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Dynamics of Structural Shocks and the Euro Adoption Process

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Dynamics of Structural Shocks and the Euro Adoption Process

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Abstract

The objective of this article is to analyse the structural shocks convergence between Central European countries and the euro zone over time in order to determine more precisely the timing of the euro adoption process. For our purposes, we first identify these shocks using a traditional structural VAR model and then use a dynamic space-state model estimated by applying the Kalman filter technique.

Our estimation results show relatively low real and high monetary shocks convergence between the two areas, especially compared to previous experiences, namely of Greece, Ireland, Portugal and Spain. However, considering that supply shocks are more relevant when determining the feasibility of the euro adoption, the CEC economies should still preserve some independency of their monetary policies.

JEL Classification: C32, F42

Keywords: structural shocks, the euro adoption, SVAR, Central European countries, dynamic space-state model, Kalman filter

1 Introduction

[1] Recently, the European Monetary Union was enlarged for the second time with the adhesion of Slovenia as the thirteenth member. Soon, other new EU countries are going to adopt the common currency, i.e. Malta and Cyprus first and the Baltic Republics later, and the Central European Countries probably in 2009-2010.
Even if, the exact calendar of the euro adoption still remains an open question, this second EMU enlargement seems to be a good occasion to bring in the foreground, once again, the discussion about the pros and cons of joining the eurozone.

The long-term benefits of monetary integration, such as lower transaction costs, more financial stability and economic integration, are well known and widely accepted. But, it is the short-term costs of the process which postpone each decision to join the single currency.

One of the most obvious costs is the necessity to verify the Maastricht criteria, which could be incompatible with the economic catching - up of the new countries. We can take as an example the inflation criterion, which must be verified in the context of higher productivity growth when the nominal exchange rate stability must also be maintained. Moreover, the exchange rate stability must be hold even in the case of increased capital flows and where all barriers to their free movement are removed.

Another important cost is linked to the probability of asymmetric real shocks in the accession countries. Indeed, if this type of shocks occurs and

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monetary policy is no longer a national issue, losses in economic output and increase in unemployment could be very significant. So, if a country is touched by real supply shocks, its exchange rate will not longer generate a rapid adjustment in international prices to compensate for output losses and restore equilibrium (Mundell, 1961).

On the other hand, a great real demand shock assymetry could also be problematic because the frequency of those shocks will not decrease with the euro adoption, contrary to nominal demand shocks, since fiscal policy matters remain in the hands of national governments (see supra).

So, each decision about if and how quickly to adopt the euro should be based on a comparison between these costs and benefits (De Grauwe, 2005).

In this study we concentrate on the latter-mentioned issue, namely on the analysis of structural shocks convergence between four Central European countries (CECs afterwards): Hungary, Poland and the Czech and Slovak Republics, and the euro zone (approximated here by Germany). Indeed, we think that it would be interesting to determine not only what type of structural shocks is affecting the accession countries, but also if and how they change over time with the progress in economic catching-up of the new countries and in economic integration among the EU members[2]. This kind of analysis, especially compared to the previous experiences of the periphery countries, such as Greece, Ireland, Portugal and Spain, could be helpful to

[2]Indeed, some authors supporting the endogeneity of the Optimum Currency Area (OPA) criteria find a strong relationship between economic integration and shocks correlation. So, "countries which join EMU, no matter what their motivation may be, may satisfy OCA properties ex-post even if they do not ex-ante!" (Frankel and Rose, 1997)

determine a more precise calendar for the adoption of the euro.

Our approach consists of two steps:

- First, we identify the type of the structural shocks by using a conventional structural vector autoregressive (VAR) model with the appropriate restrictions as developed by Clarida and Gali (1994).

  In the case of the new EU countries, a similar method has been used, for example, by Horvath (2001), Fidrmuc and Korhonen (2003), Gros and Hobza (2003) or Borghijs and Kuijs (2004). In general, authors‘ findings suggest that smaller CECs economies are more affected by nominal shocks than the bigger countries, which economies are touched by real shocks. But their results also confirm a significant shocks asymmetry for many advanced accession countries compared to the euro zone.

- Secondly, we estimate a dynamic space-state model by using the Kalman filter technique to obtain the evolution of the shock convergence between the CECs and the EMU economies.

  Here, we apply the approach initiated by Boone (1997) and then introduced by Zhang and Sato (2005), and Cortinhas (2006) to assess the possibility of a monetary union between selected Asian countries.

  Some elements of this approach had also been used by Babecki *et al.* (2003) to analyse exchange rate regimes and shock asymmetry in accession countries[3]. Their estimations results show the progressing conver-

[3] To our knowledge, there is no other analysis treating dynamics of shock asymmetry in the new EU countries. Indeed, most of the literature focuses on structural shock correlation from the static point of view.

gence in nominal shocks, but also the increase in supply shock asymmetry between the studied economies.

