A Currency Union Model With Heterogeneous Labor Market Institutions

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November 2007

Research question

1. How do inflation and unemployment differentials in a currency union depend on labor market structures?

2. What are the implications of different labor market structures in currency union for optimal monetary policy?

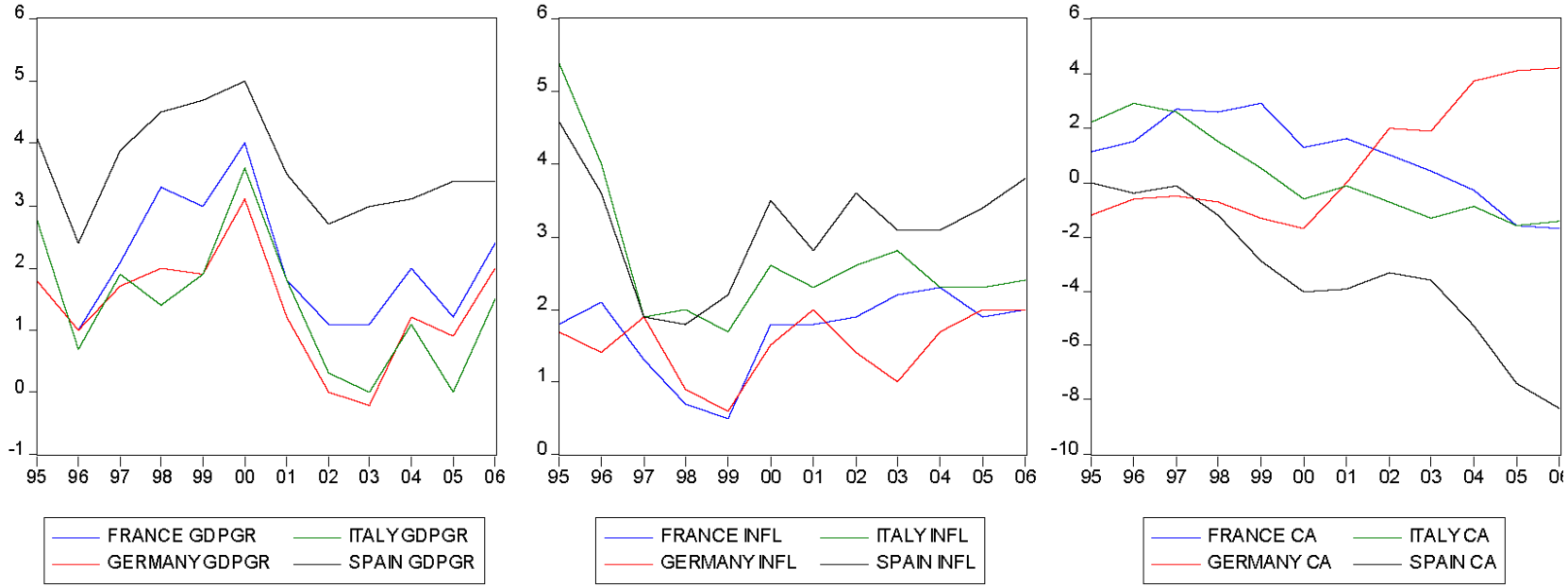
Outline

1. Introduction and Motivation

2. The Model: Building Blocks

3. Positive analysis: how do labor market structures affect differentials?

4. Normative analysis: optimal monetary policy



After seven years of Euro: Output and inflation differentials are sizeable and persistent.

Three main elements seem to characterize European labor markets:

1. Unemployment is high and tends to be prolonged over time.

2. Firing costs are high (job separation is low).

3. Real wages seem to be rather inflexible.

–> But there is substantial heterogeneity across countries

Country	Unemployment rate	EPL index	Unemployment benefits	Wage Coordination index	Union Density	Real Wage Rigidities
Austria	7.10	1.26	32.21	4.00	36.50	0.11
Belgium	12.76	1.22	38.74	4.00	55.60	0.25
Finland	8.83	1.09	34.15	3.00	76.20	0.29
France	12.30	1.44	40.24	2.00	9.70	0.23
Germany	11.71	1.44	28.16	4.00	25.00	0.63
Ireland	4.45	0.52	32.46	5.00	37.80	0.27
Italy	8.05	1.78	34.30	4.00	34.90	0.06
Netherlands	6.48	1.23	52.52	4.00	23.20	0.25
Portugal	6.65	1.87	42.87	n.a.	23.50	n.a.
Spain	10.26	1.63	37.12	n.a.	13.90	0.52
Average	*8.86*	*1.35*	*37.28*	*3.75*	*33.63*	*0.29*
UK	2.79	0.35	16.59	1.00	31.20	0.77
USA	5.53	0.10	13.53	1.00	12.80	0.25
Japan	4.72	1.40	10.65	5.00	21.50	0.06
Average	*4.35*	*0.62*	*13.59*	*2.33*	*21.83*	*0.36*

Labor market heterogeneity in Europe (Source: Nickel (2001), OECD)

Labor markets and differentials in a currency union

- Asymmetric shocks generate inflation and unemployment differentials: labor market rigidities can amplify the size and persistence of the response to shocks

- Symmetric shocks can have large and long-lasting asymmetric effects if the two regions have different labor market structures

Labor Market Frictions vs. Real Wage Rigidities

- Labor Market Frictions (LMF): Employment protection legislation, hiring costs, matching technology

  $\longrightarrow$ Quantities are rigid (unemployment), prices (wages) have to adjust

- Real Wage Rigidities (RWR): Wage bargaining, wage staggering, legislation

  $\longrightarrow$ Prices (wages) are rigid, quantities (unemployment) have to adjust

The currency union literature: the importance of nominal rigidities

- Benigno (2004), Benigno and Lopez Salido (2002), Monacelli and Galì (2006)

  $\longrightarrow$ An Inflation Targeting strategy that gives higher weight to inflation in the "sticky price" region is nearly optimal

- Campolmi and Faia (2007):

  $\longrightarrow$ CU model with sticky prices, labor market frictions and real wage rigidities. Very rich, very complicate.

The Model: Building Blocks

- Two countries, Home and Foreign, of equal size (normalised to 1). Each country is specialized in a bundle of differentiated goods: Y_H and Y_F.

- The two countries have a currency union: one Central Bank, no exchange rate.

- Financial markets are complete. There is no migration.

- 3 shocks: two country specific technology shocks (correlated), one monetary policy shock.

The Supply Side

Three main changes with respect to a standard two country New Keynesian model (Blanchard and Galì, 2006):

1. Labor market frictions (hiring costs and separation rate in the labor market)

2. Wages are set in a Nash bargain that divides the rent from existing employment relationships

3. Introduction of real wage rigidities

Production and Employment Evolution

- In each country there is a continuum of firms, indexed by $j \in [0, 1]$, each producing a differentiated good with an identical technology: $Y_t^i(j) = A_t^i N_t(j)$

- In each period a fraction δ_i of the employed loses their jobs and joins the unemployment pool. Employment in firm j evolves according to:

$$N_t^i(j) = (1 - \delta_i) N_{t-1}^i(j) + H_t^i(j), \ for \ i = H, F(^*)$$

where $H_t^i(j)$ is the the number of new hires for firm j in country i.

The Labor Market

- Aggregate hirings and (before hiring) unemployment in country i evolve according to:

$$\begin{aligned} H_t^i &= N_t^i - (1-\delta_i) N_{t-1}^i \\ U_t^i &= 1 - (1-\delta_i) N_{t-1}^i \end{aligned}$$

- Hiring costs for an individual firm in country i are given by $G_t^i H_t^i(j)$, where the cost per hire G_t are an increasing function of the *labor market tightness* index $x_t^i = \frac{H_t^i}{U_t^i}$:

$$G_t = A_t B \left(x_t\right)^{\varphi}, \; G_t^* = A_t^* B^* \left(x_t^*\right)^{\varphi}$$

Wage Determination

- The presence of hiring costs creates a positive rent for existing employment relationships. Nash wage bargaining.

