Discussion of Disasters

Nelson Mark
University of Notre Dame and NBER

1 The facts

$$p_t = r_{1t} - r_{2t} - E_t \Delta e_{12t+1} \neq 0$$

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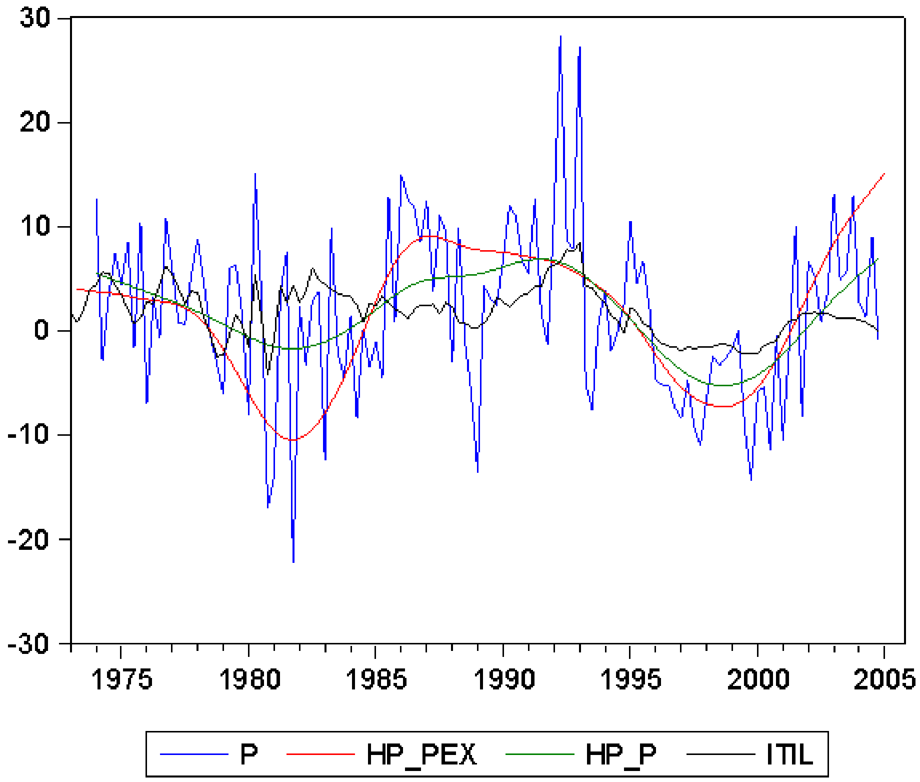
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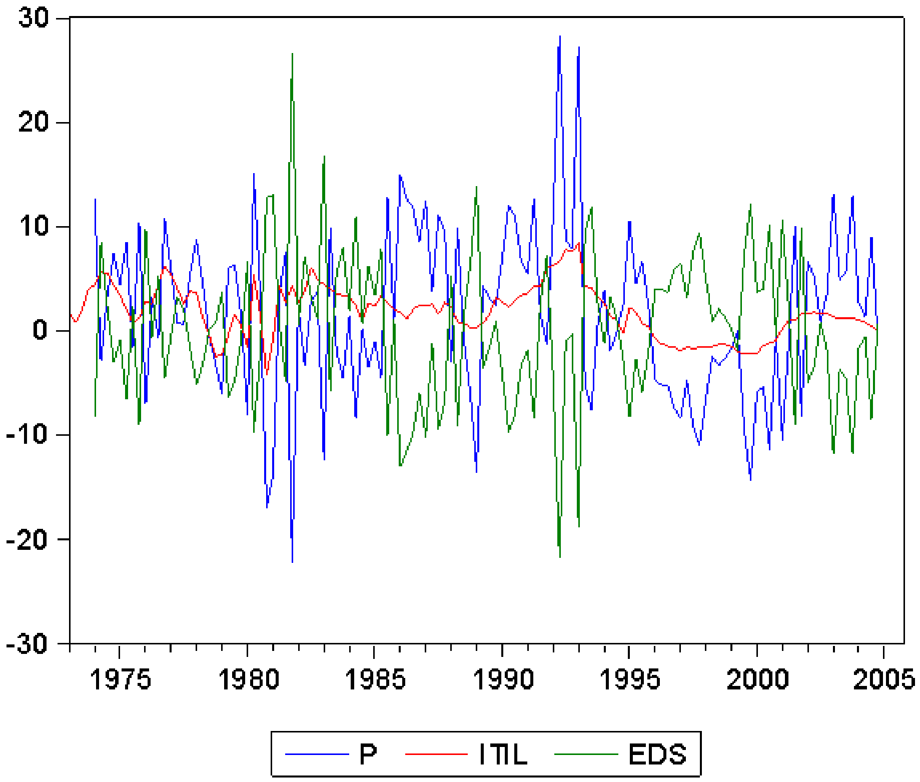
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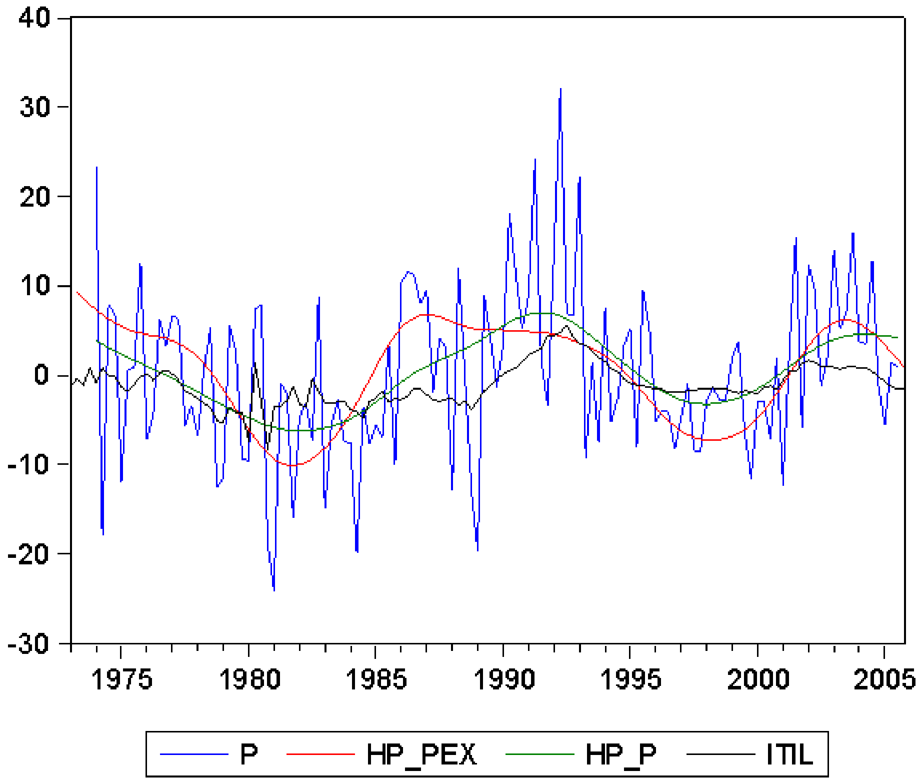

