

Business Cycle Convergence in EMU: A Second Look at the Second Moment

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OUTLINE

- **Motivation**
- **Contribution**
- **Shocks and business cycle estimation**
- **Analysis of synchronization**
- **Costs of inclusion**
- **Conclusions**

MOTIVATION:

- Mundell (1961) and the costs of fixing the exchange rate:
 - Reacting to asymmetric shocks:
 - Exchange rate and interest rate policy
 - Wage flexibility and labour mobility
- OCA criteria
- A meta-criterion: *Symmetry of shocks or synchronization of business cycle* minimizes the cost of joining a currency area
- Common monetary policy in a currency area as a source of potential asymmetries: Symmetry in the transmission mechanism

MOTIVATION:

- Critiques to OCA theory:
 - The effective participation in a monetary union could change the structure and economic relations among the countries joining it
 - Endogeneity with trade integration, with financial integration
 - There is some evidence of endogeneities (with trade integration):
 - European Commission (1990) / Krugman (1991) controversy
 - Frankel and Rose (1998): (Empirically positive) relation between trade and business cycle

⇒ *Ex ante* < *Ex post* suitability to join a monetary union

MOTIVATION: The empirics of business cycle correlation in EU

- Four main issues:
 - Synchronization in EMU-12
 - Core – periphery debate
 - Enlargement of EMU
 - European idiosyncrasy vs global cycle

MOTIVATION: The empirics of business cycle correlation in EU

- Homogeneity in business cycles in Europe as much as in US (Agresti and Mojon, 2001, Wynne and Koo, 2000)
- Artis and Zhang (1997 and 1999) and Inklaar and De Haan (2001) controversy: evidence / no evidence of a systematic relationship between monetary integration (the ERM) and cycles homogeneity in Europe
- Convergence period in EMU-12 since the 90s (Angeloni and Dedola, 1999, Massman and Mitchell, 2003, Darvas and Szápari, 2005, Afonso and Furceri, 2008)
- Increase in EU heterogeneity during the 2000-2002 recession (Fidrmuc and Korhonen, 2004)

MOTIVATION: The empirics of business cycle correlation in EU

- Evidence of a core group
- Several new EU members showed highly synchronized cycles with the EMU-12 countries, especially Hungary, Poland and Slovenia (Artis *et al.*, 2004, Darvas and Szápari, 2005, Fidrmuc and Korhonen, 2004 and 2006, Afonso and Furceri, 2008)
- Synchronization among new EU members has also decreased during the 2000-2002 recession (Fidrmuc and Korhonen, 2004)
- The recent birth of a European business cycle is diluted within an international business cycle (Artis, 2003, Pérez *et al.*, 2007)

MOTIVATION: The empirics of business cycle dispersion in EU

Crespo-Cuaresma and Fernández-Amador (2010):

- A long period of sizeable and significant convergence took place in the 90s and finished with the inception of the monetary union in 1999, when a period of smooth divergence started
- A regime of more synchronization is obtained from 1996 onwards
- EMU core is more synchronized than EMU-12
- New members group has experienced a strong convergence since 1995 and thus, since 2004 is in a level of synchronization similar to that of the EMU-12
- A hypothetical EMU enlargement including the new EU members does not introduce distortion in synchronization after the crisis of 2001-2002, specially from 2004 onwards
- EMU-12 more synchronized than OCDE/Global specially since the beginning of the 90s (1992) until 2004, when dilution in a global cycle

CONTRIBUTION: Extension/Robustness of previous research

- We analyze the dynamics of dispersion of demand shocks and demand-GDP across countries in a group as a measure of cyclical synchronization (sigma-convergence)
- Procedure:
 - Estimation of **demand shocks and cyclical (demand) component** (SVAR Blanchard and Quah, 1989)
 - Crespo-Cuaresma and Fernández-Amador (2010) approach:
 - Compute the (weighted) cross-standard deviation series
 - Test for significant changes in dispersion
 - Identify convergence/divergence periods
 - Compute cost of inclusion for countries considered
- Groups considered: EMU-12, Core, New Members, EMU-22, International
- Series: GDP, CPI; 36 countries

SHOCKS AND BUSINESS CYCLES ESTIMATION

SVAR à la Blanchard and Quah (1989):

$$y'_{2t} = (\Delta\text{GDP, inflation})$$

$$\omega'_{2t} = (\text{demand shock, supply shock})$$

- **Stable VAR:**

$$y_{it} = K_{i1}y_{it-1} + K_{i2}y_{it-2} + \dots + \varepsilon_t = \sum_{j=0}^{\infty} L^j K_j y_{it-j} + \varepsilon_t$$

$$C_{i0} = 0$$

$$0 = C_i - \sum C_{i-j} K_j$$

- **Wold-MA representation:**

$$y_{it} = \varepsilon_t + C_{i1}\varepsilon_{it-1} + C_{i2}\varepsilon_{it-2} + \dots = \sum_{j=0}^{\infty} L^j C_j \varepsilon_{it-j} \Big/ \varepsilon_t \sim N(0, \Omega)$$

$$A\varepsilon_t = B\omega_t$$

- **Structural (shock) representation:**

$$y_{it} = B_{i0}\omega_t + B_{i1}\omega_{it-1} + B_{i2}\omega_{it-2} + \dots = \sum_{j=0}^{\infty} L^j B_j \omega_{it-j} \Big/ \omega_t \sim N(0, I)$$

SHOCKS AND BUSINESS CYCLES ESTIMATION

SVAR à la Blanchard and Quah (1989):

- Therefore the long-run total impact matrix:

$$\Xi_{\infty} = \sum_{j=0}^{\infty} C_j = (I - K_1 - \dots - K_p)^{-1} A^{-1} B$$