- The real wage is a weighted average of the Nash bargained wage W_t^{Nash} and a wage norm $\bar{W}$, which it is simply assumed to be the wage prevailing in steady state

$$W_t^R = \left(W_t^{Nash}\right)^{1-\gamma} \left(\bar{W}\right)^{\gamma}$$

- When real wage rigidities are present, wages do not move enough to absorb the impact of technology shocks.

The Evolution of Marginal Costs

The introduction of hiring costs an real wage rigidities changes the nature of marginal costs:

$$MC_t = \frac{W_t^R}{A_t}(S_t)^{\alpha} + B(x_t)^{\varphi} - \beta(1-\delta_H)E_t\left\{\frac{C_{Ht}^W}{C_{Ht+1}^W}\frac{A_{t+1}}{A_t}B(x_{t+1})^{\varphi}\right\}$$

1. Marginal costs depend on the evolution of real wages and of marginal hiring costs (present and future)

2. Hiring costs introduce an intertemporal link that will lead to persistence in employment fluctuations

Introducing Sticky Prices: The NK Phillips Curve

- Nominal price rigidities à la Calvo (1983). The NKPC has apparently the same form as in the NK model standard

$$\hat{\pi}_t^H = \beta E_t \left\{ \hat{\pi}_{t+1}^H \right\} + \lambda \widehat{mc}_t$$

- But now the dynamics of marginal costs are substantially affected by the introduction of real imperfections:

$$\begin{aligned} \widehat{mc}_t &= -\Psi_0 \hat{u}_t + \Psi_1 \hat{x}_t - \Psi_2 E_t \left\{ \hat{x}_{t+1} \right\} \\ &\quad -\gamma \Psi_3 \left(S \right)^{\alpha} \left(\hat{a}_t - \alpha \hat{s}_t \right) \end{aligned}$$

  where the structural parameters Ψ_0, Ψ_1, and Ψ_2 depend on labor market frictions and on the degree of real wage stickiness.

Sticky Price Equilibrium

- The model incorporates many realistic features, but it is still tractable (6 equation model).

- The Union IS equation (the demand side of the model):

$$(1) : \hat{u}_t^U = E_t \hat{u}_{t+1}^U + (\hat{\imath}_t - E_t \hat{\pi}_{t+1}^U - E_t \Delta \hat{a}_{t+1}^U)$$

- Terms of trade movements distribute production among the two regions and explain unemployment differentials

$$(2) : \hat{s}_t - \bar{s}_t = \frac{1}{1-u^*} \hat{u}_t^* - \frac{1}{1-u} \hat{u}_t$$

where $\bar{s}_t = \hat{a}_t - \hat{a}_t^*$.

Aggregate Supply

- NKPC Home:

$$(3) \quad : \quad \hat{\pi}_t^H = \beta E_t \left\{ \hat{\pi}_{t+1}^H \right\} - \lambda \kappa_0 \hat{u}_t + \lambda \kappa_1 \hat{u}_{t-1} + \lambda \kappa_2 E_t \hat{u}_{t+1} - \gamma \lambda \kappa_3 \hat{a}_t + \alpha \gamma \lambda \kappa_3 \hat{s}_t$$

- NKPC Foreign:

$$(4) \quad : \quad \hat{\pi}_t^F = \beta E_t \left\{ \hat{\pi}_{t+1}^F \right\} - \lambda^* \kappa_0^* \hat{u}_t^* + \lambda^* \kappa_1^* \hat{u}_{t-1}^* + \lambda^* \kappa_2^* E_t \hat{u}_{t+1}^* - \gamma^* \lambda^* \kappa_3^* \hat{a}_t^* - \alpha \lambda^* \gamma^* \kappa_3^* \hat{s}_t$$

Terms of Trade and Monetary Policy

- From the definition of the terms of trade $S_t = \frac{P_{Ft}}{P_{Ht}}$:

$$(5) : \hat{s}_t - \hat{s}_{t-1} = \hat{\pi}_t^F - \hat{\pi}_t^H$$

- Monetary Policy: The Central Bank follows a Taylor-type monetary policy rule

$$(6) : \hat{\imath}_t = \rho_m \hat{\imath}_{t-1} + \phi_\pi (1 - \rho_m) \hat{\pi}_t^U - \phi_x (1 - \rho_m) \hat{u}_t^U + \varepsilon_t^m$$

Baseline Calibration

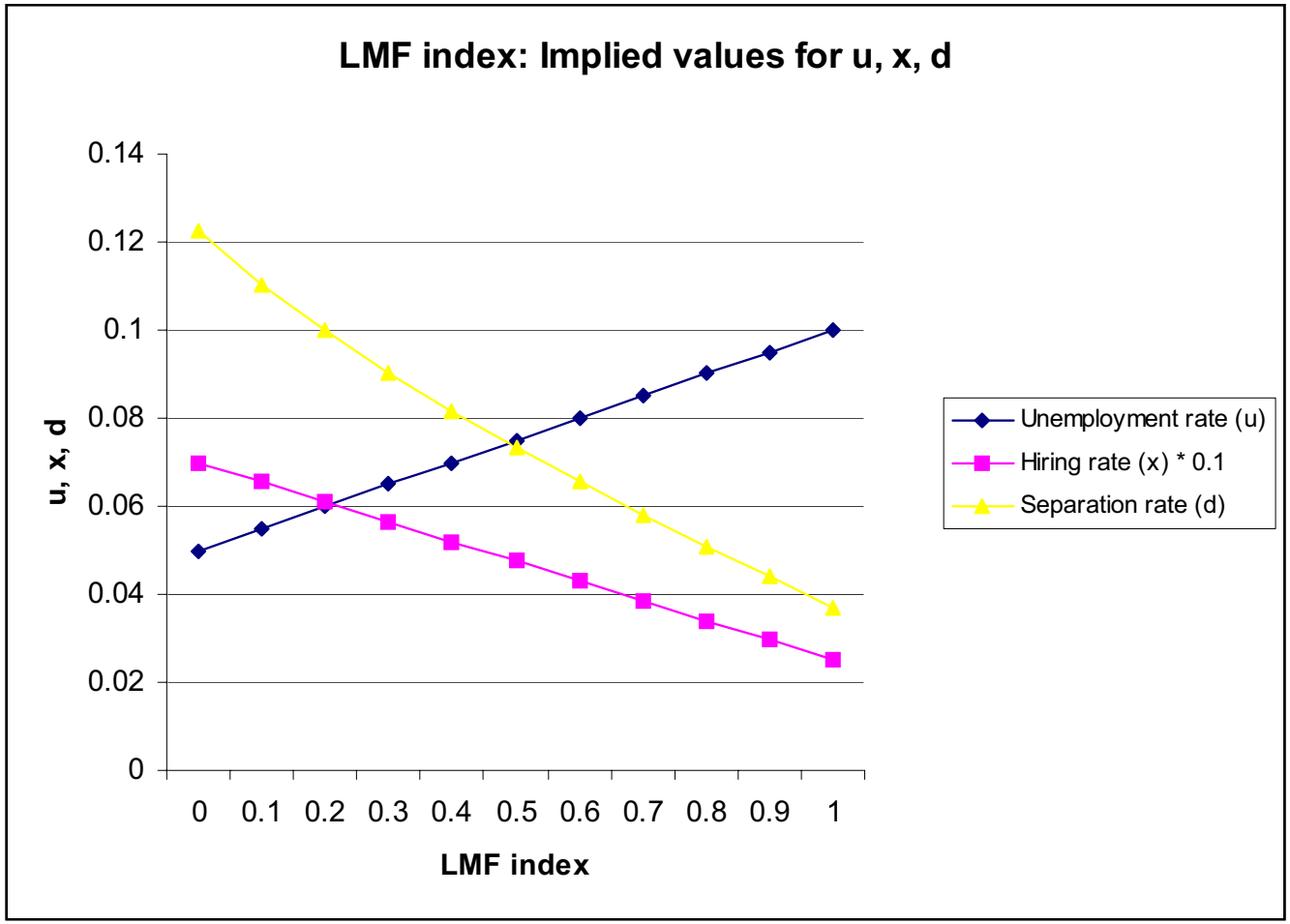
Preferences	β	ϕ^i	ϵ^i	μ^i	α
	0.99	0	6	1.2	0.2
Technology	A^i	φ^i			
	1	1			
labor market	u^i	x^i	δ_i	η^i	
	0.08	0.5	0.087	1	
Price and Real Wage rigidities	θ^i	γ^i			
	0.75	0.5			
Shocks' Persistence and Volatility	ρ_a^i	ρ_{a,a^*}	σ_a^i	σ_ε	
	0.95	0.258	0.0085	0.002	