Our findings confirm a general intuitive assumption that structural (real) asymmetry between the CECs economies and the euro zone remains rather high, even if a decreasing trend could be visible for some countries, e.g. Poland.

Moreover, we also find a quite spectacular convergence between the monetary shocks touching the two zones. The former could be explained by the transition process of the new countries that is still not finished. The later is due to the fact that the CECs authorities have aligned their monetary policies to this of the European Central Bank (ECB).

The rest of the paper is organized as follows. The methodology and data are presented in section 2. Section 3 explains the main estimation findings and political implications. Section 4 concludes.

2 Methodology and Data

The presentation of the methodology is divided into two parts. First, we concentrate on the estimation of a VAR model and then on the method applied to estimate a dynamic space-state model.

2.1 Structural shocks identification

Following the conventional approach, we apply to our trivariate VAR model of real output, prices and the real exchange rate the Blanchard and Quah (1989) long - term restrictions. In so doing, we are able to identify real supply, real demand and monetary shocks touching the countries under consideration.

More precisely, we impose the following restrictions on the matrix of the long-term shock effects:

1. Monetary shocks, such as modifications in money supply, have no permanent influence either on output or on the real exchange rate.
2. Real demand shocks to government spending or changes in fiscal policy have no long-term effect on output[4].
3. So, in the long run, changes in output depend only on productivity and demographic shocks.

Taking into account the above-mentioned restrictions, our VAR model form is as follows:

$$\begin{pmatrix} dy_t \\ drer_t \\ dp \end{pmatrix} = \begin{pmatrix} a_{11} & 0 & 0 \\ a_{21} & a_{22} & 0 \\ a_{31} & a_{32} & a_{33} \end{pmatrix} \begin{pmatrix} \varepsilon_s t \\ \varepsilon_d t \\ \varepsilon_m t \end{pmatrix} \tag{1}$$

So, for estimation purposes, we assume that real GDP (y), consumer prices (p) and the real effective exchange rate (rer) follow a stationary stochastic processes responding to three orthogonal shocks: real supply shocks ($\varepsilon_s t$), real demand shocks ($\varepsilon_d t$), and nominal demand shocks ($\varepsilon_m t$).

Our data are logarithmic and the model is estimated in first difference given the unit root test, which concludes that the variables are I (1). The

[4]We suppose that both aggregate demand and supply shocks affect the real exchange rate defined as the realtive price of nontradables to tradables. So, for exemple, an increase in government spending, which falls heavily on nontradable goods, leads to an appreciaiton through its impact on the realtive prices (Rogoff, 1992)

cointegration tests indicate that a VAR model in first differences is the correct specification. We chose two lags estimation for all countries on the basis of lag length tests. And the VAR model is estimated without a deterministic trend and cointergration terms.

The estimation results are used to recover the original real and nominal disturbances (see Annex A for details), and then static and dynamic convergence of structural shocks are determinated.

2.2 Time-varying estimation of structural shocks

To determine the dynamics of shocks touching the CECs economies, we proceed to time-varying estimation of the space-state model by using the Kalman filter technique.

More precisely, we apply the method initiated by Boone (1997), which could be presented using the following measurement equation of the space-state model:

$$(\epsilon_t^i - \epsilon_t^j) = \alpha_t + \beta_t(\epsilon_t^i - \epsilon_t^k) + \omega_t \tag{2}$$

Where ϵ_t represents the previously identified real and nominal structural shocks. Superscripts i denotes each of accession countries, j denotes the euro zone and k - the rest of the word approximated as usual by the USA.

α_t and β_t are time-varying coefficients, whose dynamics are described by the transition (state) equation of the model:

$$\alpha_t = \alpha_{t-1} + \mu_{1t} \quad (3)$$

and

$$\beta_t = \beta_{t-1} + \mu_{2t} \quad (4)$$

ω_t and μ_t are independent, normally distributed error terms with zero mean and a constant variance R and Q.

To estimate our model, some previous conditions have to be established.

1. Given that the starting value of the state coefficients and those of the variance-covariance matrix of the state equation are necessary, we perform the OLS estimations to assess them (Zhang *et al.*, 2005).

2. It is important to note that, the "signal-to-noise ratio", which is the ratio of the variance of residuals from the transition and measurement equations (Q/R), has a great influence on the estimation results. So, as a second step, its value must be set in such way as not to put too much of the explanatory power on unobserved variables (Q large) and to avoid estimating the time-varying coefficients as constants (Q small). Generally, the Q/R ratio is included between 0.1 and 0.4 (Boone, 2000). In so doing, the model equations fit rather well the real economic relations and the estimations of unobservable variables are relatively smooth. Testing different possibilities, we set the Q/R ratio at 0,1, i.e. Q=1, R= 0,1, for all studied countries.