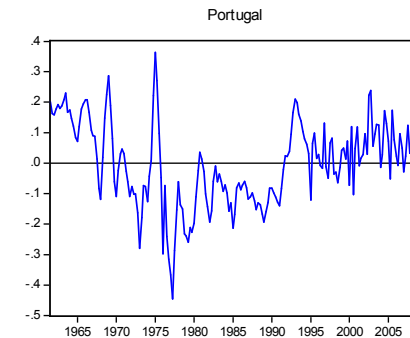
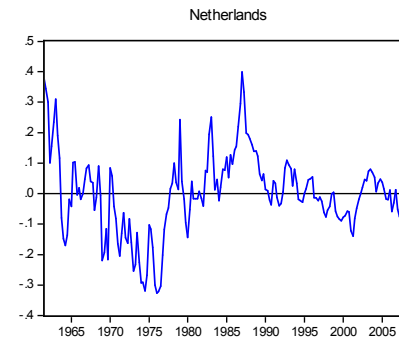
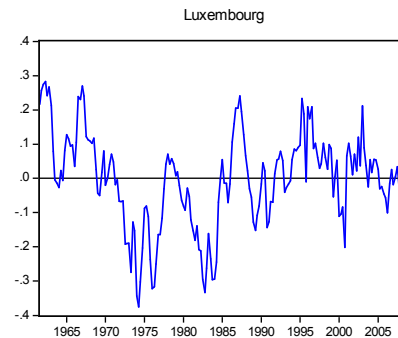
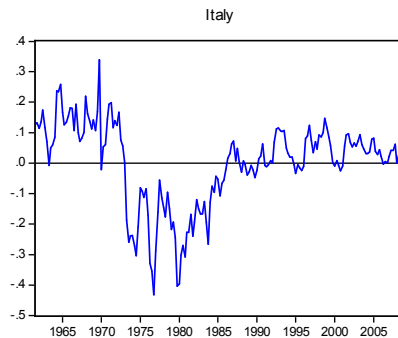
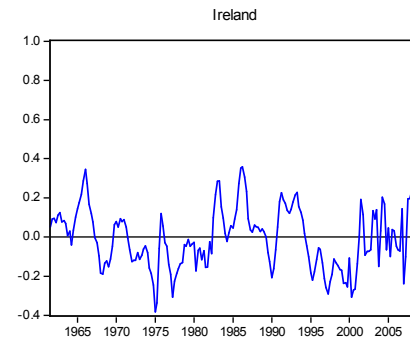
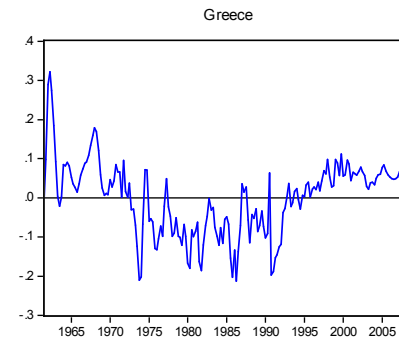
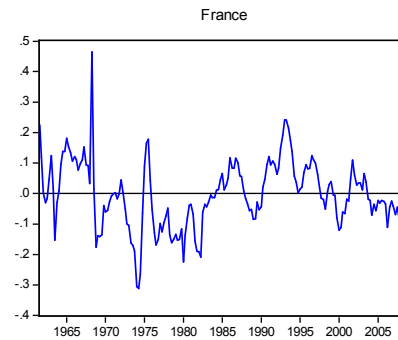
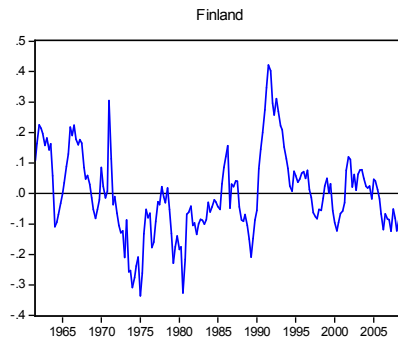
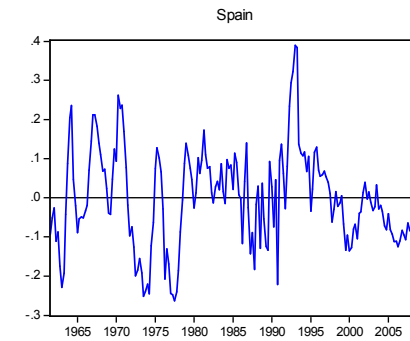
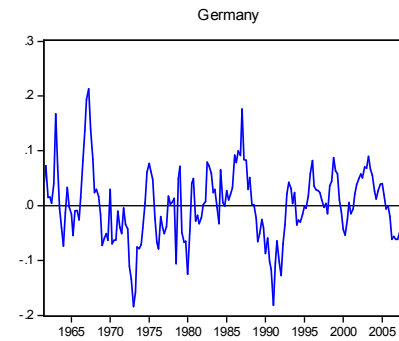
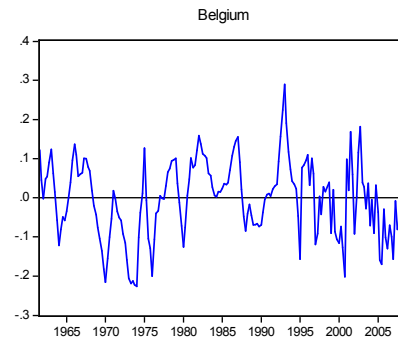
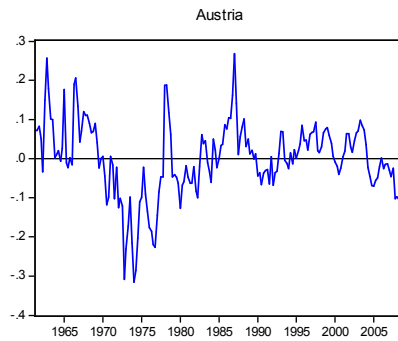
- Where we impose the long-run restriction: where $A = I$

$$\Xi_{\infty} = \begin{bmatrix} 0 & \xi_{12} \\ \xi_{21} & \xi_{22} \end{bmatrix}$$

- Finally we obtain $\Xi_{\infty}, \omega_{2t}$
- We can analyze the impulse response functions to *1%std* impulse to both shocks
- And we can retrieve the supply component of GDP (adding a linear trend and an intercept term) and the demand component of GDP

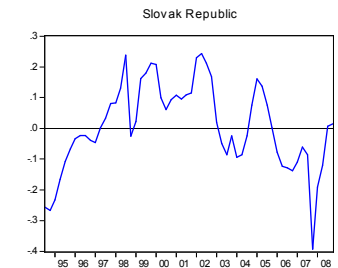
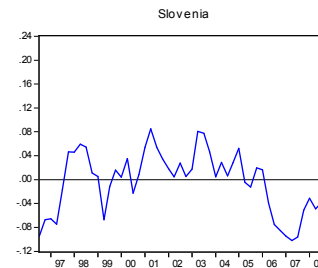
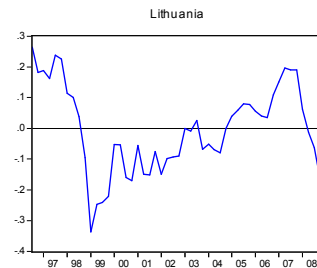
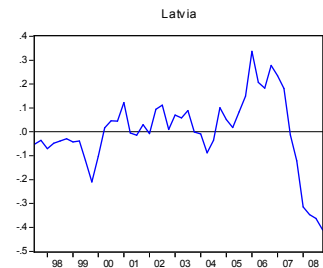
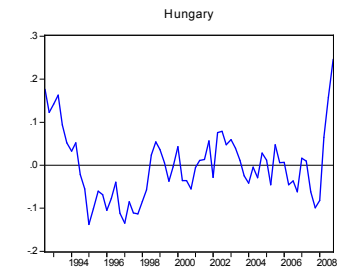
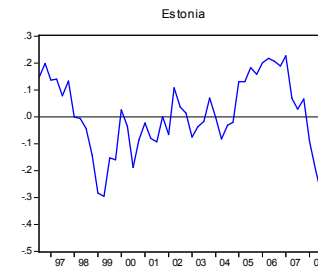
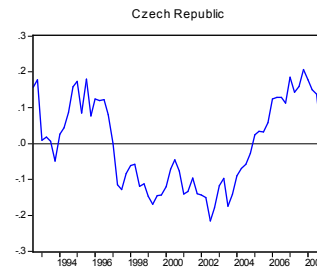
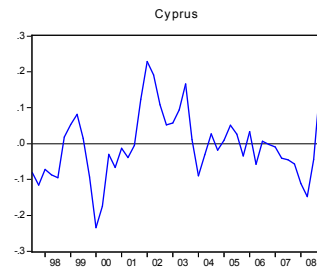
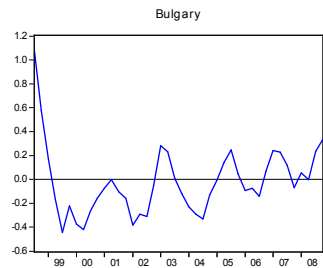
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- Costs of inclusion
- Conclusions