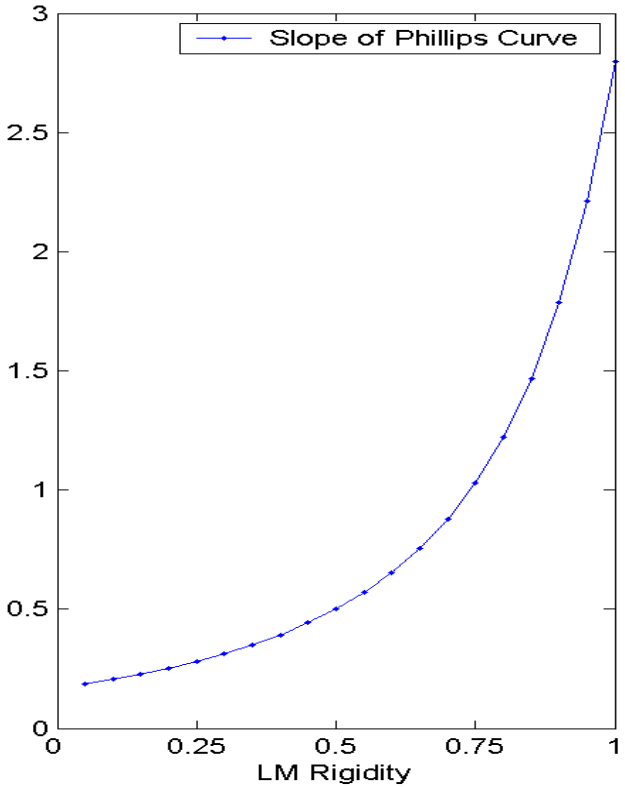
The Slope of the NKPC

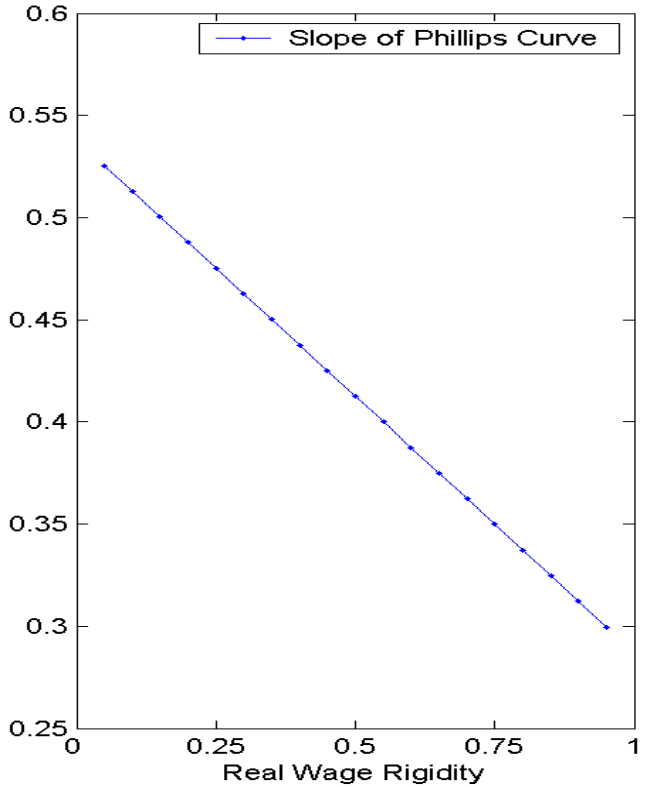
Sensitiveness analysis:

- RWR: change the degree of RWR γ from 0 to 0.9

- LMF: change simultaneously the unemployment rate u (from 0.05 to 0.10) and the job-finding rate x (from 0.7 to 0.25) such that a low unemployment rate is associated with a high job-finding rate (one dimensional look). Equivalent - through steady state relationships - to vary the separation rate δ


LMF index: Implied values for u, x, d
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
u, x, d
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
LMF index
Unemployment rate (u)
Hiring rate (x) * 0.1
Separation rate (d)


Slope of Phillips Curve
3
2.5
2
1.5
1
0.5
0
0
0.25
0.5
0.75
1
LM Rigidity


Slope of Phillips Curve
0.6
0.55
0.5
0.45
0.4
0.35
0.3
0.25
0
0.25
0.5
0.75
1
Real Wage Rigidity

POSITIVE ANALYSIS

We restrict our positive analysis to the following monetary policy rule:

$$r_t = \rho_m r_{t-1} + (1 - \rho_m)\, 1.5 \pi_t^U + \varepsilon_t$$

We analyze inflation and unemployment differentials

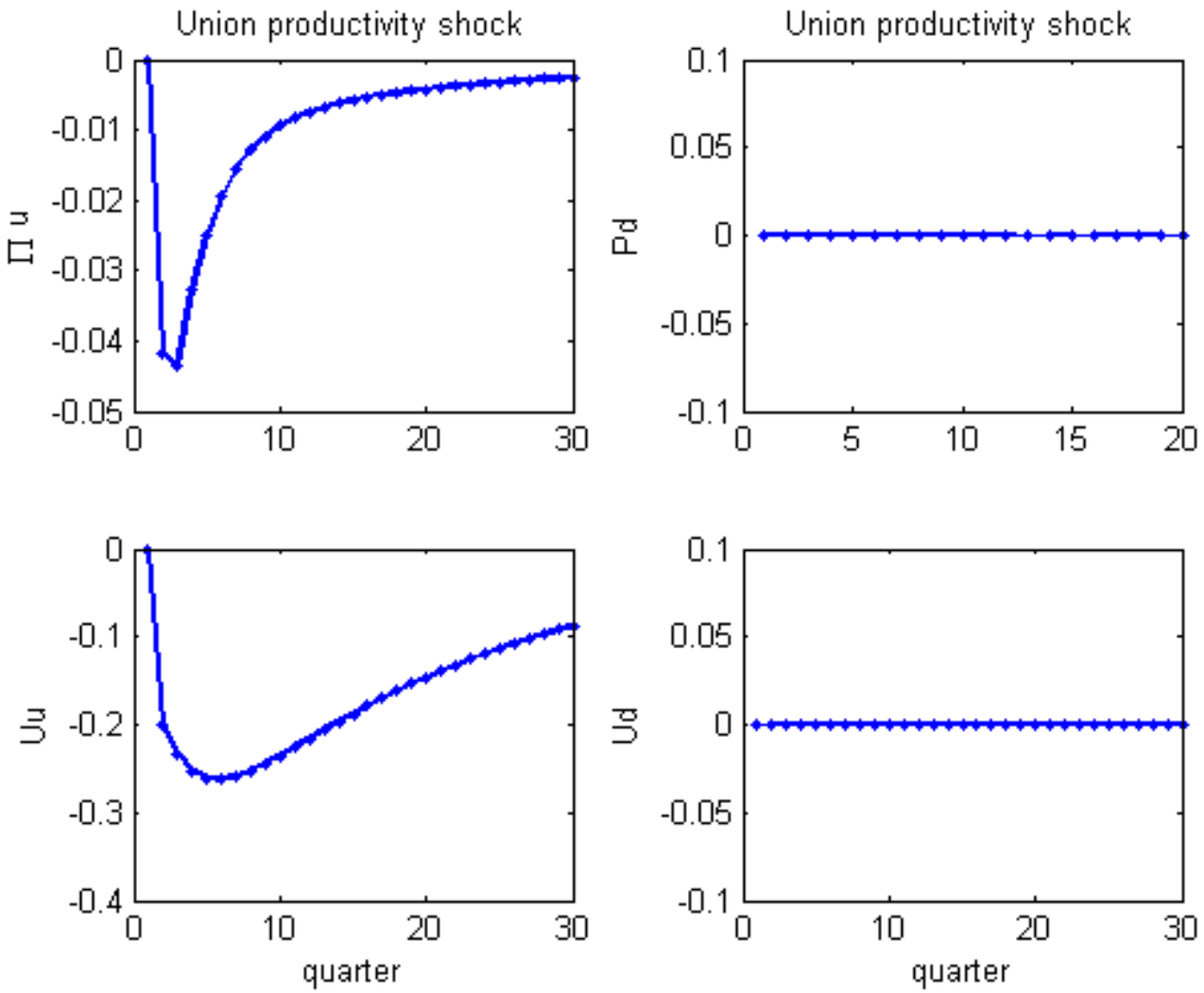
$$\begin{aligned} d\pi_t &= \pi_t^H - \pi_t^F \\ d\hat{u}_t &= \hat{u}_t^H - \hat{u}_t^F \end{aligned}$$