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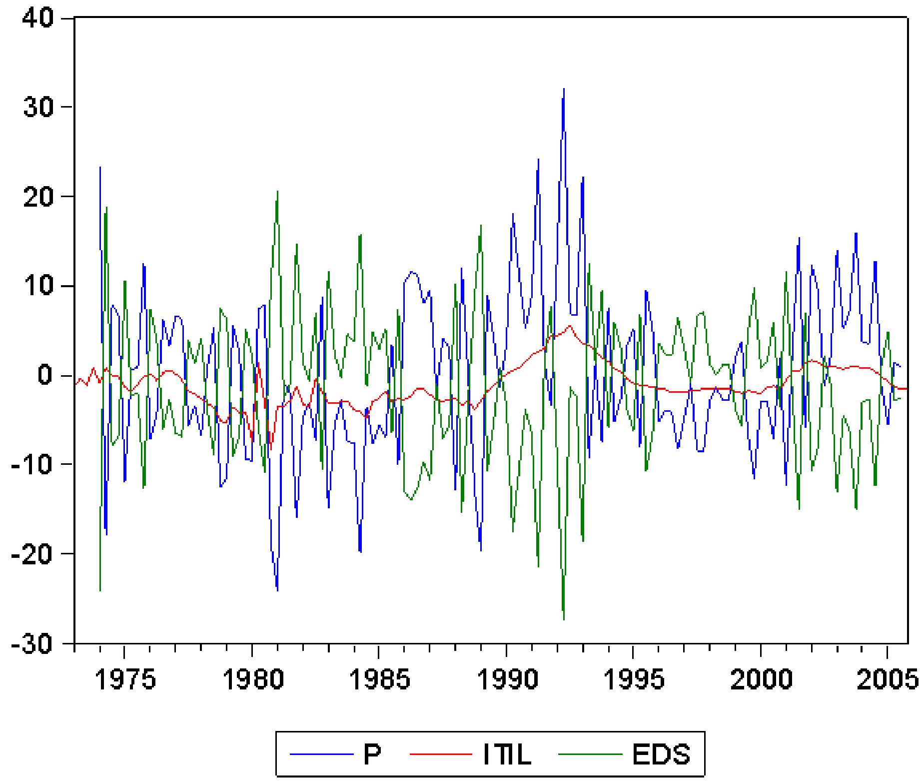