SHOCKS AND BUSINESS CYCLES ESTIMATION



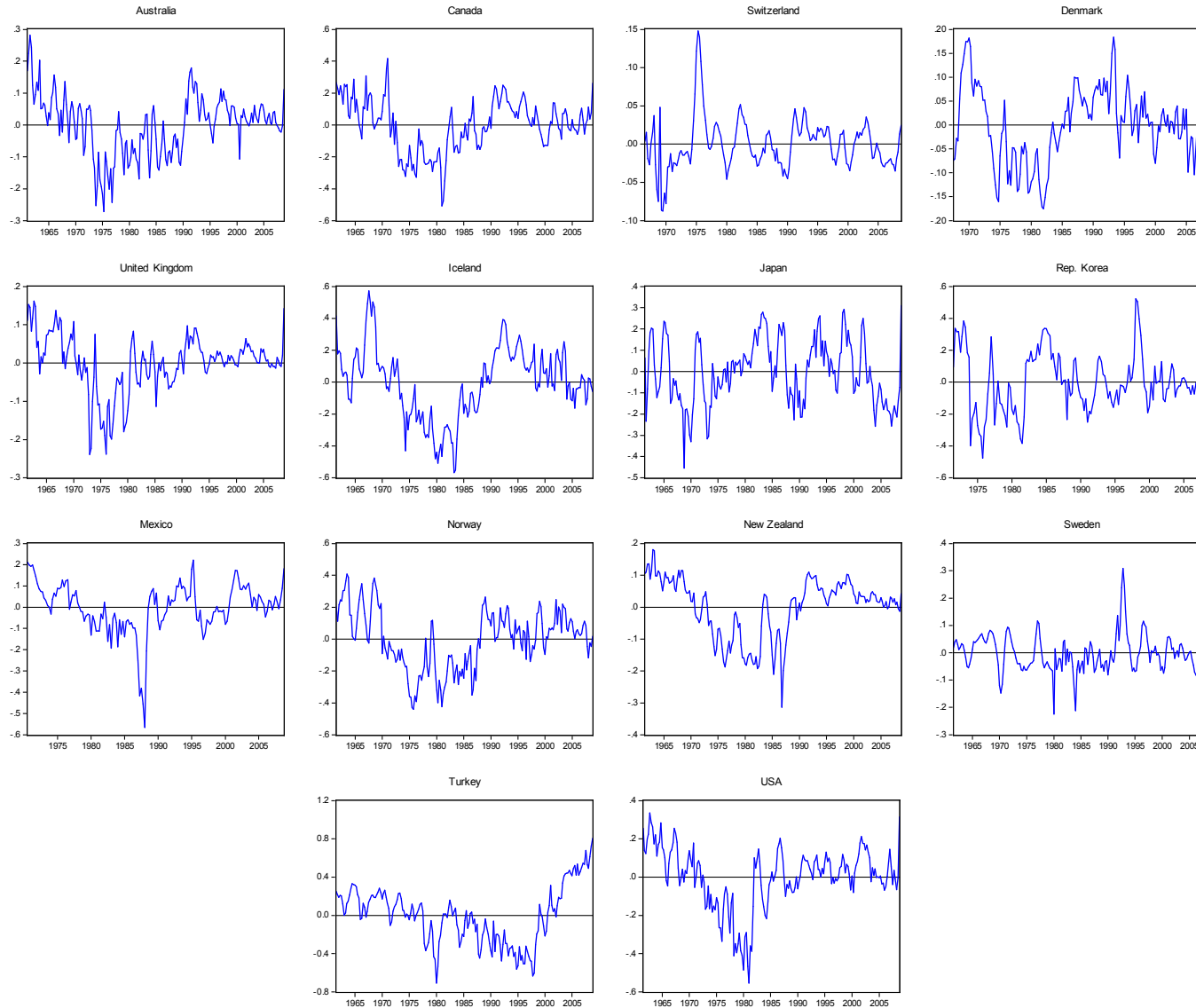
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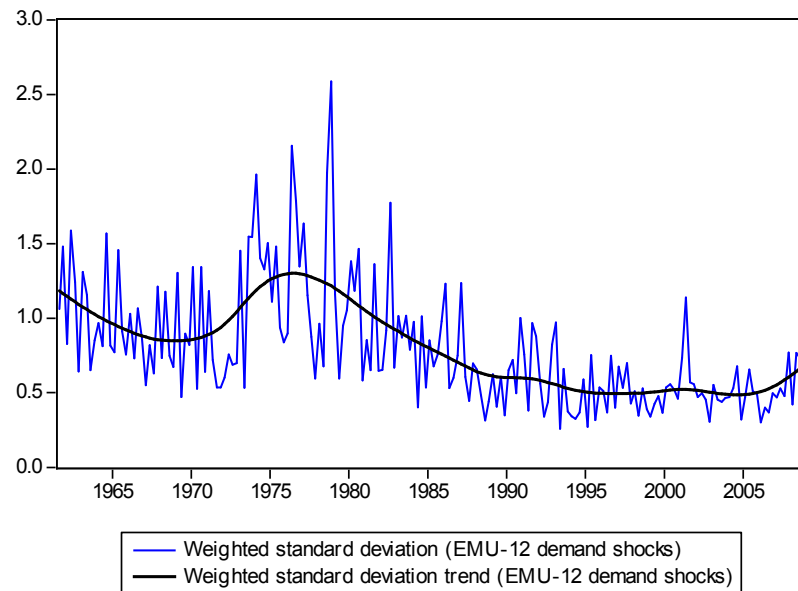
SHOCKS AND BUSINESS CYCLES ESTIMATION