Three cases

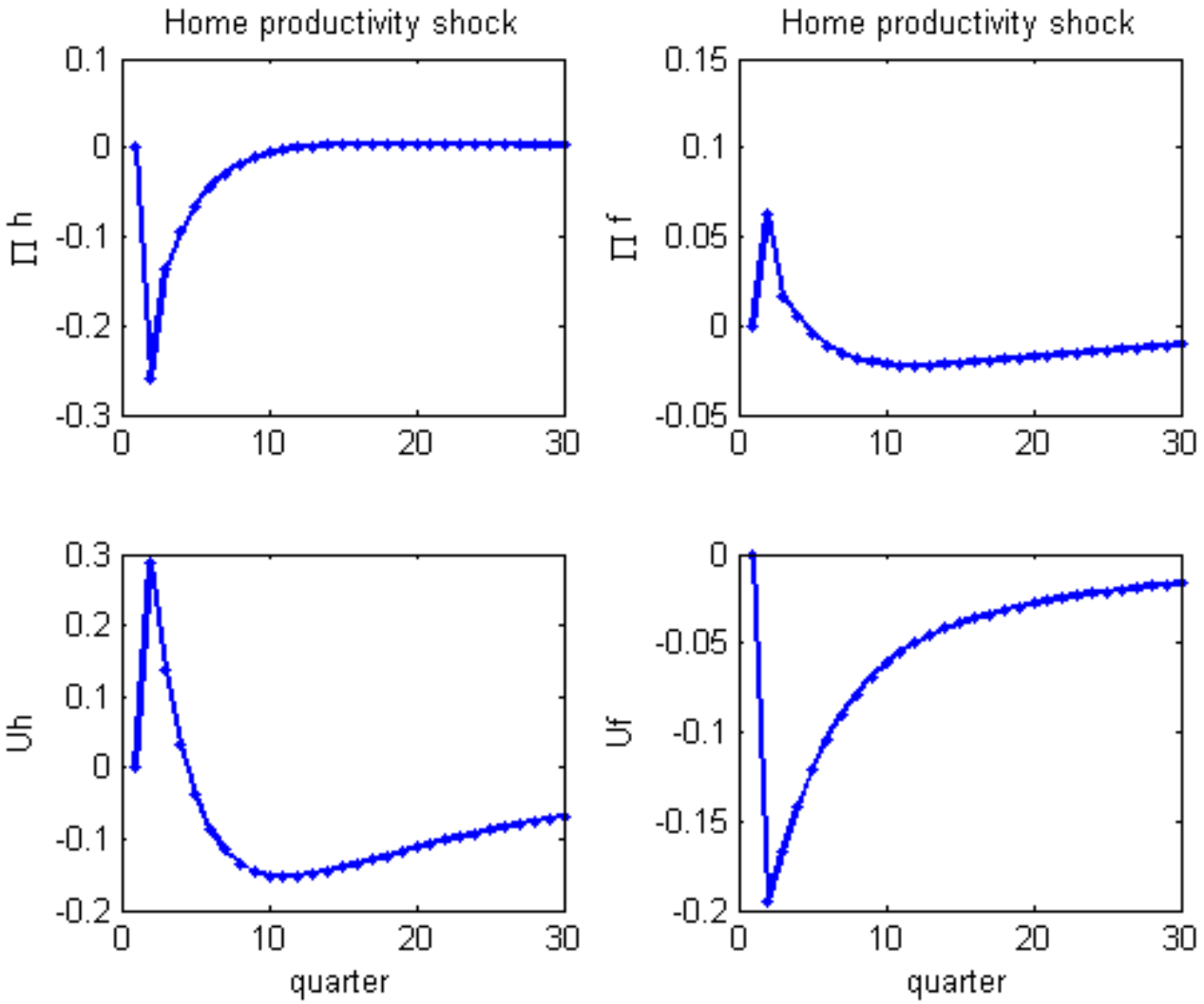
1. Benchmark: symmetric shocks in a symmetric currency union

2. Asymmetric shock with symmetric labor market institutions

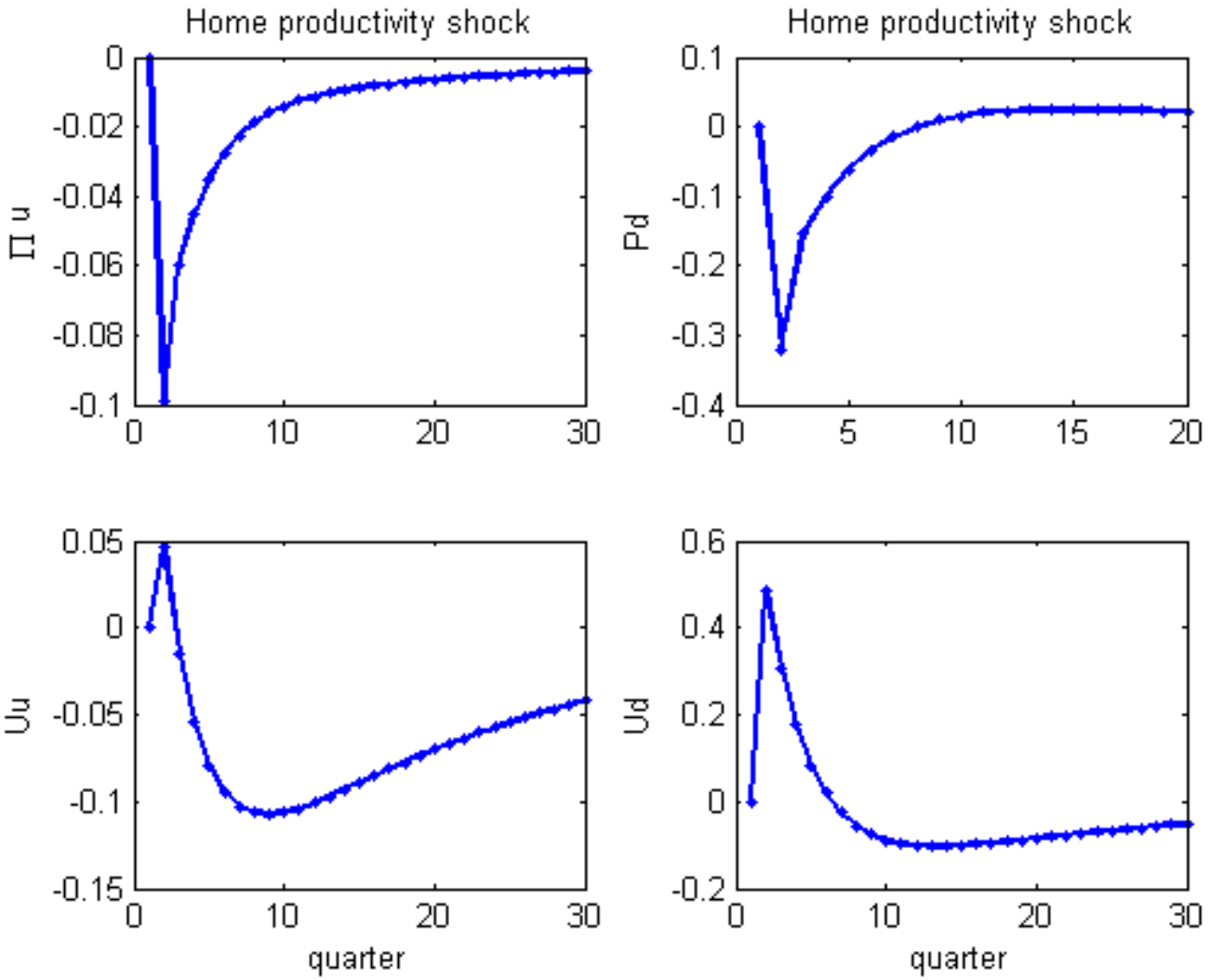
3. Symmetric shock with asymmetric LMF and RWR (H rigid, F is flexible)