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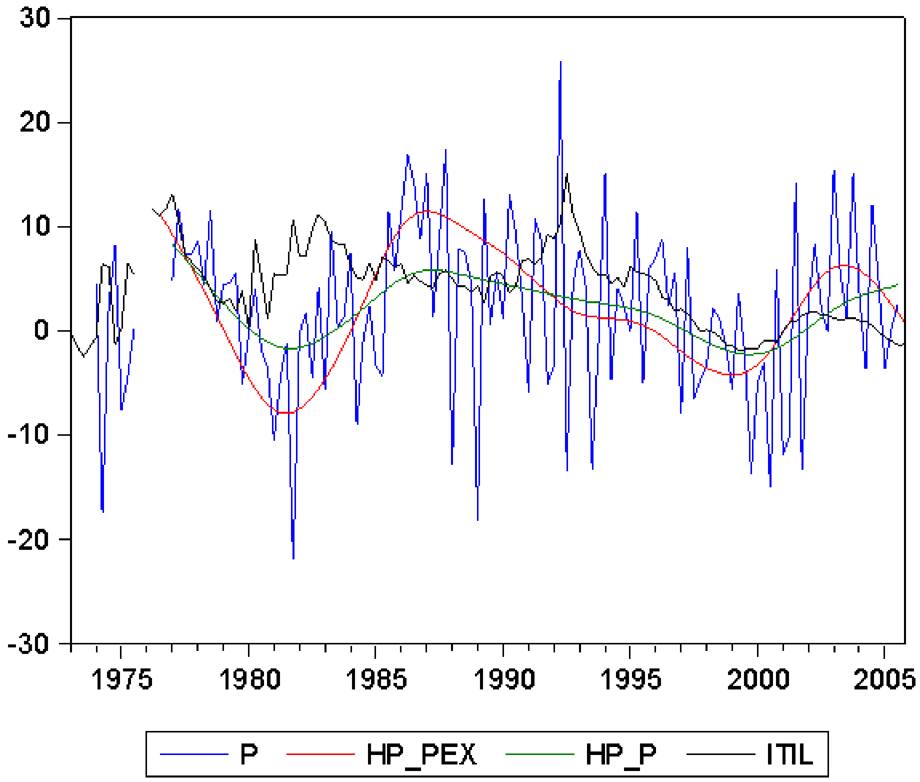
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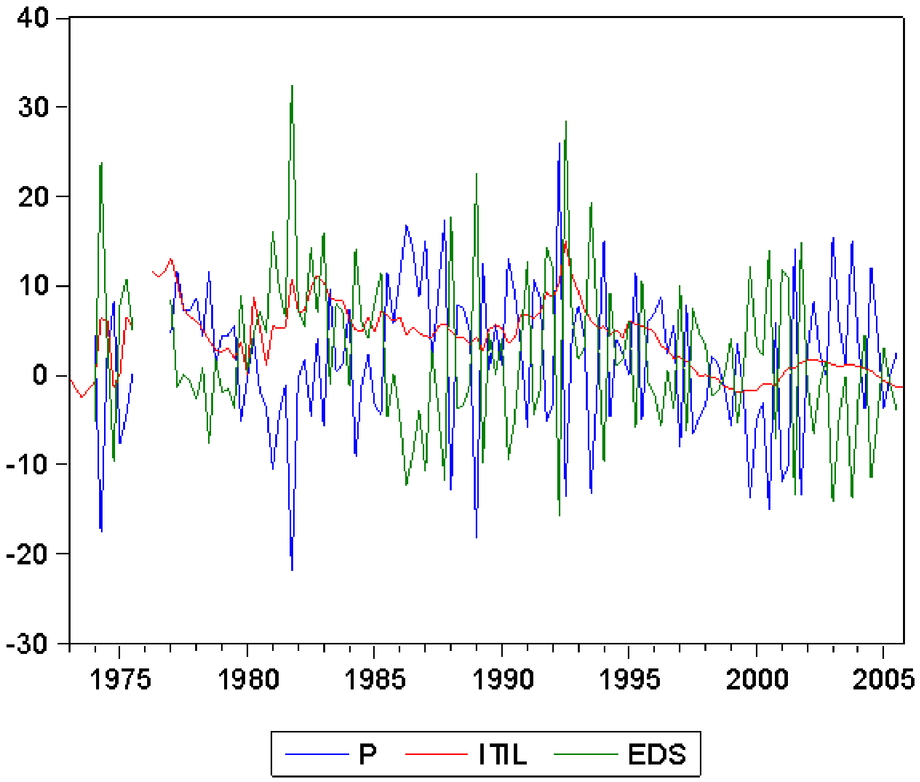
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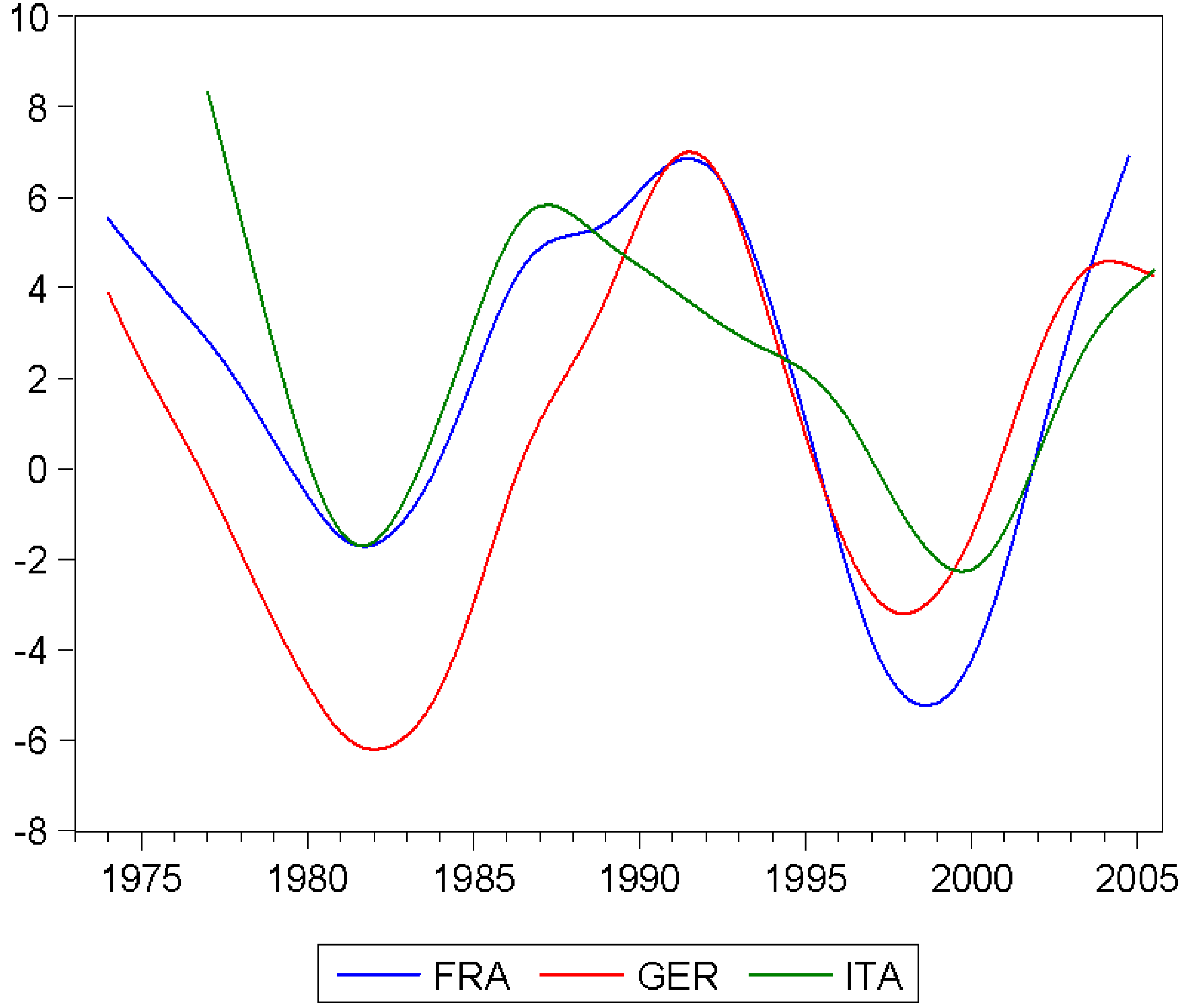
Against the USA



2 The problem

$$p_t \perp \Omega_t$$

3 Risk factors studied by Burnside et al. (2006)

1. S&P 500
2. Fama and French factors
3. Per-capita consumption growth
4. Luxury retail sales growth
5. Per-capita durables services growth
6. Industrial production
7. CAPM
8. Yogo factors

- ICAPM predicts

$$p_t = -R_t Cov_t\left(m_{t+1}, \frac{F_t - S_{t+1}}{P_{t+1}}\right)$$

- p_t and $Cov_t(\cdot, \cdot)$ have opposite signs
  - $p_t < 0 \rightarrow m_{t+1}$ and $\frac{F_t - S_{t+1}}{P_{t+1}}$ positively correlated
  - $p_t > 0 \rightarrow m_{t+1}$ and $\frac{F_t - S_{t+1}}{P_{t+1}}$ negatively correlated.
  - From Mark and Wu (1998): Sort the data and see. m_{t+1} assumes habit persistence. Plots are standardized.