3. Finally, we suppose that shock asymmetry between the CECs and the euro zone economies decreases if both coefficients α_t and β_t tend toward zero. In this case, shocks affecting a CEC economy are entirely

explained by shocks touching the euro zone. On the other hand, if the coefficient β_t tends to one, the asymmetry between these two areas increases because the rest of the world contributes more to the CECs‘ economy fluctuations than the euro zone.

2.3 Data, variables, estimation period

We use semi-annual data transformed from quarterly one provided by the IMF‘s International Financial Statistics. The motivation behind such a choice is the fact that quarterly data are very informative, but also a little too noisy to determine a general trend of shock dynamics in a credible fashion. The common solution in the literature is the use of annual data, but our estimation period is too short. Indeed, the analysis covers the period from 1995 to 2006 to avoid distortions from structural changes at the beginning of the CECs‘ transition process. In the case of the periphery countries used here as a benchmark for the new ones, we also use semi-annual data covering exactly the same lap of time as we dispose for the CECs, i.e. eleven years before the euro adoption.

The choice of variables, i.e. real GDP, the consumer price index and the real effective exchange rate is rather common in this kind of analysis. Real GDP is calculated using the GDP deflator (IFS databases).

Finally, we decide not to transform the original data into relative variables to capture asymmetric shocks for the obvious reason that the former do not take into account propagation mechanism and individual country reaction to each shocks.

3 Results

The presentation of estimation results is divided into two parts. The first part reports the correlation coefficients of shocks as identified by the structural VAR model. The second one presents these shocks‘ dynamic paterns as given by the space-state analysis.

3.1 Static correlation of shocks

The results of the static correlation analysis indicate a significant real asymmetry between the two areas. Indeed, the time-average correlation coefficients of supply shocks are generally highly negative for all new countries, whereas those of real demand shocks are close to zero.

Table 1: *Correlation of structural shocks between the CECs and the euro zone*

	Czech Rep.	Hungary	Poland	Slovak Rep.
Monetary Shocks	0,27	0,2	0,26	0,16
Real Demand Shocks	-0,07	-0,05	-0,06	-0,18
Supply Shocks	-0,43	-0,25	-0,7	-0,04

Regarding the correlation coefficients of monetary shocks, we can observe a rather significant symmetry between the CECs and the euro zone economies.

The above-mentioned findings are even more important if we compare them to those of the periphery countries.

Table 2: *Correlation of structural shocks between the periphery countries and Germany*

	Greece	Ireland	Portugal	Spain
Monetary Shocks	-0,29	0,08	0,17	0,20
Real Demand Shocks	-0,29	0,06	0,03	-0,28
Supply Shocks	0,53	0,23	0,16	0,1

Indeed, structural asymmetry of the CECs economies is much more problematic, given the fact that supply shocks are highly correlated between the periphery countries and Germany during the period preceding the EMU creation. However, no significant correlation of the real demand shocks could be found and the time-average correlation coefficient of monetary shocks is even lower in the case of the periphery countries and Germany than the CECs and euro zone.

Several conclusions can be drawn from this analysis.

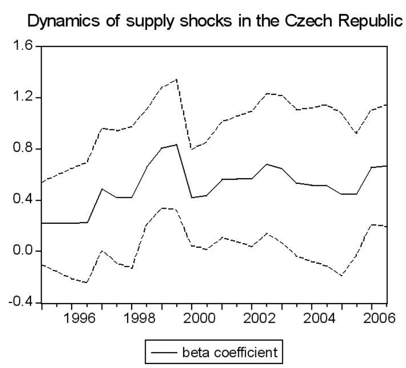
- First, the monetary shocks symmetry and the real demand asymmetry suggest a high degree of monetary policy alignment and a low degree of fiscal policy coordination between the CECs and euro zone.
- Second, the CEC economies show a high degree of structural asymmetry, so the probability of asymmetric shocks might still be high, which requires some independancy of their monetary policies.

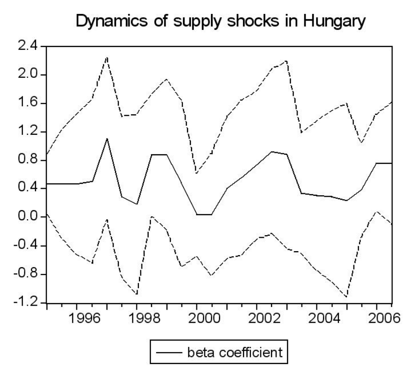
However, this analysis does not take into account the possibility of changing relationships in the asymmetry of structural shocks over time. That is why we estimate a dynamic space-state model using the Kalman filter.