Case 1: Union productivity shock



Case 2: Home productivity shock in a symmetric currency union



Home productivity shock in a symmetric currency union cont'd

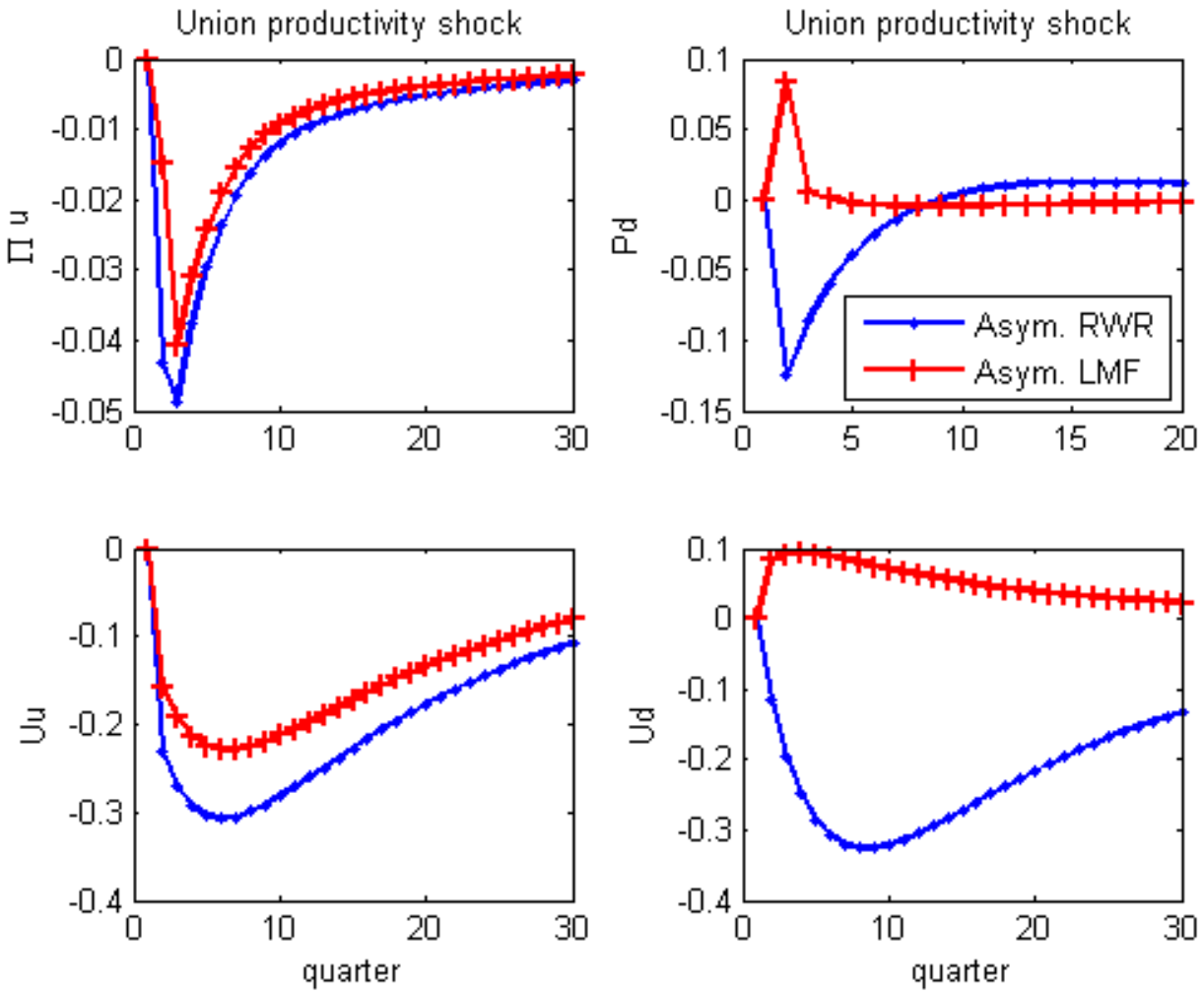
Union productivity shock in a asymmetric currency union

1. Asymmetric RWR:

$$\begin{aligned} \gamma h &= 0.7 \\ \gamma f &= 0.3 \end{aligned}$$

2. Asymmetric LMF:

$$\begin{aligned} xh &= 0.25; uh = 0.1 \\ xf &= 0.7; uf = 0.05 \end{aligned}$$



Case 3: Union productivity shock in a asymmetric currency union

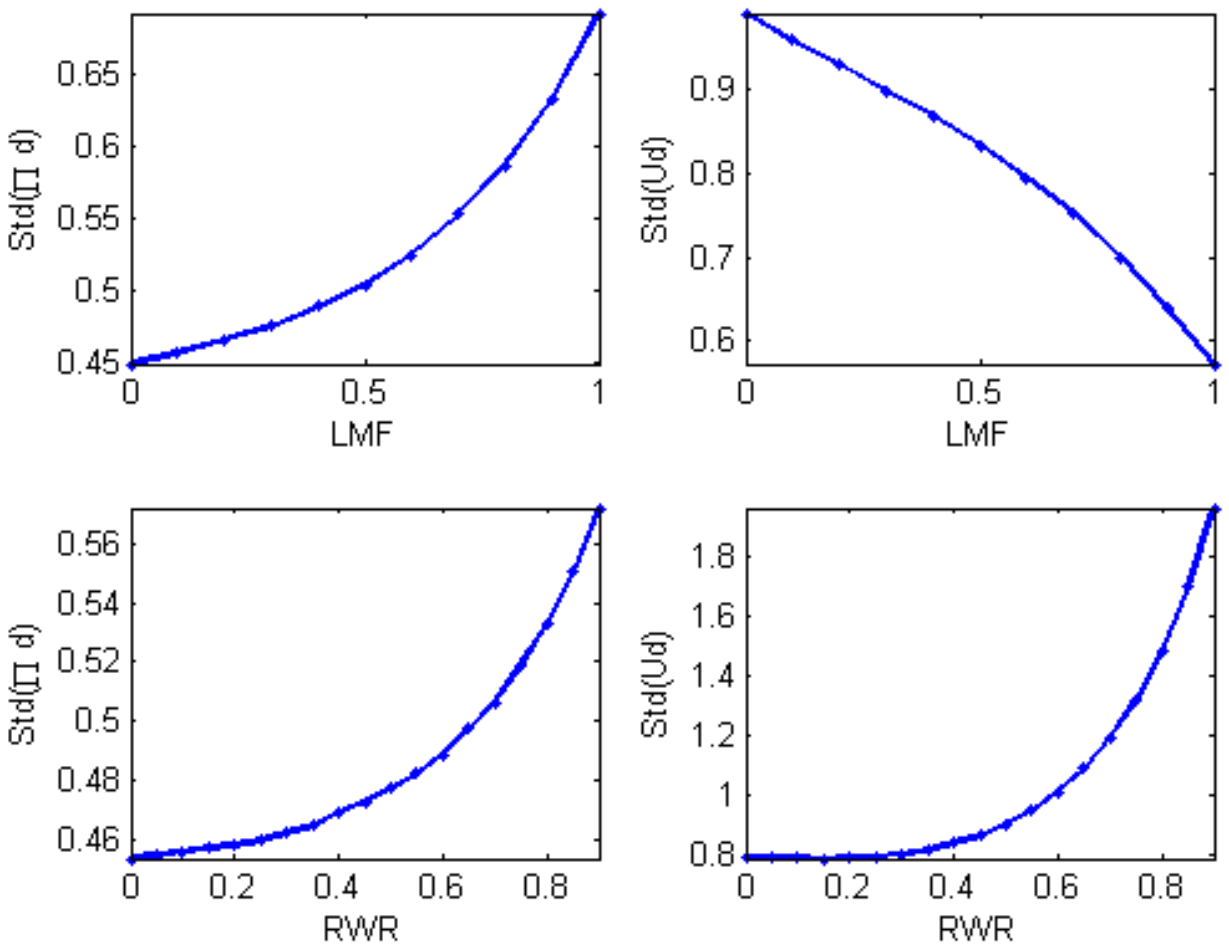
Volatilities and Persistence of differentials