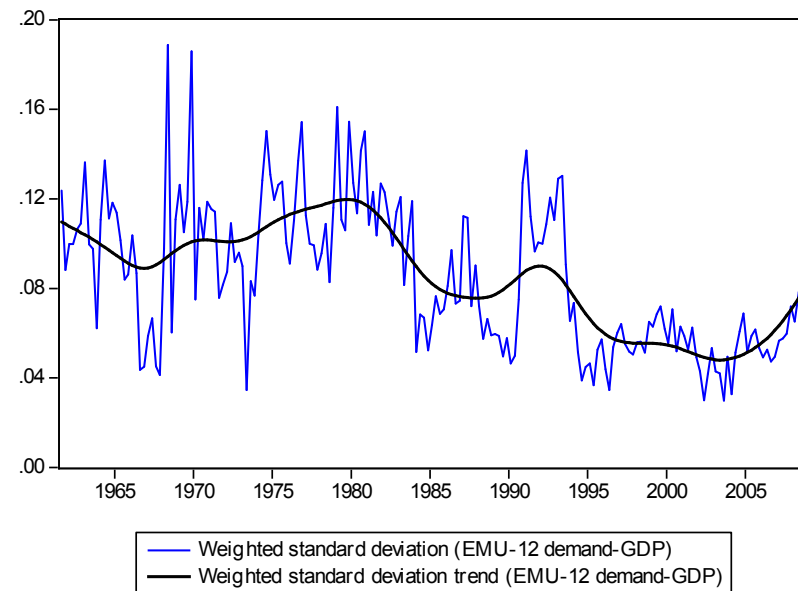
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ANALYSIS OF SYNCHRONIZATION: Standard deviation series

Demand shocks



Demand-GDP



ANALYSIS OF SYNCHRONIZATION: Carree-Klomp (1997) test

- Test for equality of variances:

$$T_{2,t,\tau} = (N - 2.5) \log[1 + 0.25(\hat{\sigma}_t^2 - \hat{\sigma}_{t+\tau}^2)^2 / (\hat{\sigma}_t^2 \hat{\sigma}_{t+\tau}^2 - \hat{\sigma}_{t,t+\tau}^2)]$$

Distributed as a $\chi^2(1)$ under the null of no change in the variances

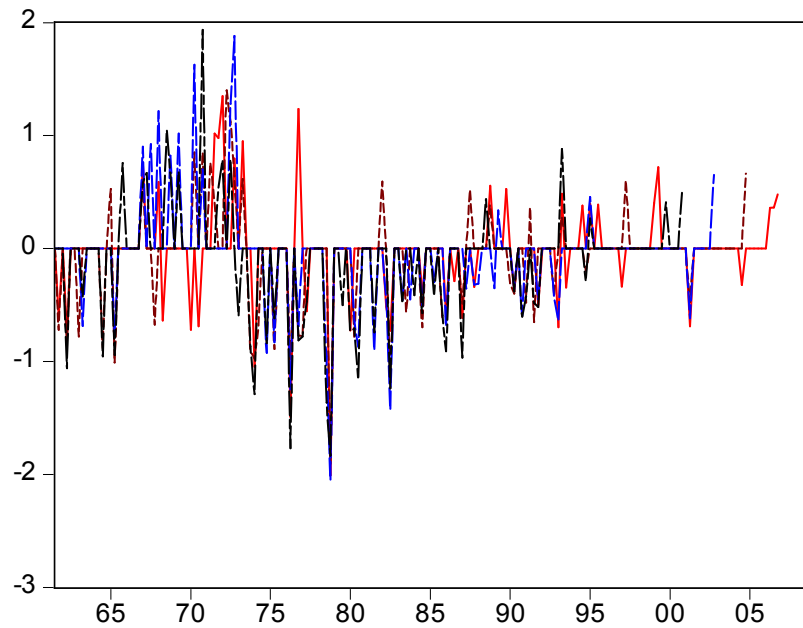
- Identification of convergence/divergence periods at different horizons:

$$(\sigma_{t+\tau} - \sigma_t) I[T_{2,t,\tau} > \chi_{0.95}^2(1)]$$

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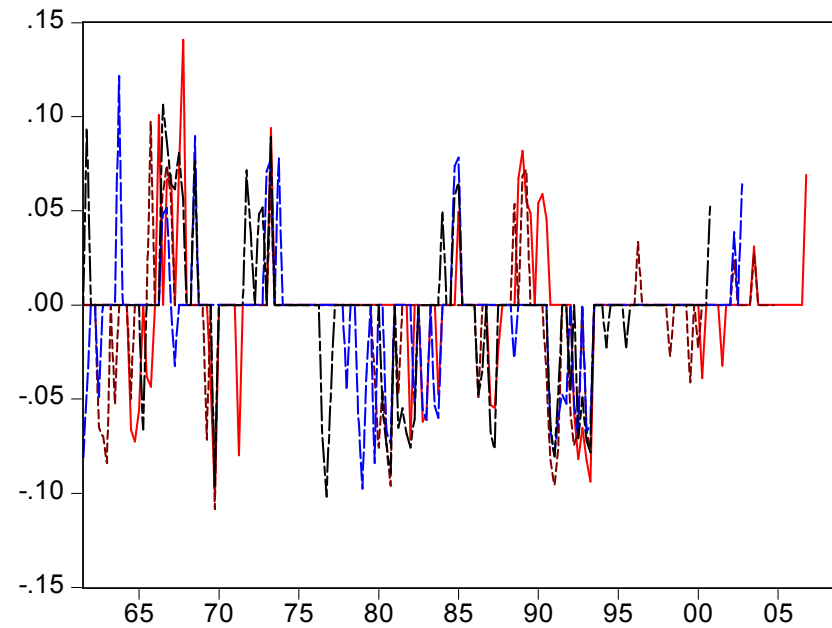
ANALYSIS OF SYNCHRONIZATION: Carree-Klomp (1997) test

Demand shocks



— Significant changes 2 years (demand shocks)
- - - Significant changes 4 years (demand shocks)
- - - Significant changes 6 years (demand shocks)
- - - Significant changes 8 years (demand shocks)

Demand-GDP



— Significant changes 2 years (demand-GDP)
- - - Significant changes 4 years (demand-GDP)
- - - Significant changes 6 years (demand-GDP)
- - - Significant changes 8 years (demand-GDP)

ANALYSIS OF SYNCHRONIZATION: Bai-Perron (1998, 2003)

- A parametric approach: Approximate the dynamics of the dispersion series with an AR(r) process and assess the existence of structural breaks using the Bai and Perron's (1998 and 2003) methodology

- Given the specification:

$$\hat{S}_t = \sum_{j=1}^R (\alpha_{0,j} + \alpha_{1,j} \hat{S}_{t-1} + \dots + \alpha_{r,j} \hat{S}_{t-r}) I(T_{j-1} \leq t < T_j) + \varepsilon_t$$

- Estimate the breakpoints as:

$$\{\hat{T}_1, \dots, \hat{T}_{R-1}\} = \arg \min \sum_{t=1}^{T_R} \hat{\varepsilon}(T_1, \dots, T_{R-1})_t^2$$