3.2 Dynamics of structural shocks

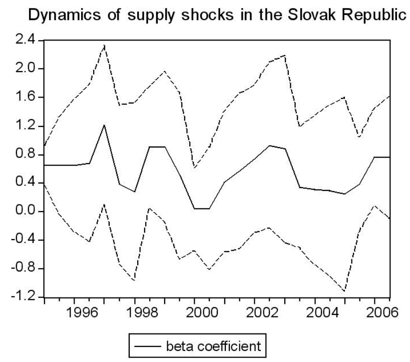
The following figures present patterns of the time-varying coefficient β_t first for the CECs and then for the periphery countries compared to the euro zone as opposed to the rest of the world.

Indeed, in the majority of cases, we can clearly distinguish the pattern of the coefficient[5].



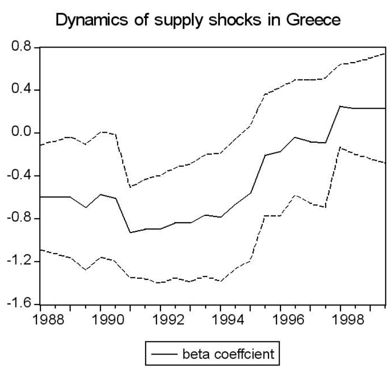


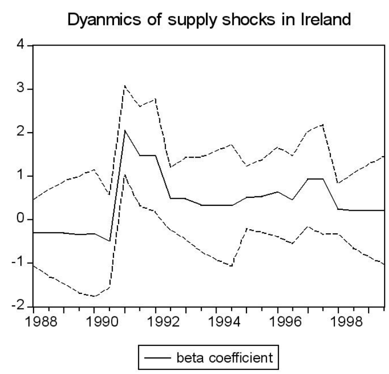
[5]The time-varying coefficient α_t generally oscillates around zero, which could also suggest that our model is correctly specified (Annex C)

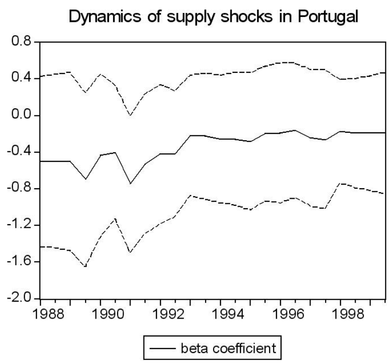


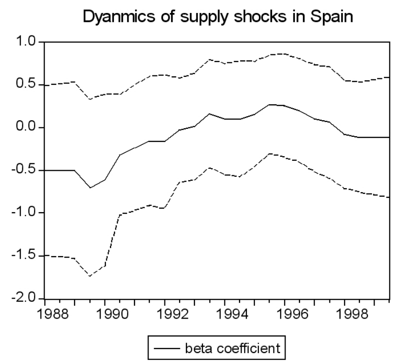
Regarding supply shocks, we can observe that Poland converges slowly toward the euro zone since 1999 - 2000, even if the coefficient β_t remains still high at the end of the studied period. The Slovak Republic and Hungary supply shocks show rather weaker convergence with the EMU countries. Indeed, the coefficient β_t is stable and remains at a rather high level during the estimation period. In the case of the Czech Republic economy, some increase in structural asymmetry could even be distinguished.

More detailed analysis shows an increase in shock asymmetry during the financial turmoil of 1996 - 1998 in the Czech and Slovak Republics, and at the beginning of the 2000's in Hungary. Moreover, the CEC economies diverge periodically from the euro zone pattern of supply shocks, e.g. in 2004, when the countries joined the EU. But, this occasional divergence has been already noted for the periphery countries (Babecki, 2003), when Portugal and Spain diverged from the European pattern of supply shocks immediately after joining the EU. However, the periphery countries showed considerable progress in supply shocks convergence during the 1990‘s, which was particulary visible in the case of the Greek and Irish economies. Indeed, at the moment of the euro adoption, the coefficient β_t is very close to zero for all countries.