Sensitivity analysis:

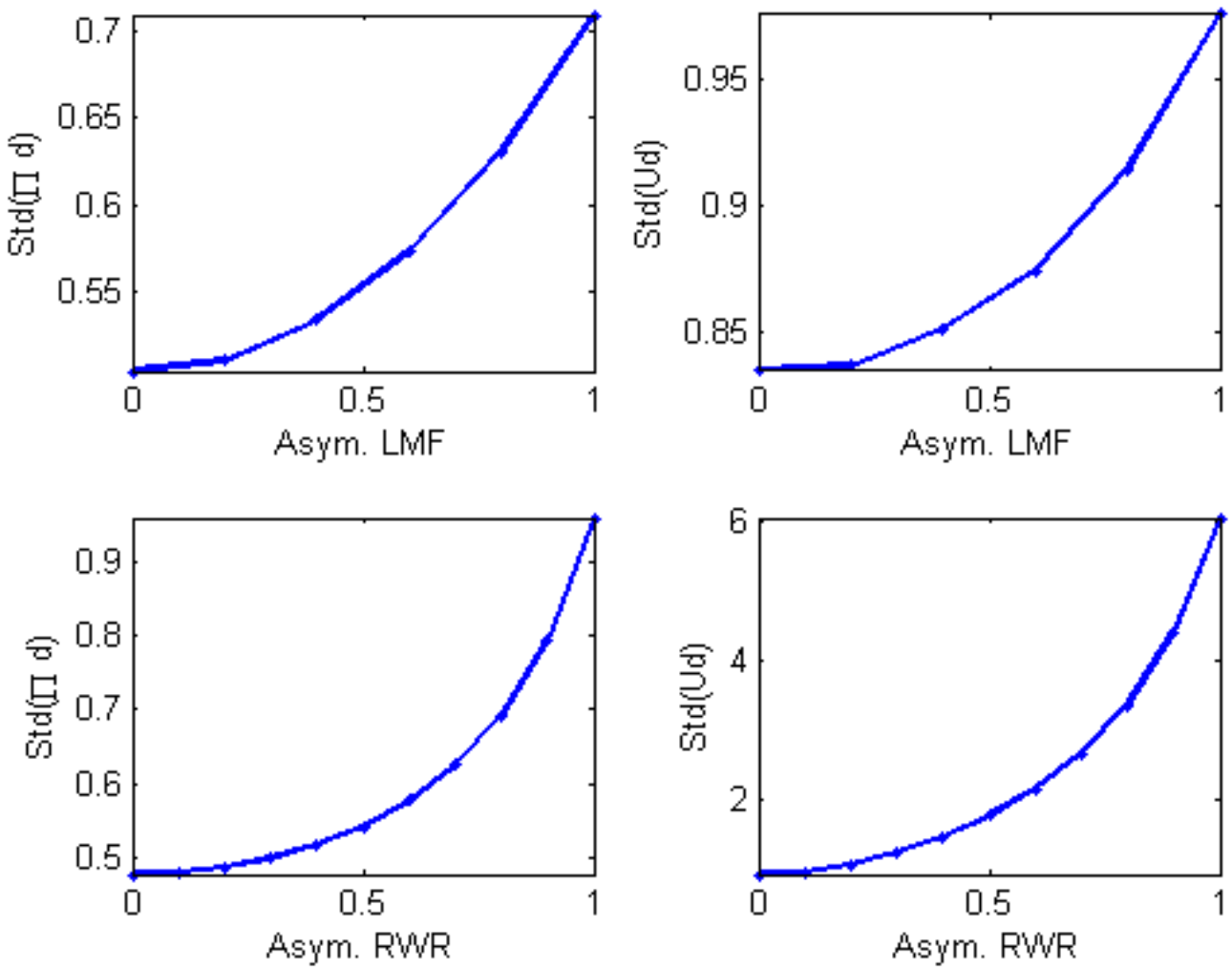
1. How does the volatility of inflation and unemployment differentials change with different LMFs and RWRs?

2. How does the persistence of inflation and unemployment differentials change with different LMFs and RWRs?

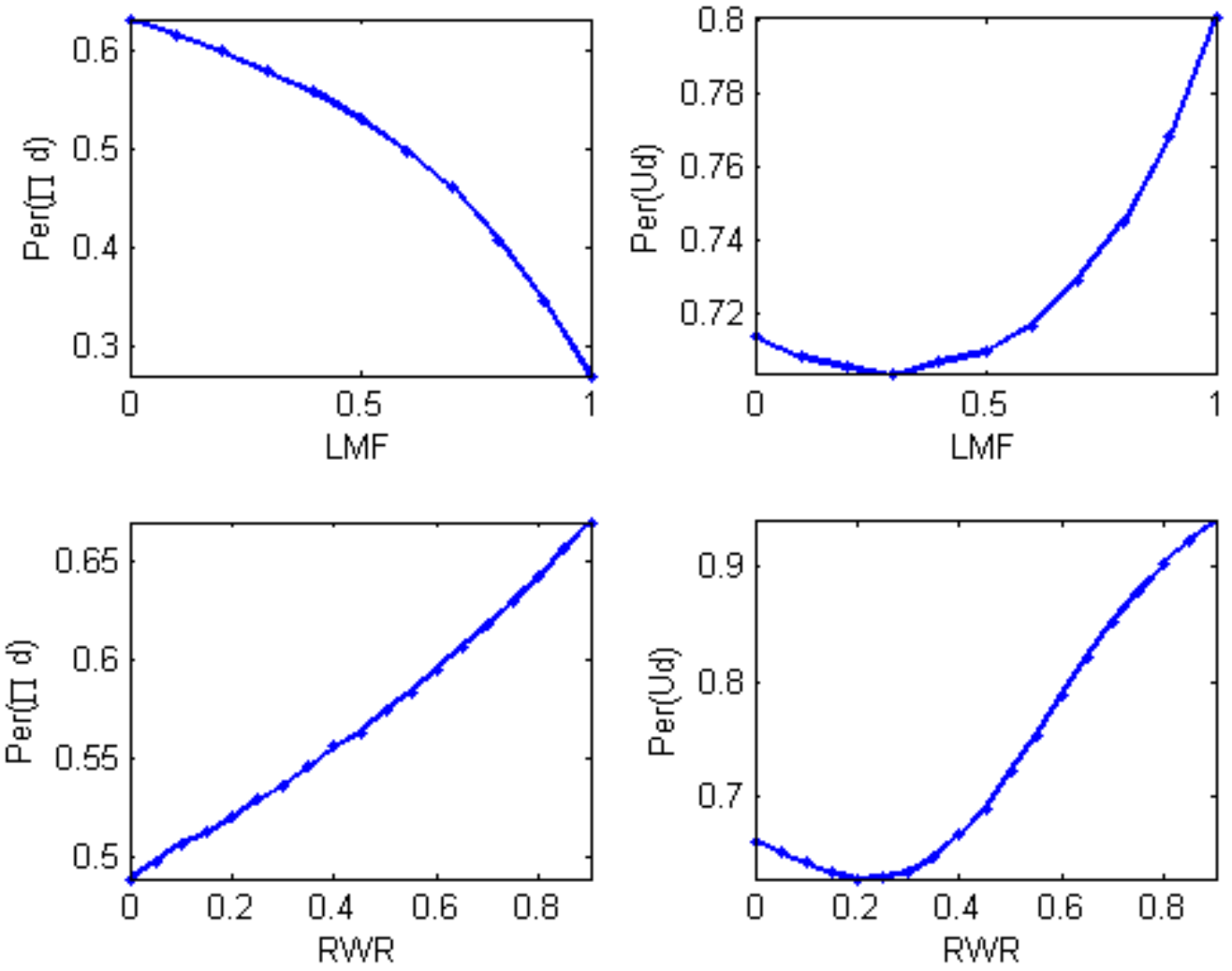
   $\longrightarrow$ Persistence measured as the sum of the AR coefficients in an AR(5) model