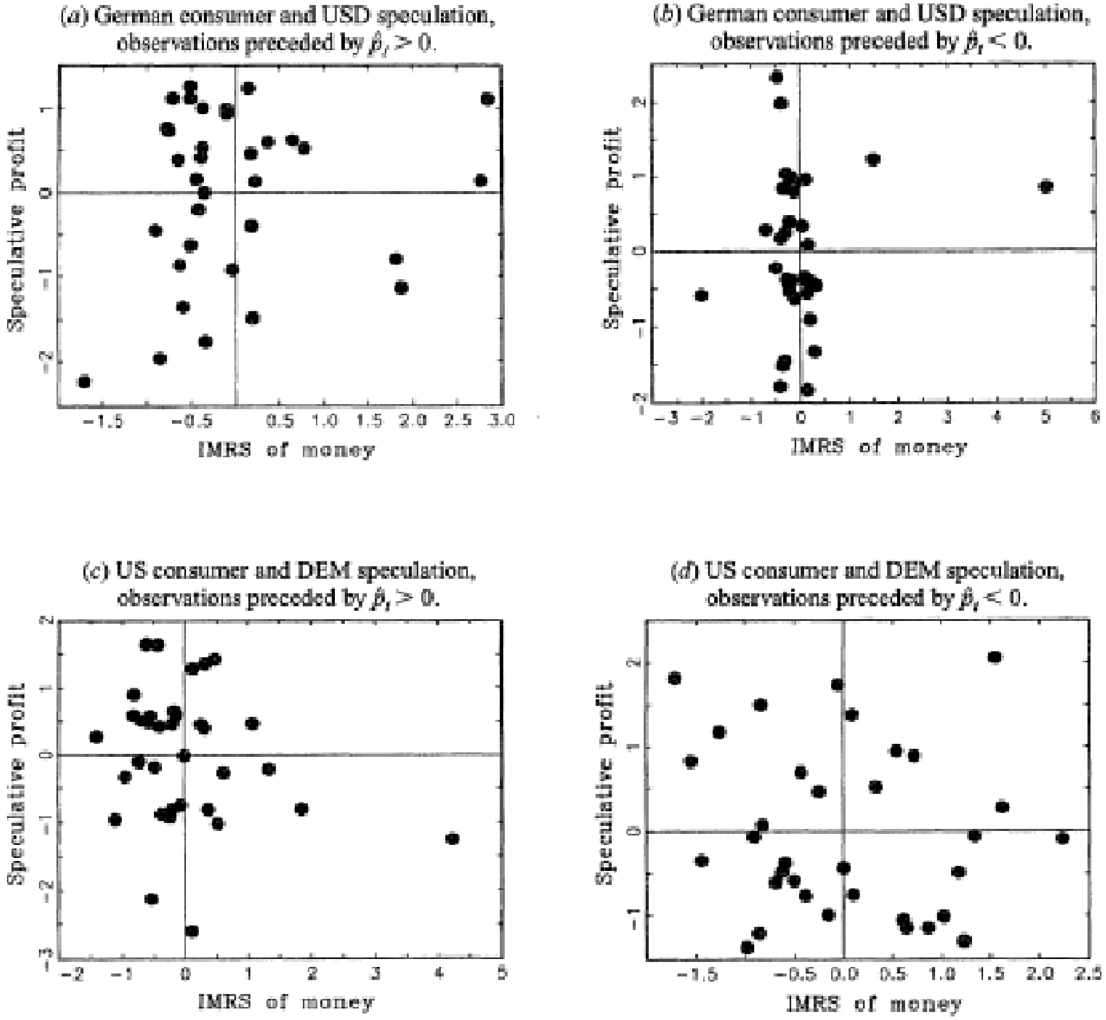


Fig. 3. *Scatter plots of standardised forward foreign exchange speculative profits* $\tilde{z}_{t+1}$ *and intertemporal marginal rate of substitution of money* $m_{t+1}(\theta, \gamma, \delta)$ *under habit persistence with* $\theta = 0.99, \gamma = 7, \delta = -0.5$ *sorted according to whether* $\hat{p}_t$ *is positive or negative.*

4 Disaster risk is an appealing approach because DUIP is orthogonal to (virtually) all known risk factors.

The Model

- Country $i's$ real exchange rate is the relative price of the traded good

$$e_{it} = \frac{P_{it}^{T}}{P_{it}^{NT_i}}$$

- Bilateral real exchange rate between 1 and 2 is the realtive price of their non traded goods. Close to Balassa-Samuelson formulation.

$$e_{12t} = \frac{e_{1t}}{e_{2t}} = \frac{P_{2t}^{NT}/P_{2t}^{T}}{P_{1t}^{NT}/P_{1t}^{T}}$$

- Period utility is separable in the two goods

$$U\left(C_{it}^{T}, C_{it}^{NT_i}\right) = \frac{\left(C_{it}^{T}\right)^{1-\gamma} + \left(C_{it}^{NT_i}\right)^{1-\gamma}}{1-\gamma}$$

- Complete set of state-contingent securities

$$C_{it}^{T} = C_{jt}^{T} = C_{t}^{T*}$$

- *Technology.* Time t non traded good becomes an asset (capital) a depreciating Lucas tree bearing traded fruit.

$$D_{it+s} = \alpha^{s} w_{it+s}$$

where $\alpha = e^{-\lambda}$ and w_{it} is an exogenous productivity shock.