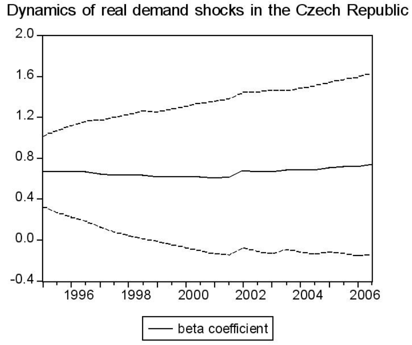




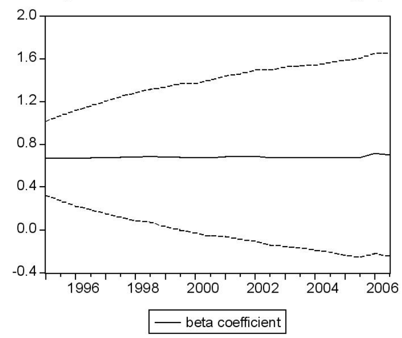




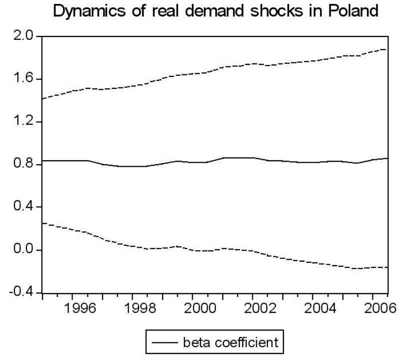
The convergence of real demand shocks between the accession countries and the euro zone is difficult to be establish clearly. Indeed, shocks asymmetry remains constant during the entire estimation period for all countries, except for the Slovak Republic.



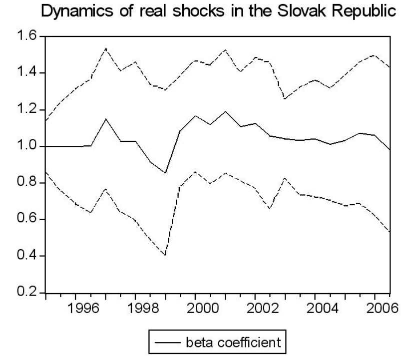
Dynamics of real demand shocks in the Czech Republic



Dynamics of real demand shocks in Hungary

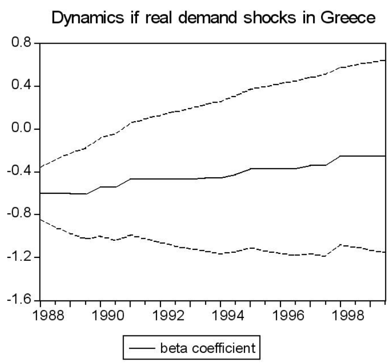


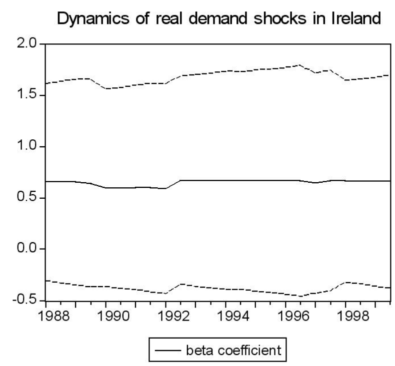
Dynamics of real demand shocks in Poland

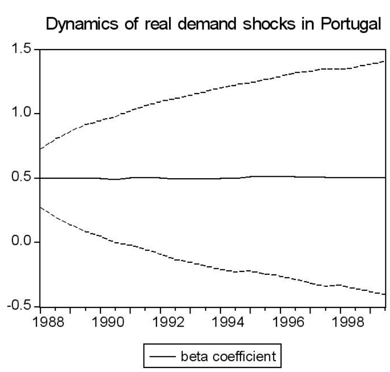


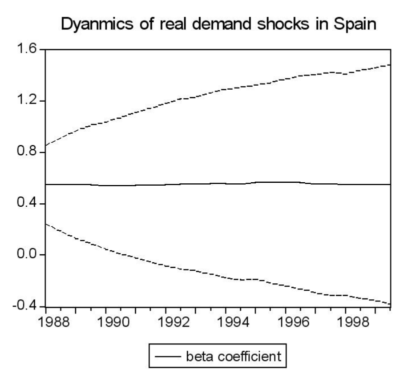
Dynamics of real shocks in the Slovak Republic

However, this is also the case of the periphery countries, where, even if the degree of shock asymmetry is relatively lower, no visible convergence trend can be noticed.