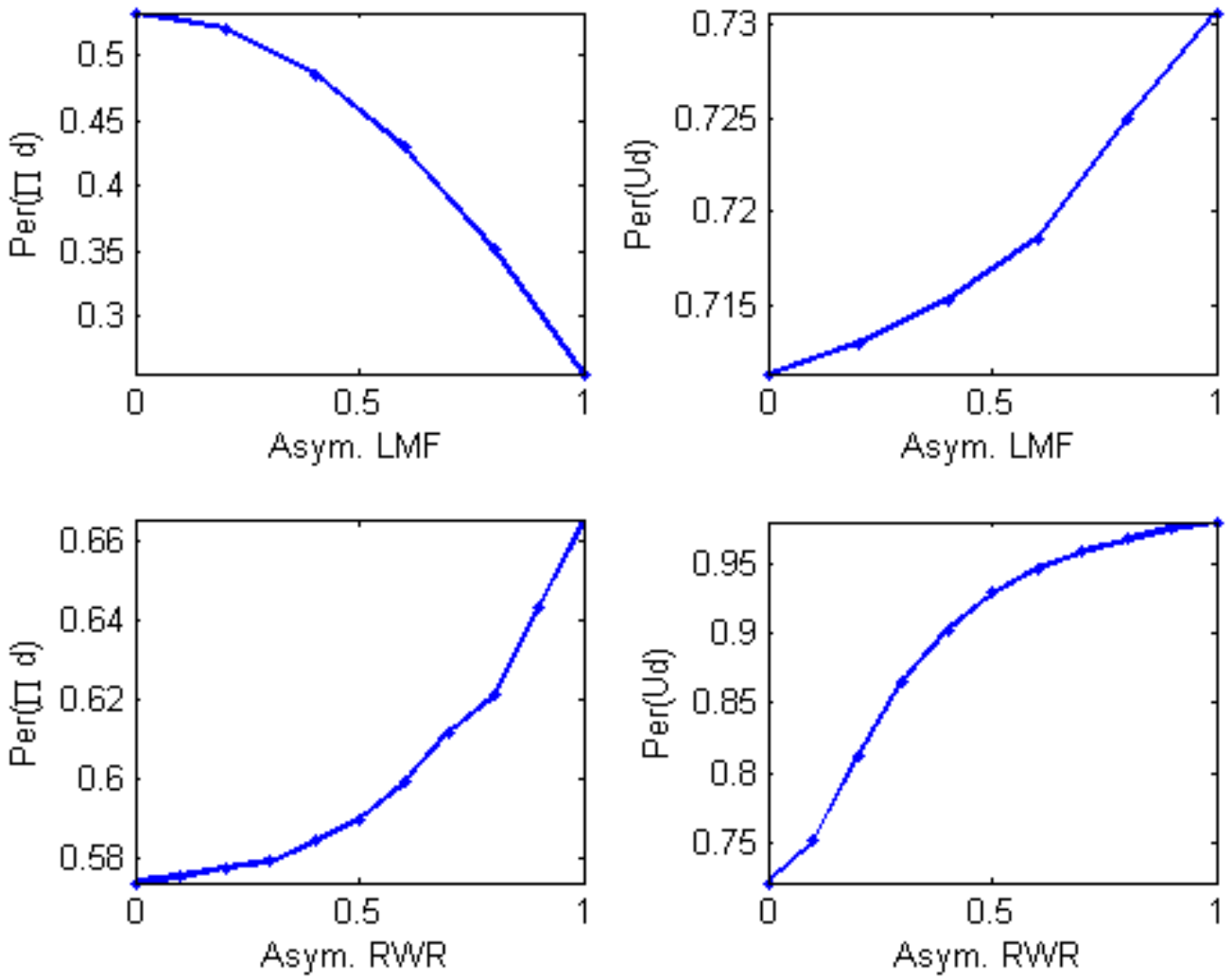
Standard deviations of differentials for different labor market structures



Standard deviations of differentials for asymmetric labor market structures



Persistence of differentials for different labor market structures



Persistence of differentials for asymmetric labor market structures

Results

1. Real wage rigidities increase the volatility and persistence of differentials

   $\longrightarrow$ real wage rigidities increase volatility of quantities (unemployment)

   $\longrightarrow$ real wage rigidities increase volatility of marginal costs and hence inflation

2. Labor market frictions increase the volatility of inflation differentials and reduce the volatility of unemployment differentials

   $\longrightarrow$ adustment in prices not quantities

3. Labor market frictions reduce the persistence of inflation differentials and increase the persistence of unemployment differentials

   $\longrightarrow$ with low low turnover, effect on unemployment is persistent

4. Asymmetries, in general, increase the volatility and persistence of inflation and unemployment differentials

NORMATIVE ANALYSIS

Welfare Criterion: A second order approximation to the welfare criterion delivers the utility loss from steady state utility

$$L_0 \simeq E_0 \sum_{t=0}^{\infty} \beta^t \left[\omega_p \left(\hat{\pi}_t^H \right)^2 + \omega_p^* \left(\hat{\pi}_t^F \right)^2 + \omega_u \left(\hat{u}_t \right)^2 + \omega_u^* \left(\hat{u}_t^* \right)^2 \right] + t.i.p$$