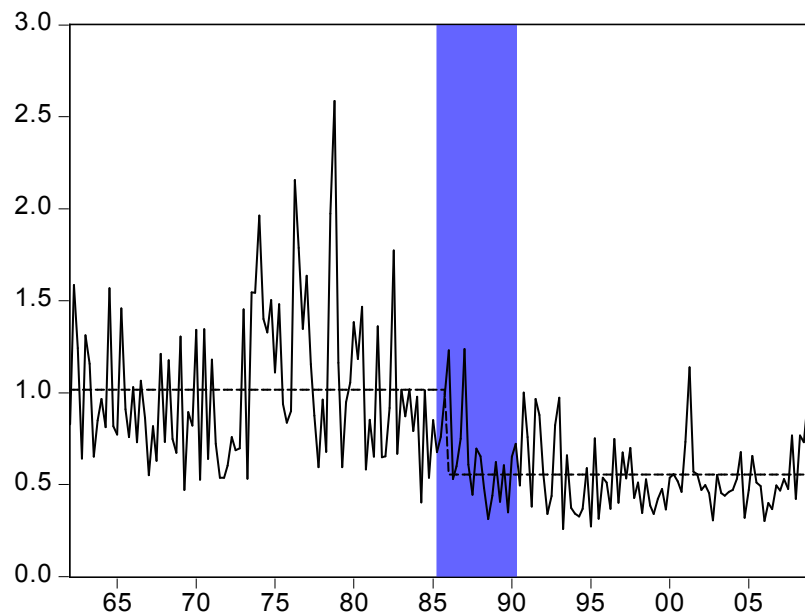
- Testing problems:

- Lack of identification of the breakpoints under the null
- Simulate the *sup-F* test under the null (Bai and Perron, 1998 and 2003)

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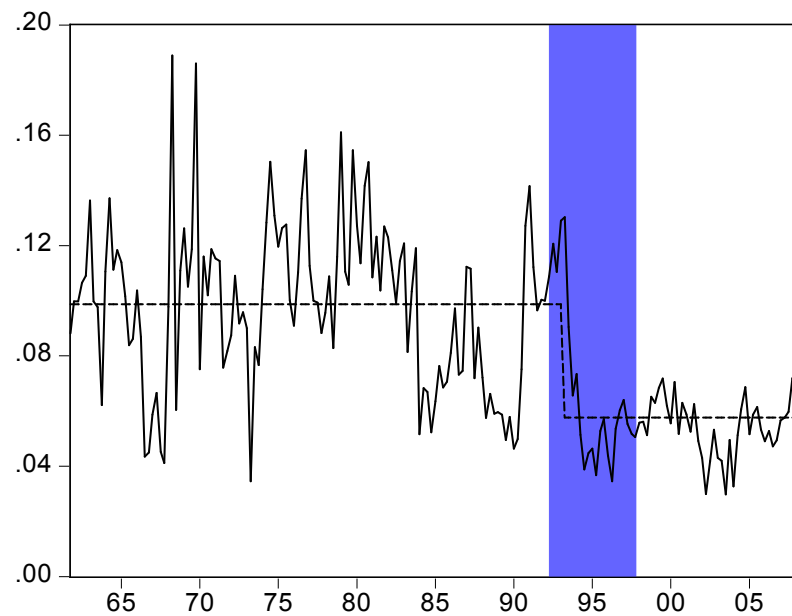
ANALYSIS OF SYNCHRONIZATION: Bai-Perron (1998, 2003)

Demand shocks (1986/1)



— Weighted standard deviation (EMU-12 demand shocks)
---- Unconditional expectation (partial SC - intercept)

Demand-GDP (1993/2)



— Weighted standard deviation (EMU-12 demand-GDP)
---- Unconditional expectation (partial SC - intercept)

ANALYSIS OF SYNCHRONIZATION: Comparative

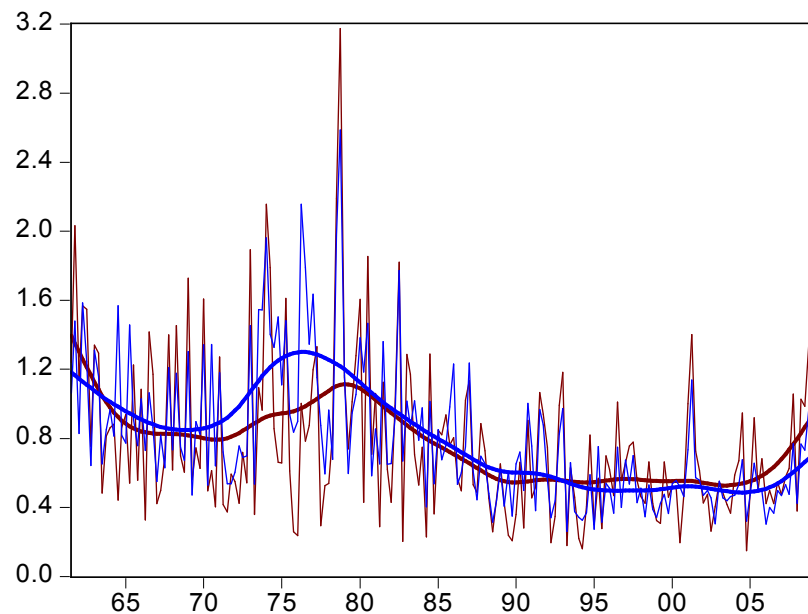
- How would the optimality of EMU with the inclusion of all the new members?
 - Consider the following groups:
 - Core
 - NEWs and EMU-22
 - Global
- How would each country contribute to the optimality of EMU?

Cost of inclusion of country j in period t

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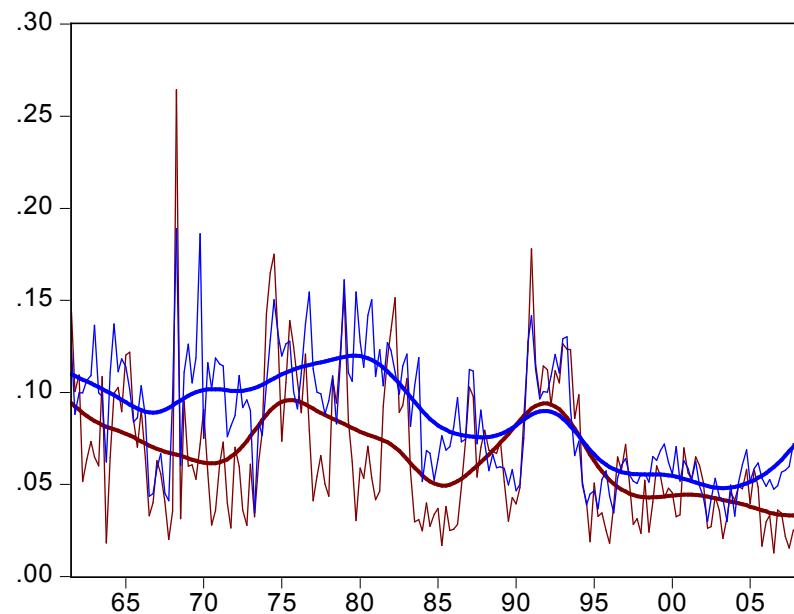
ANALYSIS OF SYNCHRONIZATION: Comparative core

Demand shocks



— Weighted standard deviation (Core demand shocks)
— Weighted standard deviation trend (Core demand shocks)
— Weighted standard deviation (EMU-12 demand shocks)
— Weighted standard deviation trend (EMU-12 demand shocks)