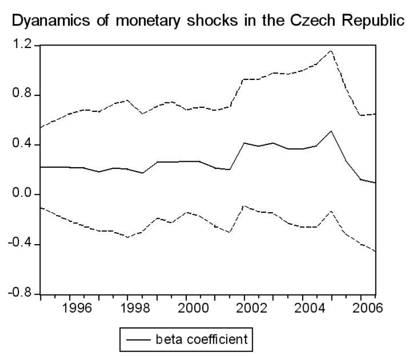


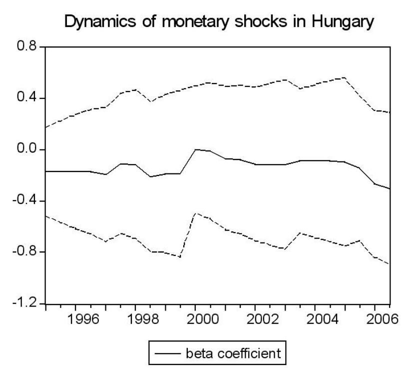


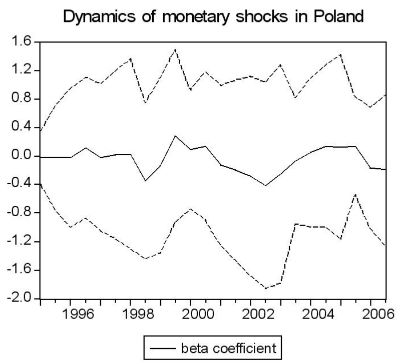


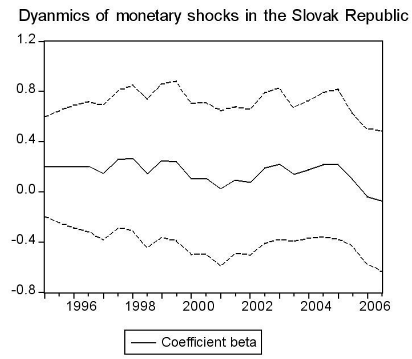
This lack of convergence in real demand shocks may be explained by the fact that in the EMU countries, the economic adjustment is assured by the national governments. However, the flexibility of fiscal policy is relatively limited first by the deficit - debt criteria during the EMU pre-adhesion phase and, after the euro adhesion, by the Stability and Growth Pact which could be problematic for the new accession countries. Indeed, the new members states need greater flexibility of fiscal policy to carry out structural reforms and support the catching-up process, which could be incompatible with the Maastricht and Stability fiscal criteria.

Looking at the dynamics of monetary shocks, we can clearly distinguish symmetry between the CECs economies and the EMU countries over the entire estimation period.

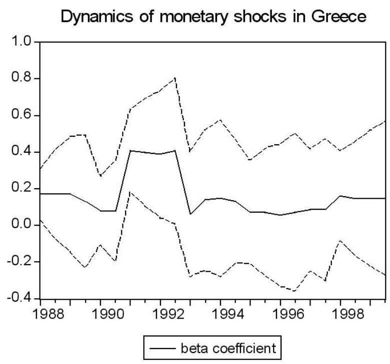


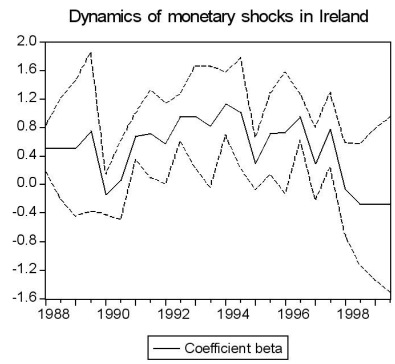


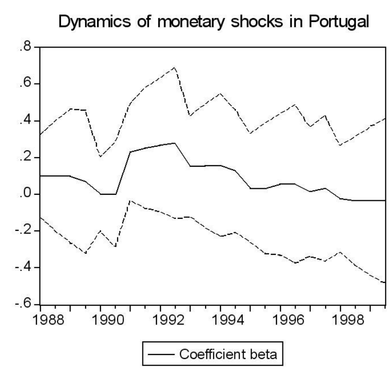


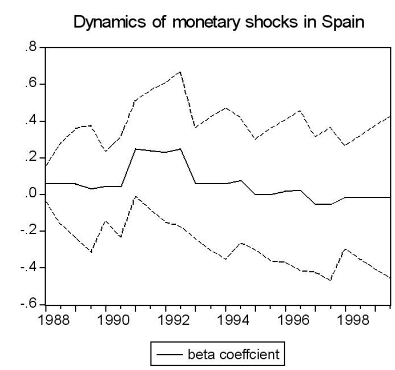


Indeed, the coefficient β_t is generally stable at a low level for all countries. This is not surprising, given the fact that all the new accession countries have aligned their monetary policies first to that of the Bundesbank and then of the ECB for stabilisation purposes at the very beginning of their transition process. We also corroborate monetary symmetry in the case of the periphery countries, especially after the early 1990's financial turmoil. An exception could be noticed for Ireland, where the coefficient β_t has begun to decrease toward zero only at the end of the estimation period.









Generally speaking, the five CECs economies present more real structural asymmetry than the periphery countries before adopting the euro. This conclusion stays in line with what can be expected intuitively, namely, the fact that structural asymmetry between the two zones will remain relatively high as long as the transition process continues. So, premature entry to the euro zone could also be very expensive for the new countries in terms of economic stability and structural reform process. In light of these findings, we think that the CECs authorities decision on postponing the euro adoption until at least 2009 - 2010 has been a correct one. So, the decision about joining the EMU should wait until these economies achieve more structural convergence with Western Europe. Indeed, even if some sources of endogeneities of OCA may be at work, the euro adoption may also make economies more specialised and less synchronised (the Krugman hypothesis)[6].