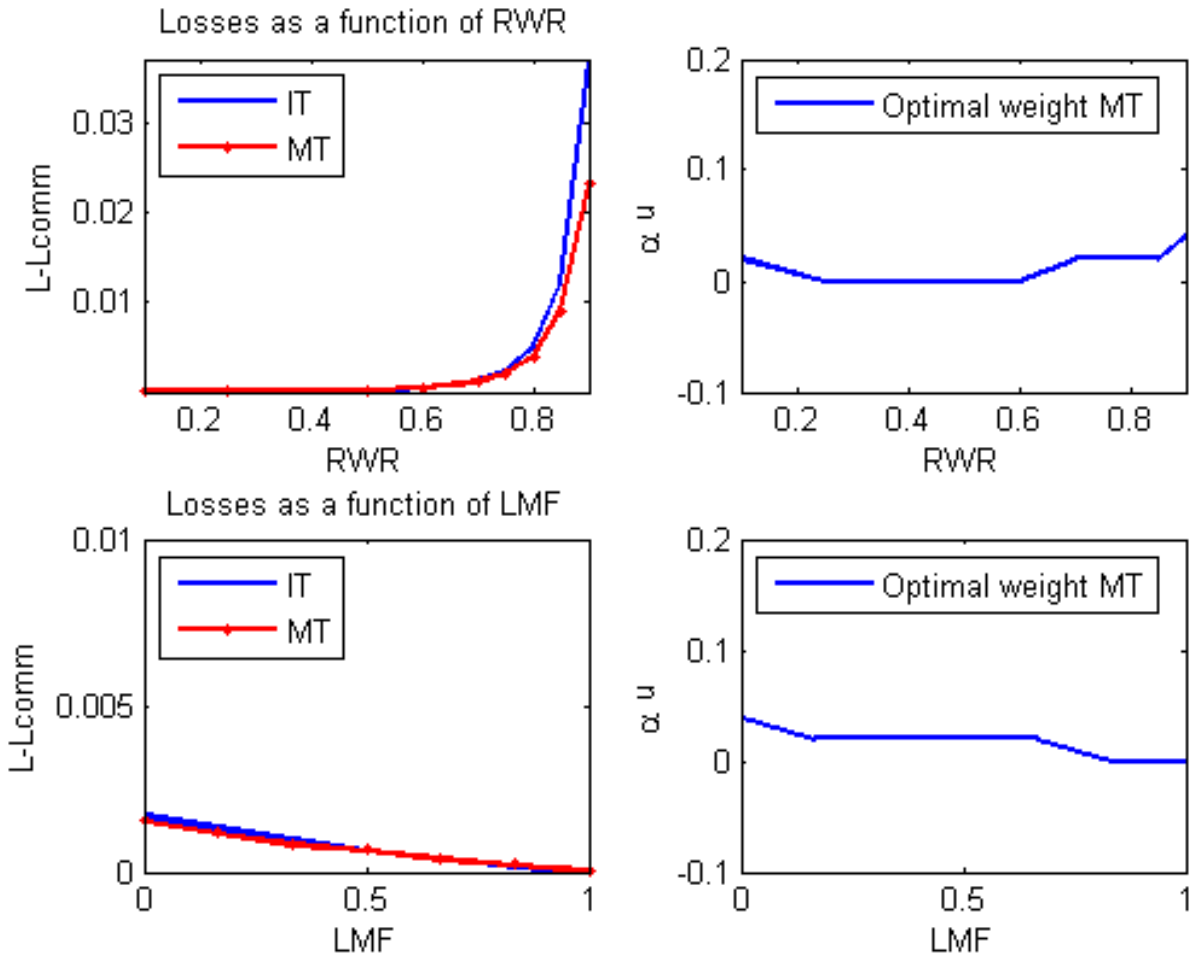
Evaluating suboptimal policy rules

We will evaluate the welfare losses of the following suboptimal target rules:

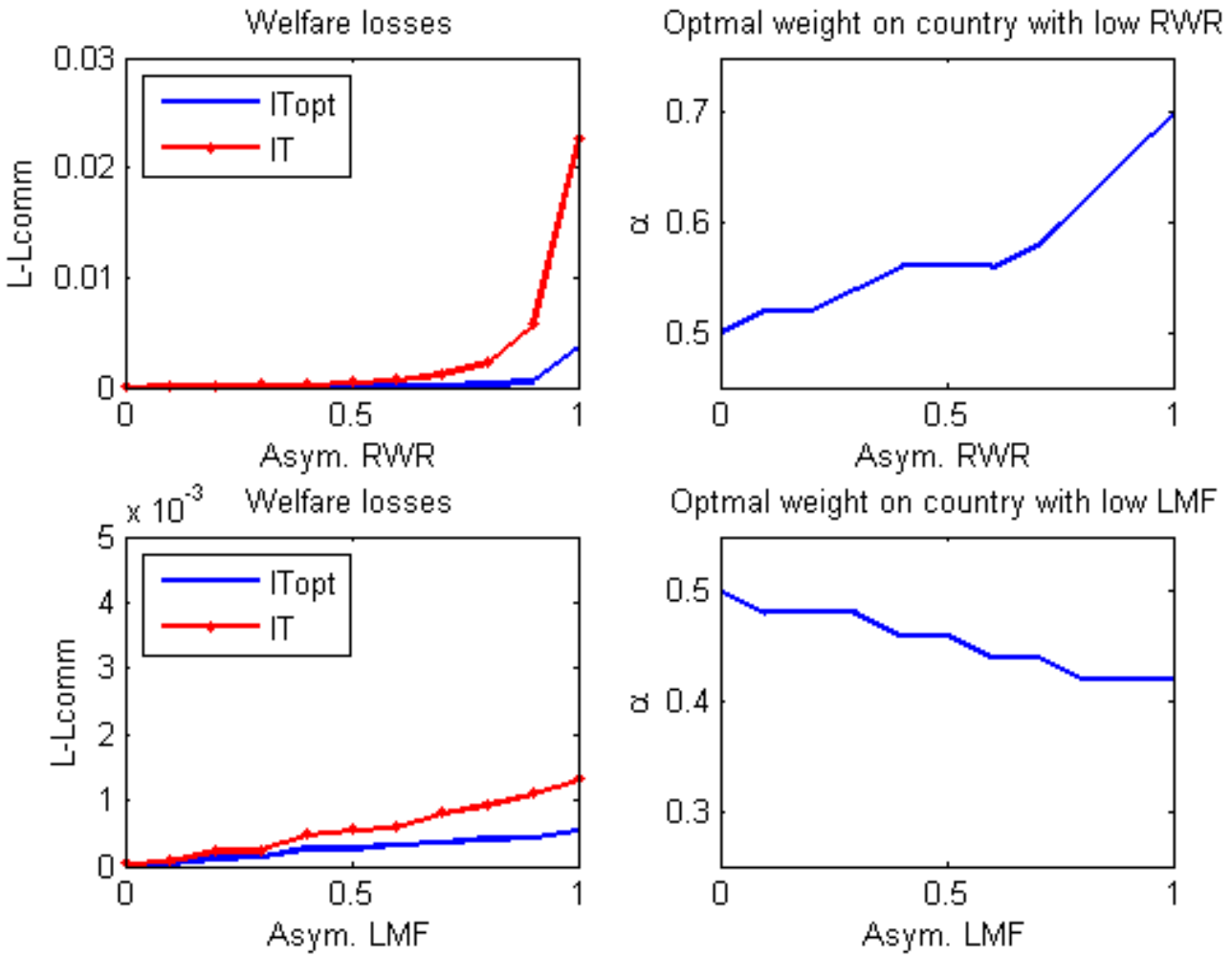
1. $\hat{\pi}_t^U = 0 \qquad (IT)$

2. $\hat{\pi}_t^U - \alpha_u \hat{u}_t^U = 0 \qquad (MT)$

3. $\alpha_{\pi_H} \hat{\pi}_{Ht} + (1 - \alpha_{\pi_H}) \hat{\pi}_{Ft} = 0 \qquad (ITopt)$



Welfare losses under IT and MT in a symmetric currency union



Welfare losses under IT and ITopt in an asymmetric currency union

Results

1. Targeting the appropriate inflation target is near optimal.

2. The appropriate inflation target gives higher weight to:

   $\longrightarrow$ countries with flexible real wages

   $\longrightarrow$ countries with sclerotic labor markets

3. Empirical question: are LMF and RWR complements or substitutes?

Conclusion

Positive analysis:

1. RWR increase volatility and persistence of differentials

2. LMF increase volatility of inflation differential but reduce its persistence

3. LMF reduce volatility of unemployment differential but increase its persistence

4. Asymmetries in general increas volatilities and persistence

Reason: Two rigidities, while often associated, have different effects.

Normative analysis:

1. a weighted inflation target is near optimal

2. target the country with flexible real wages

3. target the country with sclerotic labor markets