- Price this asset: Invest a unit of nontraded good, which is worth $P_T / P_{it}^{NT_i} = e_{it}$ traded goods.

$$\begin{aligned} e_{it}\left(C_{t}^{T*}\right)^{-\gamma} &= \beta E_t \left(C_{t+1}^{T*}\right)^{-\gamma} \left[\alpha w_{it+1} + e_{it+1}\right] \qquad (1) \\ e_{it} &= E_t \sum_{s=1}^{\infty} \beta^{s} \left(\frac{C_{t+s}^{T*}}{C_{t}^{T*}}\right)^{-\gamma} \alpha^{s} w_{it+s} \end{aligned}$$

- Price a real bond that pays one unit of the non-traded good. Invest $\frac{1}{1+r_{it}}$ units of the non traded good. It is worth $\frac{1}{1+r_{it}}e_{it}$ units of the traded good:

$$\frac{1}{1+r_{it}}e_{it}\left(C_t^{T*}\right)^{-\gamma} = \beta E_t\left(C_{t+1}^{T*}\right)^{-\gamma} e_{it+1}$$

- *Modeling disaster risk.* For $B_t \in (0,1)$, $F_{i,t} \in (0,1)$, common factor

$$\frac{C_{t+1}^{T*}}{C_t^{T*}} = \begin{cases} (1+g)\,B_{t+1} & \text{w.p.} \quad p \\ (1+g) & \text{w.p.} \quad 1-p \end{cases}$$

Country-specific factor

$$\frac{w_{it+1}}{w_{it}} = \begin{cases} (1+g_{wi})\,F_{it+1} & \text{w.p.} \quad p \\ (1+g_{wi}) & \text{w.p.} \quad 1-p \end{cases}$$

Resilience. Disaster hits all countries but intensity and recovery rate $\left(\phi_{H_i}\right)$

varies across countries.

$$
\begin{aligned}
\Gamma_{it} &\equiv B_t^{-\gamma} F_{it} \\
H_{it} &= p_t \left(E_t \left[\Gamma_{it+1} | \text{Disaster @ t+1} \right] - 1 \right) = H_{i*} + \hat{H}_{it} \\
\hat{H}_{it+1} &= \left(\frac{1 + H_{i*}}{1 + H_{it}} \right) e^{-\phi_{H_i}} \hat{H}_{it} + \varepsilon_{it+1}^{H}
\end{aligned}
$$

H_{i*} is the constant part. Country-specific piece of resilience varies over time and behaves 'like' an AR(1).

5 Rewrite in discrete state space

Common factor. Six states. Good normal, bad normal, not-so-bad disaster for 1, for 2, and super bad disaster for 1, for 2.

$$\frac{C_{t+1}^{T*}}{C_t^{T*}} \equiv G_{t+1}^*; \qquad \frac{w_{it+1}}{w_{it}} \equiv W_{it+1}$$

State	G^*	W_1	W_2	Description
1	$\left(1+\mu_g^*+\sigma_g^*\right)$	$\left(1+\mu_{1g}+\sigma_{1g}\right)$	$\left(1+\mu_{2g}+\sigma_{2g}\right)$	Good normal
2	$\left(1+\mu_g^*-\sigma_g^*\right)$	$\left(1+\mu_{1g}-\sigma_{1g}\right)$	$\left(1+\mu_{2g}-\sigma_{2g}\right)$	Bad normal
3	$\left(1+\mu_g^*-\sigma_g^*\right)B$	$\left(1+\mu_{1g}-\sigma_{1g}\right)F_{11}$	$\left(1+\mu_{2g}-\sigma_{2g}\right)$	Not-so-bad disaster for 1
4	$\left(1+\mu_g^*-\sigma_g^*\right)B$	$\left(1+\mu_{1g}-\sigma_{1g}\right)F_{12}$	$\left(1+\mu_{2g}-\sigma_{2g}\right)$	Super bad disaster for 1
5	$\left(1+\mu_g^*-\sigma_g^*\right)B$	$\left(1+\mu_{1g}-\sigma_{1g}\right)$	$\left(1+\mu_{2g}-\sigma_{2g}\right)F_{21}$	Not-so-bad disaster for 2
6	$\left(1+\mu_g^*-\sigma_g^*\right)B$	$\left(1+\mu_{1g}-\sigma_{1g}\right)$	$\left(1+\mu_{2g}-\sigma_{2g}\right)F_{22}$	Super bad disaster for 2

In the US, probability of staying in good state 0.976, probability of staying in bad normal state 0.527 (CLM). Barro estimates probability of disaster is 1.7% per year, so from state 1 or 2, the probability of going into states 3-6 is 1.7%. $\gamma = 2$.

$$P = \begin{pmatrix} 0.959 & 0.024 & 0 & \frac{0.017}{2} & 0 & \frac{0.017}{2} \\ 0.473 & 0.51 & 0 & \frac{0.017}{2} & 0 & \frac{0.017}{2} \\ 0 & 1-(0.7)^5 & \frac{(0.7)^5}{2} & \frac{(0.7)^5}{2} & 0 & 0 \\ 0 & 1-(0.7)^5 & \frac{(0.7)^5}{2} & \frac{(0.7)^5}{2} & 0 & 0 \\ 0 & 1-(0.7)^5 & 0 & 0 & \frac{(0.7)^5}{2} & \frac{(0.7)^5}{2} \\ 0 & 1-(0.7)^5 & 0 & 0 & \frac{(0.7)^5}{2} & \frac{(0.7)^5}{2} \end{pmatrix}$$

case	μ_g^*	μ_1	μ_2	σ_g	σ_1	σ_2	B	F_{11}	F_{12}	F_{21}	F_{22}
1 (medium)	0.03	0.03	0.03	0.0356	0.0483	0.0483	0.55	1	1	0.5	0.2
2 (low)							0.8				
3 (high)							0.45				

Mean and standard deviations

case	p	r_1	r_2	$\frac{e_{1t}}{e_{1t-1}}$	$\frac{e_{2t}}{e_{2t-1}}$	$\frac{e_{1t}e_{2t-1}}{e_{2t}e_{1t-1}}$	$E_{t-1}(\frac{e_{1t}e_{2t-1}}{e_{2t}e_{1t-1}})$	ρ
1	-0.0526	0.0595	0.0675	1.0687	1.0617	1.0415	1.0417	-1
	0.0310	0.0005	0.0005	0.0255	0.0896	0.4321	0.0291	
2	-0.0528	0.0590	0.0672	1.0687	1.0617	1.0416	1.0418	-1
	0.0308	0.0005	0.0005	0.0256	0.0896	0.4331	0.0289	
3	-0.0525	0.0596	0.0676	1.0687	1.0617	1.0414	1.0417	-1
	0.0311	0.0005	0.0005	0.0255	0.0896	0.4317	0.0292	

6 Negatives

Can calibrated model explain the time variation?