4 Conclusion

In this article, we attemted to determine the dynamics of the shock convergence process between Central European countries and the euro zone by comparing it with previous experiences during the EMU creation, to assess more precisely the timing of the euro adoption.

Our estimation results reported an important real structural asymmetry without a visible decreasing trend in the case of the CEC economies, which, especially compared to the periphery countries‘ dynamics, should exclude

[6]There are two distinct views on the subject. On the one hand, some authors supported by Krugman (1993) suggest that, the EMU results in higher sectorial specialisation accross its member states which might imply a greater vulnerability to asymmetric shocks. On the other hand, the opposite view (the endogeneity of OCA literature) suggests that monetary integration would instead lead to greater business cycles synchronisation. However, Giannone and Reichlin (2006) show that there has been no visible convergence nor divergence in output level among the EMU members (except the remarkable catch-up of Ireland's output).

their immediate participation in the EMU. Indeed, in this situation, only a custom-made monetary policy for each country would allow the reaction to idiosyncratic shocks and avoids important output losses.

But even if our dynamic analysis expands the existing findings concerning shock convergence in the CECs, this simplified method does not permit to assess the empirical costs of the euro adoption. Indeed, several further extensions of this work can be identified, such as the study of the costs of the Maastricht criteria verification.

Moreover, the present work could be completed by the analysis of the other OCA criteria, for example the degree of convergence in production factors mobility or the effect of economic and political coordination on the synchronisation in structural shocks.

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A Structural shock identification.

A principal technical difficulty of our analysis is the presentation of the structural shocks previously identified using the VAR model as dependent and observed variables of the state-space model. For doing that, we use the approach developed by Chamie, DeSerres and Lalonde (1994)

The structural form of the VAR model is as follows:

$$\Delta x_t = A_0 \varepsilon_t + A_1 \varepsilon_{t-1} + \cdots = \sum_{i=0}^{\infty} A_i \varepsilon_{t-i} \tag{5}$$

Where the matrix A describes the effects of shocks on the matrix X elements:

$$\Delta x_t = \begin{bmatrix} \Delta y_t \\ \Delta rer_t \\ \Delta p_t \end{bmatrix}$$

And ε_t is the matrix of the structural shocks

$$\varepsilon_t = \begin{bmatrix} \varepsilon s_t \\ \varepsilon d_t \\ \varepsilon m_t \end{bmatrix}$$

For simplicity, the variances of the structural shocks are normalized as follows:

$$E(\varepsilon_t \varepsilon_t) = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \tag{6}$$

and

$$E(\varepsilon_t \varepsilon_{t+i}) = 0, \forall x \neq 0 \tag{7}$$

First we estimate the VAR model reduced form to identify the structural model:

$$\Delta x_t = \prod_1 \Delta x_{t-1} + \cdots + \prod_q \Delta x_{t-q} + e_t \tag{8}$$

where the matrix of error terms is as follows:

$$E(\varepsilon_t \varepsilon_t) = \begin{bmatrix} \sigma_{11} & \sigma_{12} & \sigma_{13} \\ \sigma_{21} & \sigma_{22} & \sigma_{23} \\ \sigma_{31} & \sigma_{32} & \sigma_{33} \end{bmatrix} \tag{9}$$

but, the model can be rewritten in the moving-average form given the fact that the stochastic process is stationary.

$$\Delta x_t = e_t + C_1 e_{t-1} + \cdots = \sum_{i=0}^{\infty} C_i e_{t-i} = C(L) e_t \tag{10}$$

where C(L) in the equation is an infinite-order lag polynomial such that $C_k L^k e_t = C - k e_{t-k}$ and there is the following relation between the residuals of the reduced and structural form:

$$e_t = A_0 \varepsilon_t \tag{11}$$

so,

$$E(\varepsilon_t \varepsilon_t) = A_0 E(\varepsilon_t \varepsilon_t) A_0` \tag{12}$$

and

$$\sum = A_0 A_0$$

Like we previously said, the structural shocks are identified using the Blanchard and Quah (1989) decomposition method, so the equations allow us to obtain the following relationship between the matrix of long-term effects of structural shock A(1) and the equivalent matrix of reduced form shocks C(1).

$$A_0 = A(1)C(1)^{(-1)} \tag{13}$$

The matrix C(1) is obtained from the VAR reduced form estimations imposing long-terms restrictions. And A(1) represents the value of the polynomial A(L) for L=1, which mathematically is the sum of all lagged coefficients included in A(L).