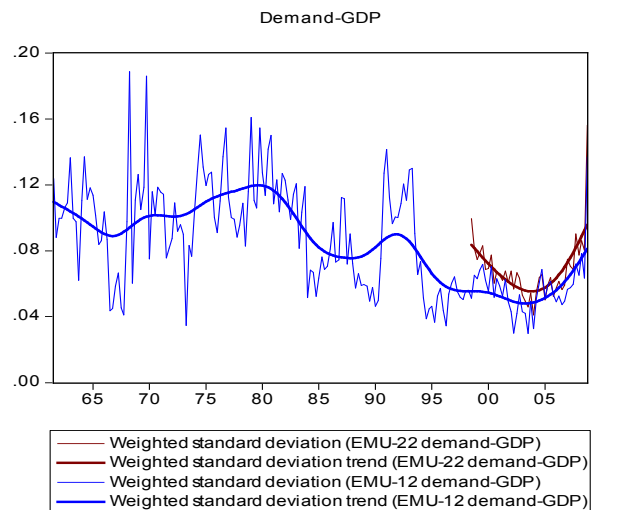
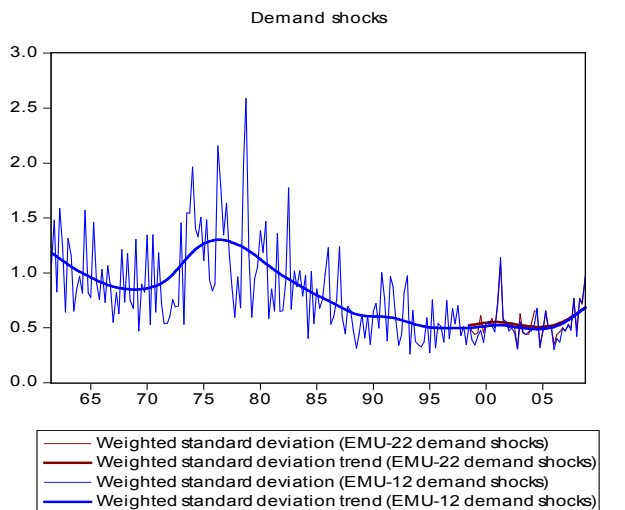
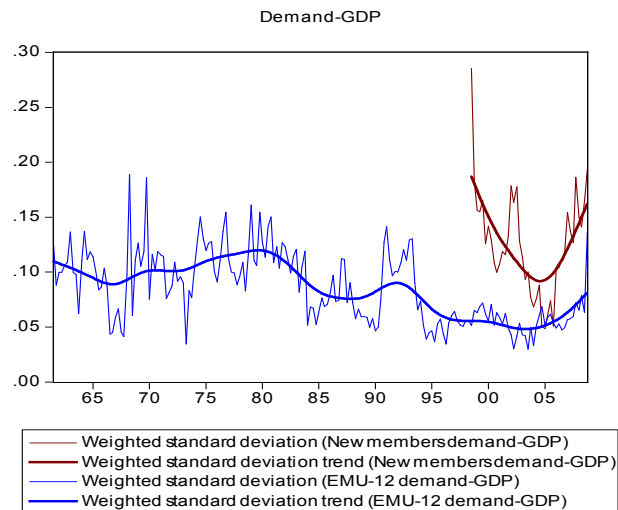
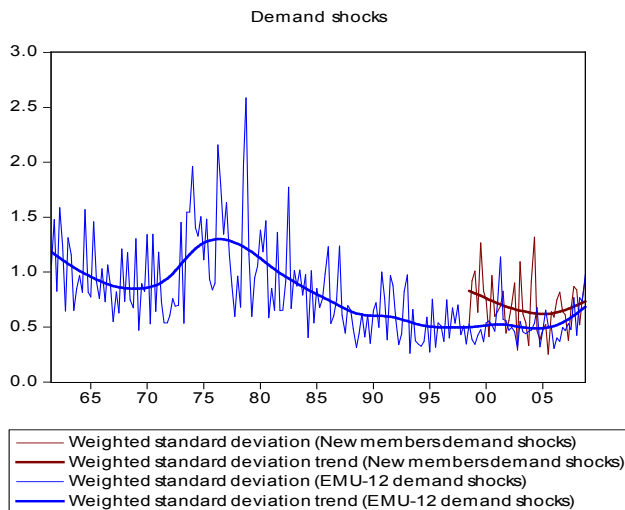
Demand-GDP



— Weighted standard deviation (Core demand-GDP)
— Weighted standard deviation trend (Core demand-GDP)
— Weighted standard deviation (EMU-12 demand-GDP)
— Weighted standard deviation trend (EMU-12 demand-GDP)

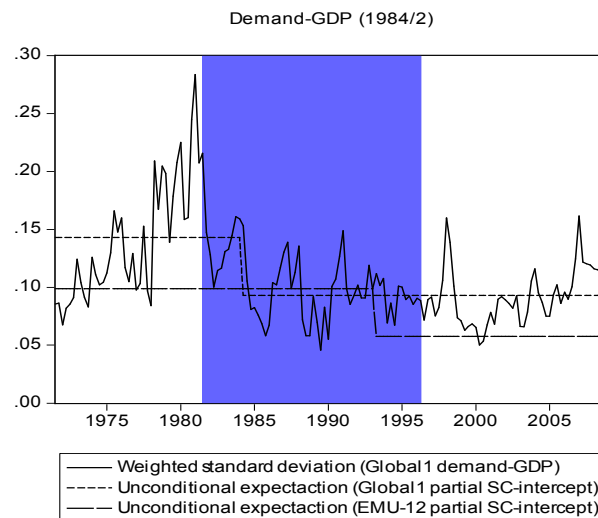
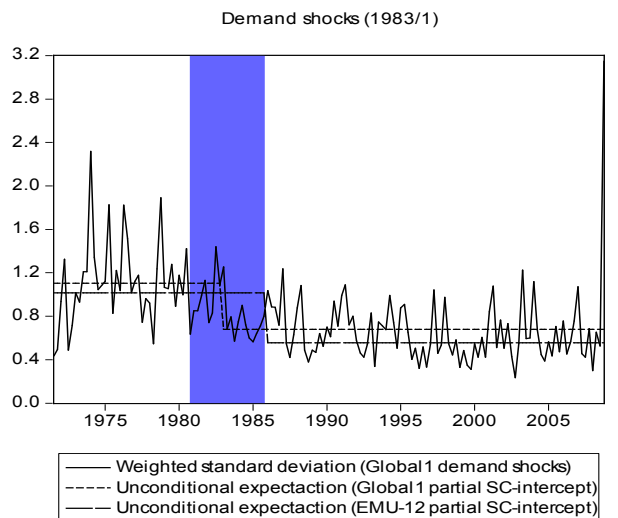
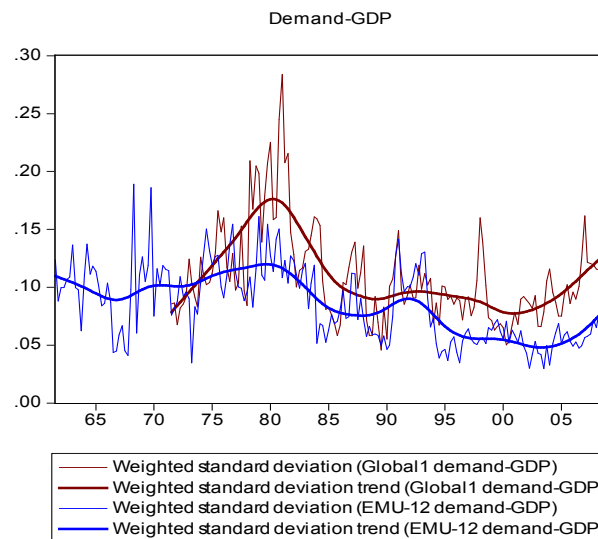
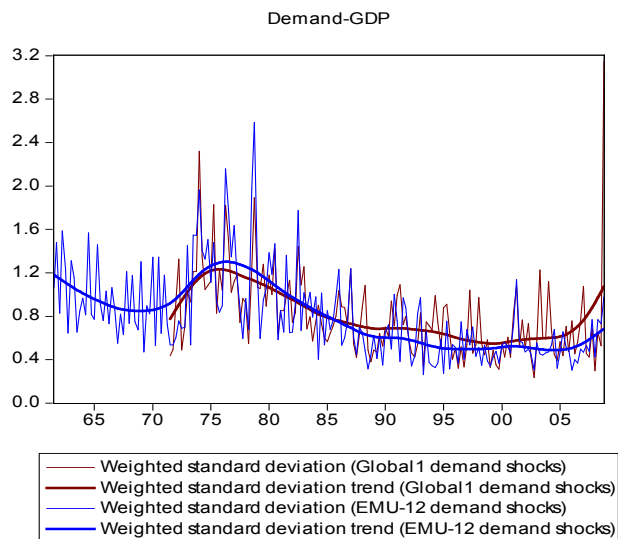
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ANALYSIS OF SYNCHRONIZATION: Comparative enlargement