Risk premium is for nominal risk.

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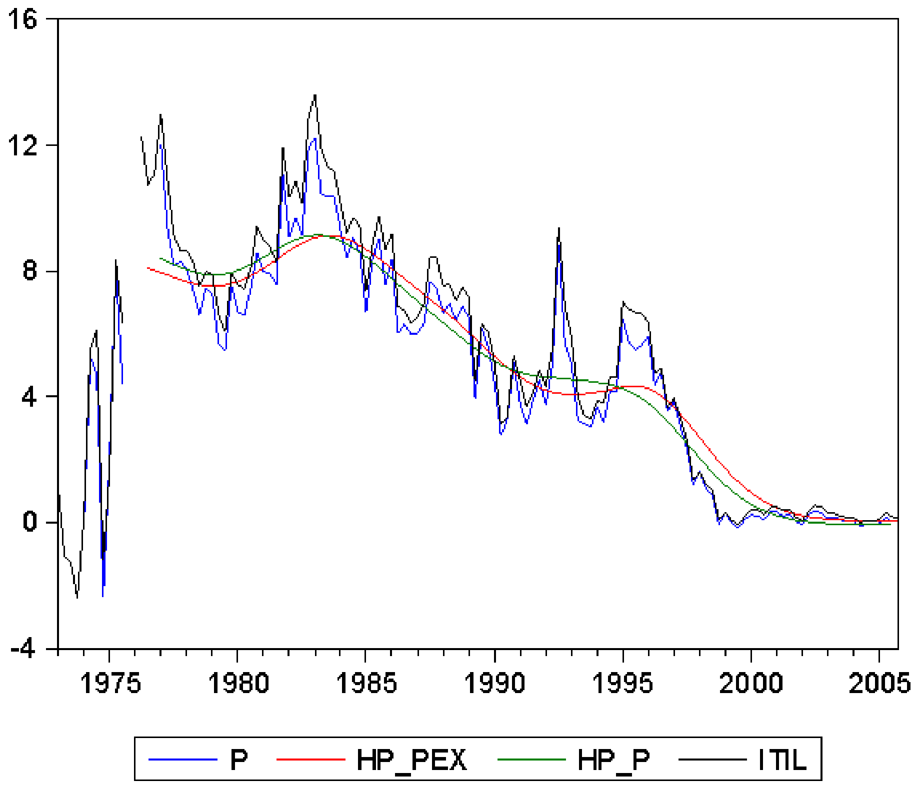
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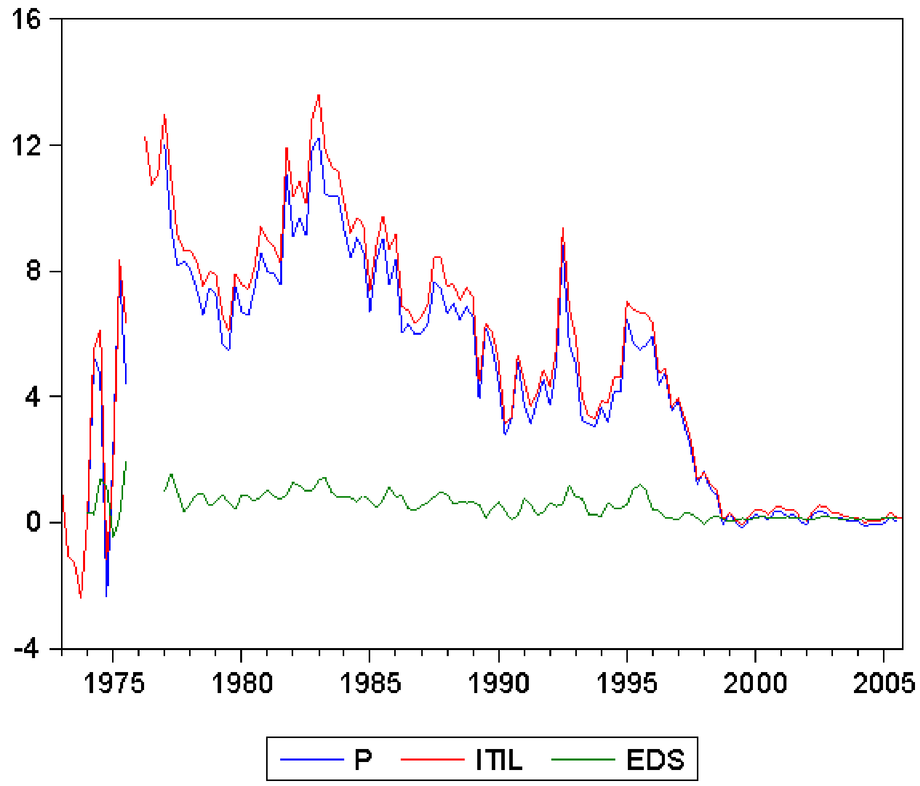
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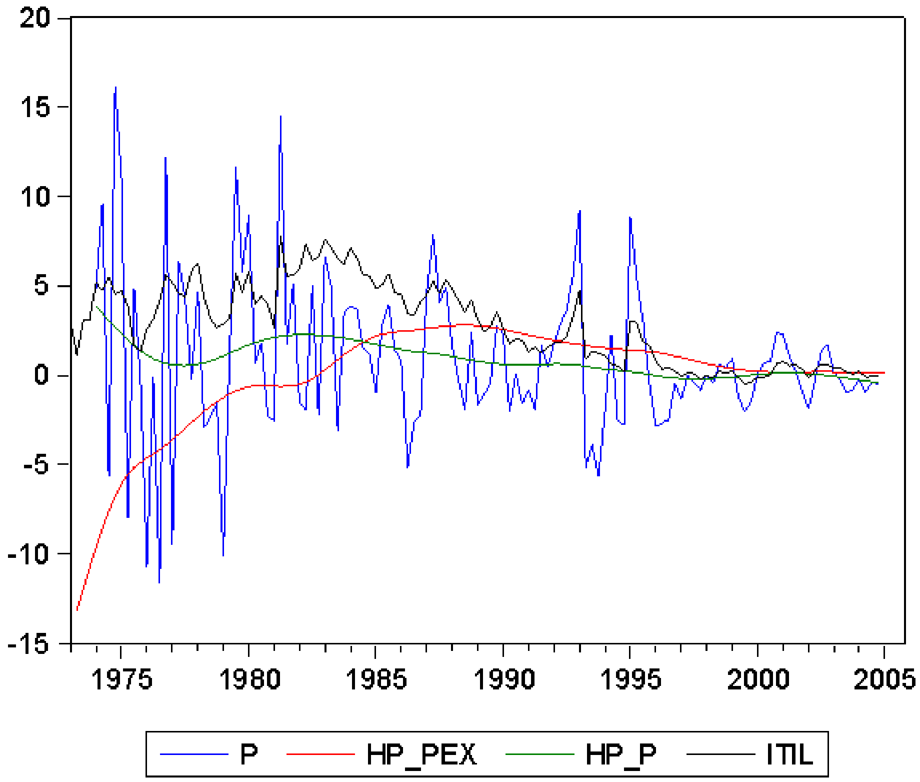