B Unit Root Test, Lag Length, Cointegretion

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Table 3: *Statistic Tests for the CECs and the euro zone*

	Czech Rep.	Germany	Hungary	Poland	Slovakia	US
Unit Root on level						
CPI ^{i}(ADF[a])	-3,6	3,36	-4,13	-3,31	-0,02	-0,8
CPI ^{t}(ADF)	-0,06	0,48	-2,43	-1,49	-2,2	-0,9
RER^i(ADF)	–0,19	-1,4	-0,47	-1,91	1,29	-1,9
RER^t (ADF)	-3,05	-2,44	-2,21	-1,8	-1,22	-1,5
GDP^i(ADF)	5,24	-0,28	1,59	0,93	3,02	-0,7
GDP^t(ADF)	2,79	-2,29	-0,2	-2,82	1,91	-3,72
Unit Root on diffrences						
CPI (ADF)	-2,16**	-3,82*	-4,37*	-1,98**	-2,3**	-1,6**
CPI (PP)	-2,08**	-4,55*	-2,69*	-1,97*	-4,7*	-1,8*
RER(ADF)	-1,88**	-3,5*	-3,63	-4,28*-3,9*	-2,41	
RER(PP)	-7,38*	-3,4**	-3,64*	-4,32*	-3,8*	-2,41**
GDP(ADF)	-1,37	-2,87**	-0,8	-2,69*	-0,5	-2,36*
GDP(PP)	-7,08*	-2,82**	-23,21*	-27,25*	-8,5*	-2,35**
Lag Lengh[b]	2	2	2	2	2	

Table 4: *Statistic Tests for the periphery countries and Germany*

	Germany	Greece	Ireland	Portugal	Spain	US
Unit Root on level						
CPI ^{i}(ADF^a)	-2,29	-1,62	-0,49	-4,81*	-4,27**	-5,17*
CPI ^{t}(ADF)	1,77	0,14	-3,49**	-1,2	6,21	-0,98
RER^i(ADF)	-1,6	- 1,24	-2,3	-5,08*	-2,08	-3,5*
RER^t (ADF)	-3,5	-2,49	-3,29	-4,06	-2,28	0,39
GDP^i(ADF)	-18,88	0,93	-1,36	-0,38	3,29	2,28
GDP^t(ADF)	-15,8	4,86	2,25	-2,2	-2,23	1,03
Unit Root on diffrences						
CPI (ADF)	-2,05**	-1,98	-4,6*	1,42	-1,85	-1,4**
CPI (PP)	-5,17*	-3,98**	-3,17	-5,95*	-5,15*	-8,2*
RER(ADF)	3,09*	-5,51*	-2,13**	-3,1*	-3,01*	-0,1**
RER(PP)	3,11*	-5,5*	-5,64*	-3,06*	-2,22**	-2,27
GDP(ADF)	-1,78*	4,64*	-1,43*	-1,8*	-3,78*	-1,79
GDP(PP)	-3,61*	-2,7*	-8,25**	-3,9*	-3,8*	-2,29**
Lag Lengh^b	2	2	2	2	2	

a: Using the tables in MacKinnon (1996)

b: According to the Akaike and Schwartz Information Criteria

i: Intercept

t: Trend

$**$: Null hypothesis can be rejected at the 10% level

$*$: Null hypothesis can be rejected at the 1% level

C The space-state model estimaiton results

Table 5: *Convergence of the CECc toward the euro zone as opposed to the United States, 1995-2006*

Supply shocks	Czech Rep.	Hungary	Poland	Slovakia
Coefficient α_t (Mean)	0,01	0,03	0,08	0,03
Coefficient β_t (Mean)	0,67	0,76	0,6	0,78
Real Demand Shocks				
Coefficient α_t (Mean)	0,06	0,07	0,07	0,01
Coefficient β_t (Mean)	0,74	0,7	0,86	0,98
Monetary Shocks				
Coefficient α_t (Mean)	-0,07	-0,09	0,016	-0,02
Coefficient β_t (Mean)	0,09	-0,06	-0,13	-0,07

Table 6: *Convergence of the periphery countries toward Germany as opposed to the United States, 1987-1998*

Supply shocks	Greece	Ireland	Portugal	Spain
Coefficient α_t (Mean)	-0,06	-0,04	-0,04	0,06
Coefficient β_t (Mean)	0,23	0,21	-0,19	-0,11
Real Demand Shocks				
Coefficient α_t (Mean)	0,02	-0,01	-0,03	-0,06
Coefficient β_t (Mean)	0,28	0,66	0,5	0,55
Monetary Shocks				
Coefficient α_t (Mean)	-0,012	0,09	0,046	-0,014
Coefficient β_t (Mean)	0,15	-0,22	-0,03	-0,015