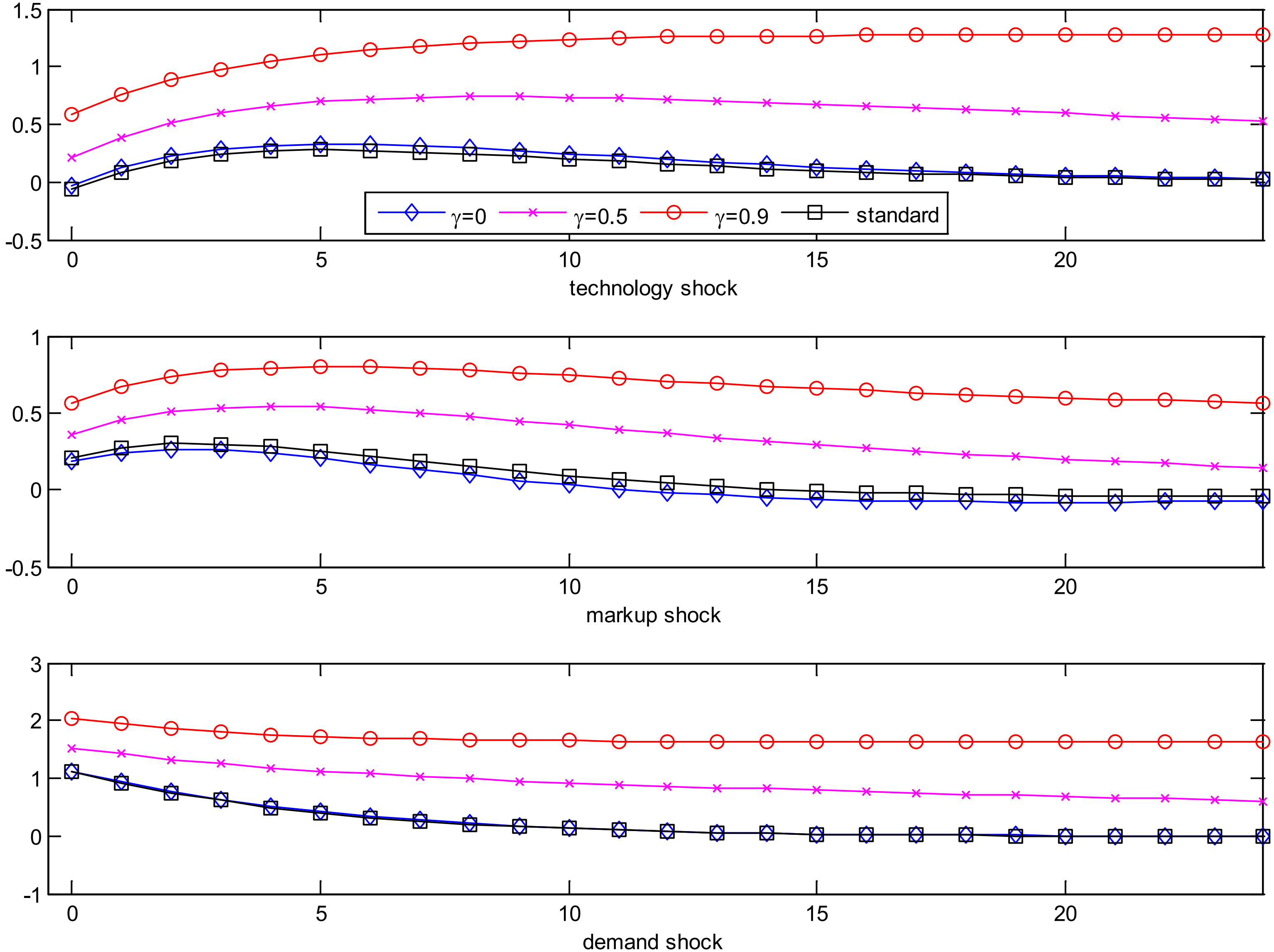


Table 1. ADF Unit Root Tests

	1 lag	*4 lags*
1970Q1-2014Q4	-2.03 (-2.87)	-1.91 (-2.87)
1985Q1-2014Q4	-2.97^{*} (-2.88)	-1.82 (-2.88)
1999Q1-2014Q4	-2.11 (-2.90)	-0.87 (-2.91)

Note: t-statistics of Augmented Dickey-Fuller tests (with intercept) for the null of a unit root in the unemployment rate. Sample period 1970Q1-2014Q4. Asterisks denote significance at the 5 percent level. Critical value (adjusted for sample size) for the null of a unit root shown in brackets.