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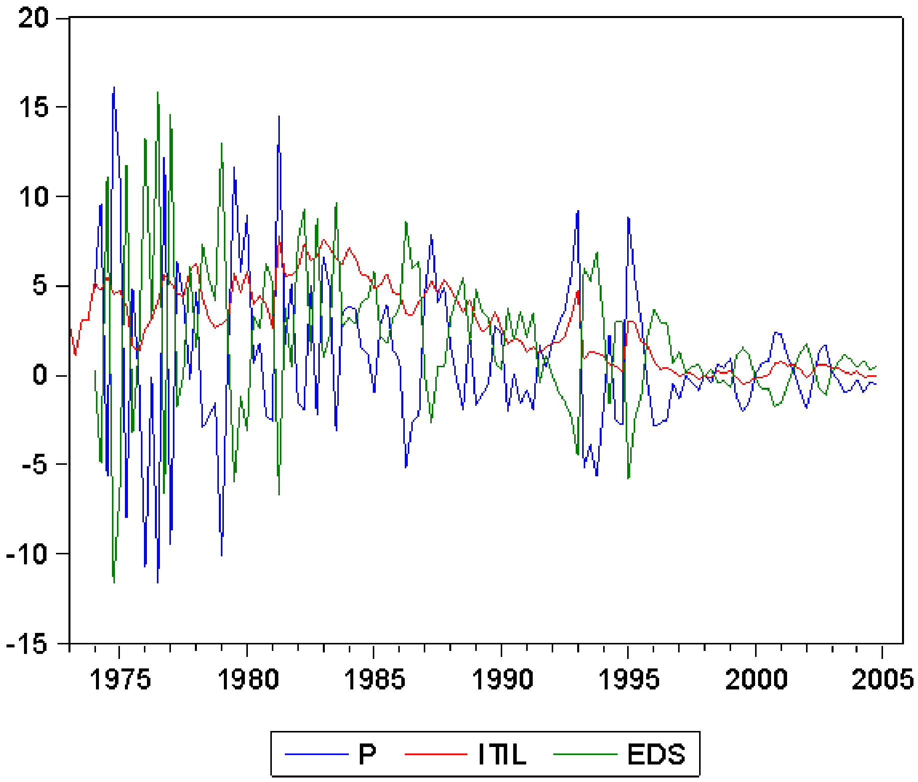