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ANALYSIS OF SYNCHRONIZATION: Comparative global



COSTS OF INCLUSION:

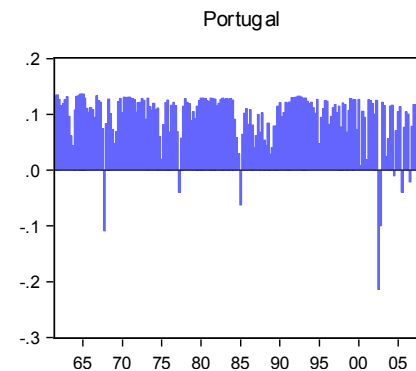
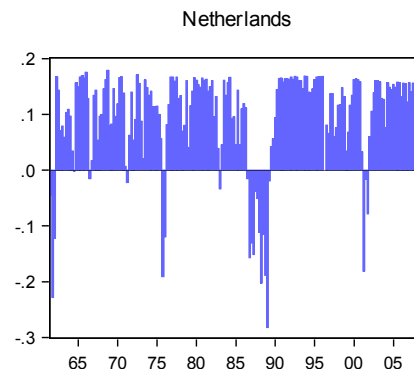
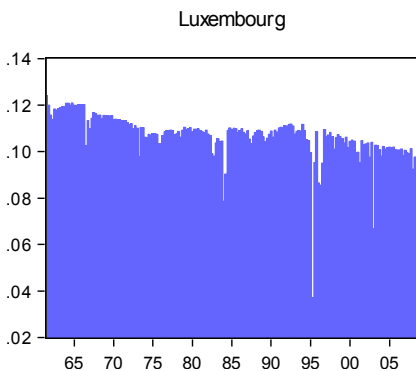
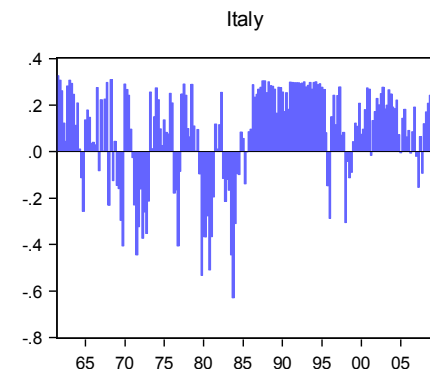
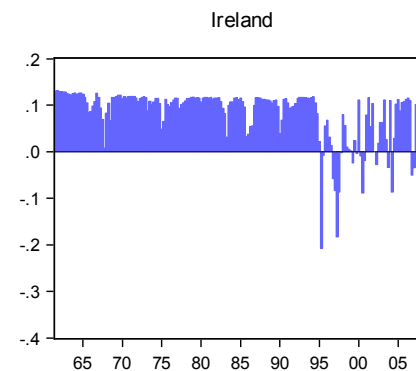
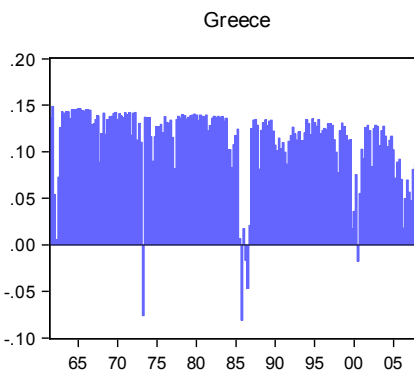
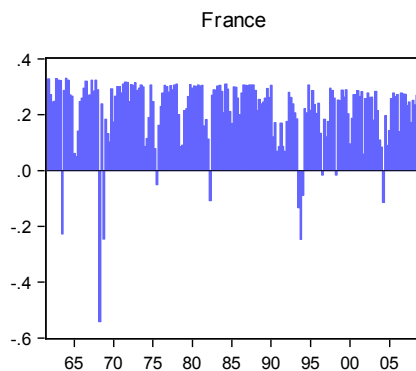
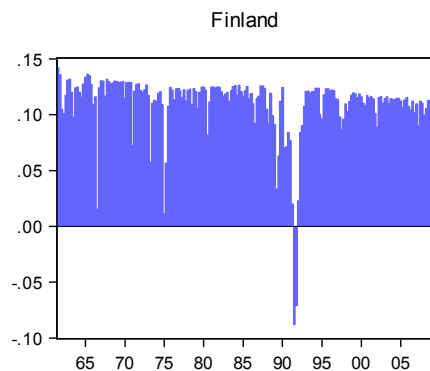
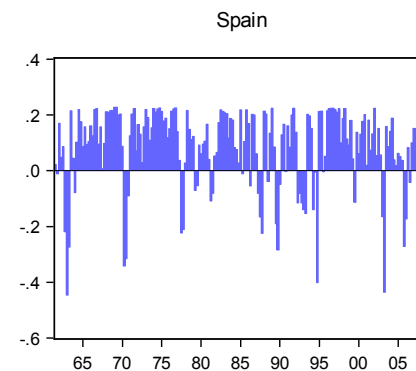
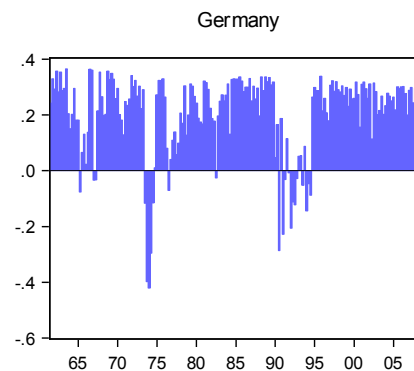
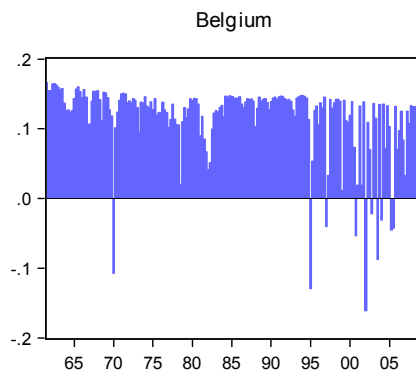
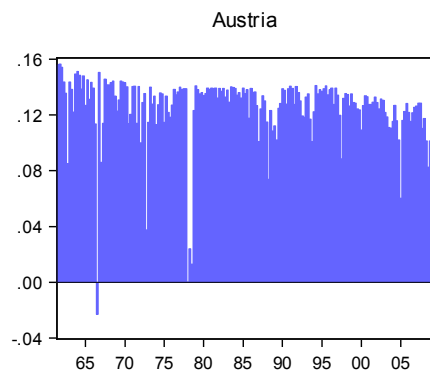
$$coi_{t,j|\Omega} = \frac{(\sigma_{t,\Omega-j} - \sigma_{t,\Omega})}{\sigma_{t,\Omega}}$$