Table 2. Calibration

φ	Curvature of labor disutility	3.4
β	Discount factor	0.99
α	Decreasing returns to labor	0.26
ϵ_w	Elasticity of substitution (labor)	4.3
ϵ_p	Elasticity of substitution (goods)	3.8
θ_p	Calvo index of price rigidities	0.75
θ_w	Calvo index of wage rigidities	0.75
ϕ_i	Lagged interest rate coefficient	0.9
ϕ_π	Inflation coefficient	1.5
ϕ_y	Output growth coefficient	0.5

Table 3
Unemployment Persistence in the Standard New Keynesian Model

	$\rho_u(1)$	$\rho_u(4)$	$\rho_u(8)$	$\rho_{u,\pi}$
Data	0.99	0.97	0.91	−0.76
Standard NK Model				
Technology	0.96 (0.93,0.98)	0.72 (0.53,0.84)	0.36 (0.03,0.64)	0.26 (0.07,0.41)
Markup	0.95 (0.91,0.97)	0.69 (0.49,0.81)	0.33 (−0.01,0.59)	0.60 (0.59,0.64)
Demand	0.81 (0.72,0.87)	0.41 (0.18,0.60)	0.14 (−0.16,0.42)	−0.81 (−0.89,−0.71)

Note: Based on 200 simulations of 180 observations each. Persistence of driving forces: a= 1, x= 0.99, and z= 0.99. For each statistic, the table reports the median and 95% confidence interval (in brackets).

Table 4
Unemployment Persistence in the NK-IO Model

	$\rho_u(1)$	$\rho_u(4)$	$\rho_u(8)$	$\rho_{u,\pi}$
Data	0.99	0.97	0.91	-0.76
Technology				
Std. NK	0.96 (0.93,0.98)	0.72 (0.53,0.84)	0.36 (0.03,0.64)	0.26 (0.07,0.41)
$\gamma = 0.0$	0.97 (0.94,0.98)	0.76 (0.56,0.89)	0.42 (0.07,0.72)	0.29 (0.14,0.49)
$\gamma = 0.9$	0.99 (0.96,0.99)	0.90 (0.76,0.97)	0.73 (0.39,0.90)	0.34 (0.25,0.50)
$\gamma = 1.0$	0.99 (0.96,0.99)	0.92 (0.80,0.98)	0.83 (0.54,0.95)	0.12 (-0.15,0.36)
Markup				
Std. NK	0.94 (0.91,0.97)	0.60 (0.43,0.74)	0.17 (-0.14,0.42)	0.55 (0.53,0.58)
$\gamma = 0.0$	0.94 (0.90,0.96)	0.58 (0.37,0.72)	0.11 (-0.21,0.37)	0.57 (0.55,0.61)
$\gamma = 0.9$	0.97 (0.94,0.99)	0.80 (0.64,0.90)	0.52 (0.18,0.78)	0.48 (0.45,0.55)
$\gamma = 1.0$	0.98 (0.93,0.99)	0.86 (0.63,0.96)	0.70 (0.28,0.90)	0.28 (0.07,0.44)
Demand				
Std.NK	0.79 (0.69,0.86)	0.38 (0.17,0.55)	0.09 (-0.20,0.34)	-0.99 (-0.99,-0.99)
$\gamma = 0.0$	0.80 (0.68,0.86)	0.37 (0.14,0.57)	0.07 (-0.16,0.39)	-0.99 (-0.99,-0.99)
$\gamma = 0.9$	0.92 (0.84,0.97)	0.75 (0.48,0.91)	0.58 (0.15,0.85)	-0.53 (-0.71,-0.36)
$\gamma = 1.0$	0.96 (0.88,0.99)	0.86 (0.58,0.96)	0.74 (0.24,0.92)	-0.36 (-0.63,-0.03)

Note: Based on 200 simulations of 180 observations each. Persistence of driving forces: a= 1, x= 0.9, and z= 0.9.