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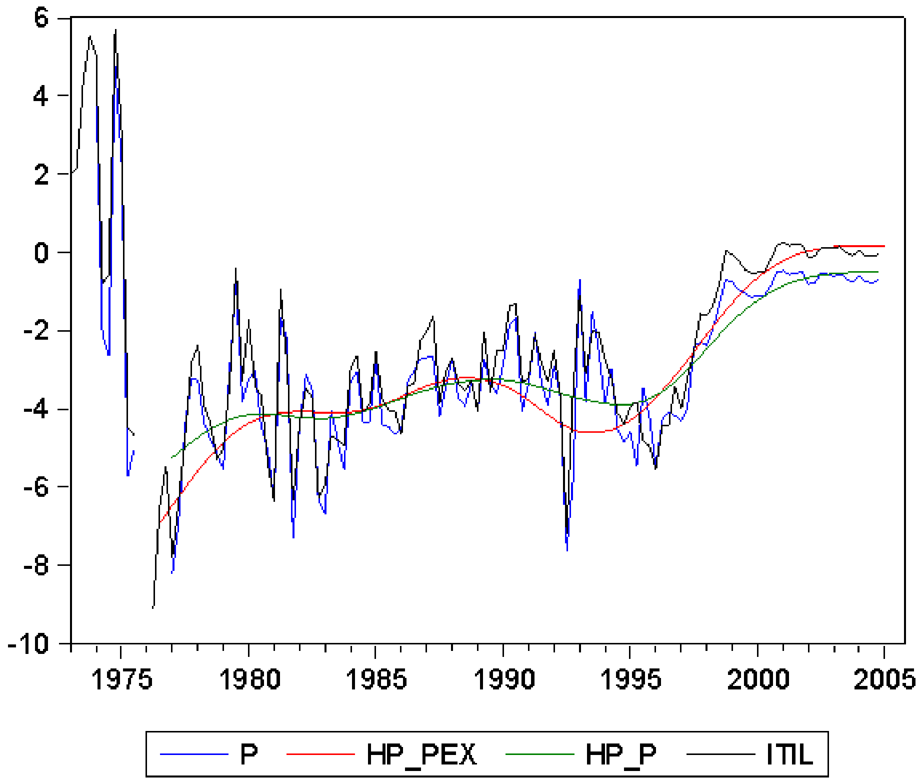
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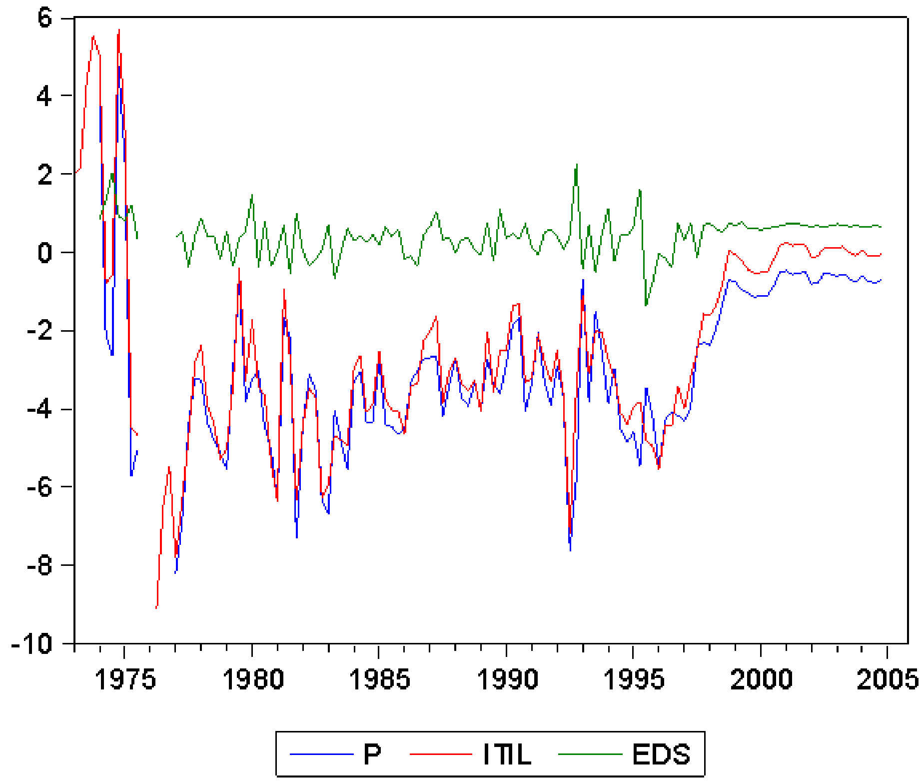
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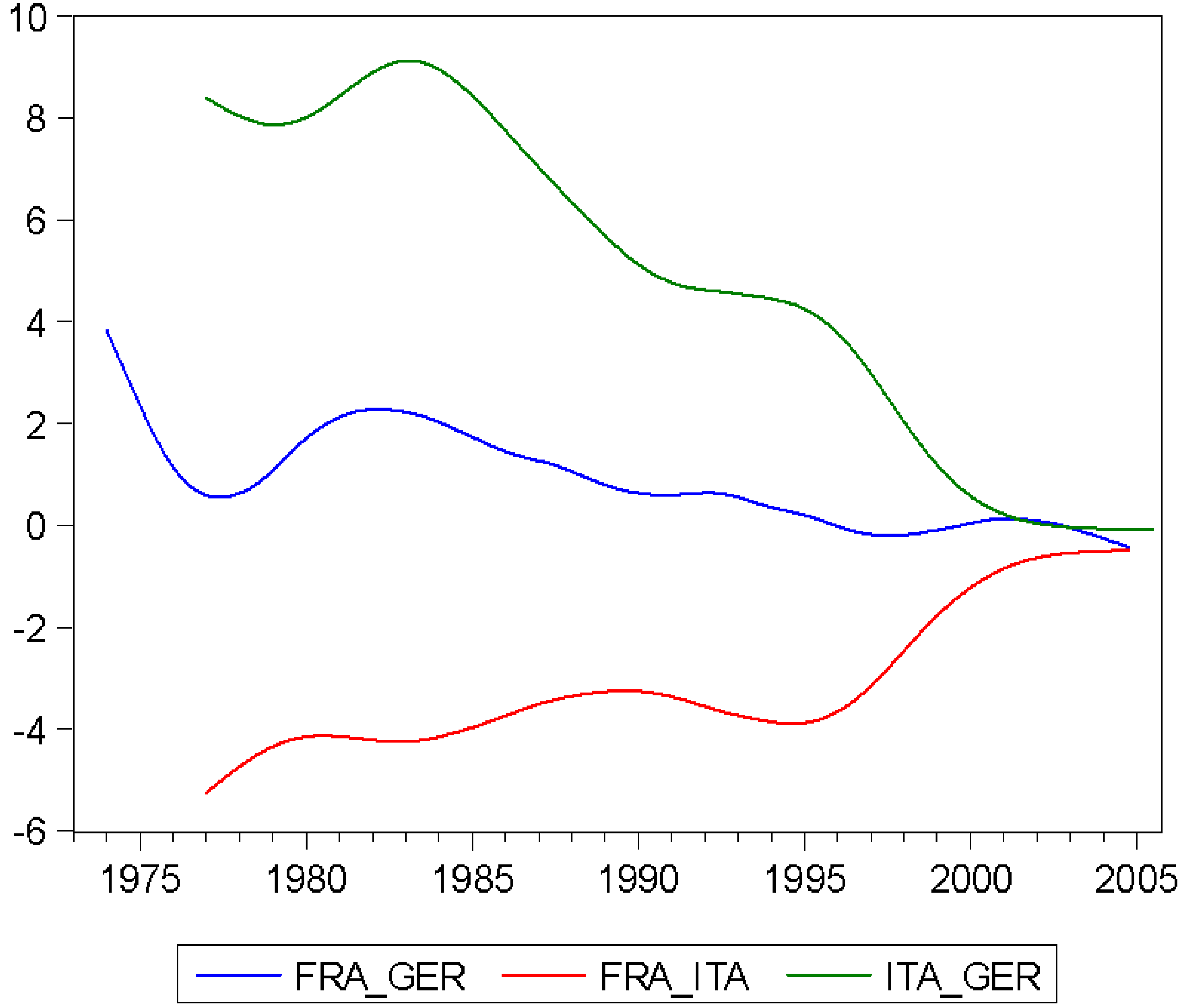
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