$coi_{t,j|\Omega} > 0 : \sigma_{t,\Omega-j} - \sigma_{t,\Omega} > 0$: benefit of country j

$coi_{t,j|\Omega} < 0 : \sigma_{t,\Omega-j} - \sigma_{t,\Omega} < 0$: cost of country j

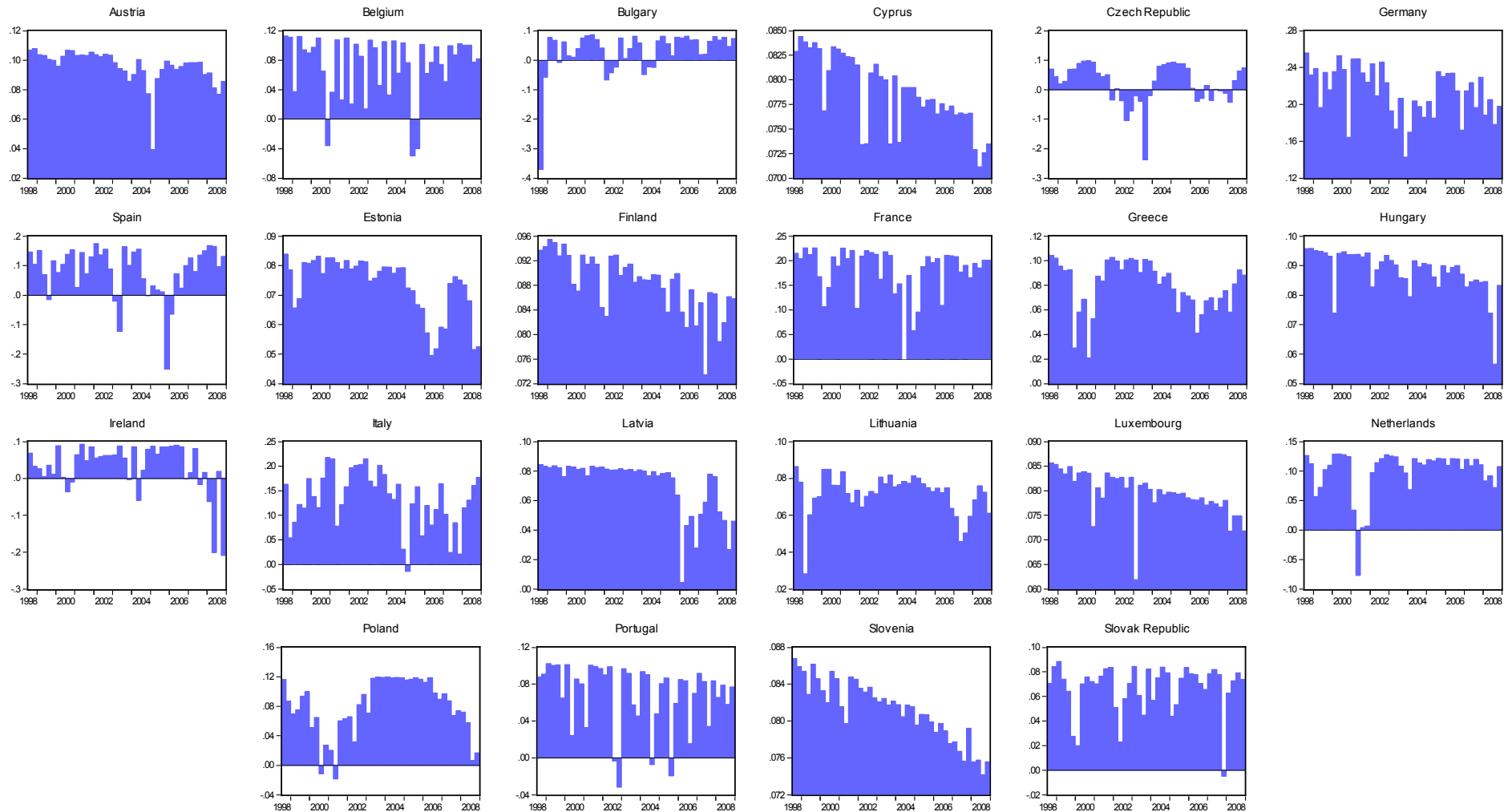
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COSTS OF INCLUSION: EMU-12



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COSTS OF INCLUSION: EMU-22



CONCLUSIONS:

- Eurozone converged to a stable lower level of dispersion in demand shocks from the late-80s and demand-GDP first-90s
- This is supported by similarities in propagation mechanisms
- Convergence diluted core differentials till 2005
- The NEWs experienced strong convergence as a group till 2005, when dispersion increases.
- The inclusion of NEWs does not imply any distortion in the optimality of EMU
- Evidence of a European business cycle during the 90s, not diluted in a global cycle
- In line with Crespo-Cuaresma and Fernández-Amador (2010)

CONCLUSIONS:

- Assessing the Euro adoption requires considering more criteria (determinants of business cycle synchronization): After the Euro adoption...
 - Evidence on nominal convergence
 - Trade and FDI promotion
 - Financial integration enhancing
 - Broad fiscal coordination preferred and only supply shocks induce to deviations from agreement, fiscal shocks-smoothing improved in enlarged EMU
 - Enough labour markets flexibility in the new EU-members

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