Monetary policy and nominal convergence in CEE countries with inflation targeting

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Abstract

The article discusses the monetary policy in small open economies with inflation targeting and their nominal convergence to the larger monetary area. Using panel data set, the paper considers the relationship between interest rates of interbank markets in the euro area and selected Central European countries – non-euro members of the European Union that follow inflation targeting strategy. We test for panel cointegration and use two estimators: Augmented Mean Group and Random Coefficients. The empirical results show that in the long run the interest rates of non-euro EU countries follow the Eurozone interest rates. What is more important, the AMG model's common dynamic insignificance suggests that other factors are not relevant to the nature of interest rates transmission.

Keywords: AMG, Swamy, cointegration, monetary policy, interest rates.
JEL Codes: E43, E52, E58, F41, F42, C32.

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This paper focuses on the four CEE countries, namely the Czech Republic, Hungary, Poland and Romania. All those countries committed themselves to take economic policy decisions based on inflation targeting framework and flexible nominal exchange rate. In this sense, the exchange rate management should remain outside the objectives of monetary policy, and the central bank itself should focus only on fighting inflation (Masson et al., 1997).

There are a number of reasons to question this argument. First, due to external conditions and increasing integration with the Eurozone CEE countries' monetary policy is strongly correlated with the one of the ECB. Second, in the presence of large balance of payments imbalances allowing for volatility in exchange rates in small open economies is rarely optimal, as the risk of sudden swings of capital flows in response to external disturbances is higher than previously assumed. In this sense, the domestic goals of monetary policy may stand in a significant conflict with the objectives of the exchange rate. In extreme cases of full financial integration small open economies may suffer from full transmission of foreign interest rates (Frankel et al. 2004). In other words, the comovement of interest rates of small open economies and larger monetary area should be observed in data.

The article discusses the results of an empirical analysis of relation between interest rates of four European economies with a floating exchange rate and an inflation targeting and interest rates of Eurozone. Second, it investigates whether there is any evidence that a certain degree of nominal convergence towards the Eurozone economy has been achieved by the considered countries. The significant constant in the cointegrating vector could be understood as a proof that in the state of equilibrium there is still a difference between interest rates of Eurozone and four countries. The significant negative trend in the cointegration vector would suggest that this difference is decreasing over time.

The study uses weekly data for the years 2001-2014. Due to the heterogeneity of the expected adjustments in the short and long run and endogeneity problems Random Coefficients and Augmented Mean Group methods have been employed. Model estimations were preceded by tests of stationarity and cointegration. Using the panel cointegration method is the main contribution to the existing literature, as similar analyses base on results for individual countries.

The results point to the fact that the costs of joining the Eurozone for CEE countries with derogation in terms of euro are lower than previously thought. According to data, in the long run the domestic interbank interest rates simply follow the euro interest rates. This implies the high level of economic integration between Eurozone and analyzed countries.

1. Literature discussion

The last two decades of research in macroeconomics resulted in a large body of empirical studies examining the tendency of central banks to adopt policies which de facto differ from official statements and policy objectives of these institutions. This also applies to difference between de iure and de facto independence of monetary policy. In fact, the extent to which a country can obtain the autonomy of monetary policy depends on the degree of economic and financial integration with dominant economies (Ehrmann and Fratzscher, 2002). It is even questioned if countries such as the UK and Sweden and Italy, the Netherlands, or France before the adoption of the euro, had any independence in their monetary policy from decisions introduced by the Bundesbank (Buscher and Gabrisch, 2011; Reade and Volz, 2011).

Four different explanations can be formulated to justify de facto dependence of monetary policy. Two of them relate to the phenomenon of fear of floating (Calvo and Reinhart, 2002). The actions of the central bank in a small open economy may be the result of its concerns about currency fluctuations – caused by international differences in interest rates, which themselves are consequences of central bank's actions. In this case, the high correlation between domestic and international interest rates may signal exchange rate stabilization policy of the central bank, which officially runs a floating exchange rate policy. Therefore, such central bank behavior would indicate the fear of floating phenomenon. In such cases, against the official standpoints and declarations of the central bank, the monetary policy measures are directed at limiting exchange rate volatility, mainly to avoid large capital flows. On the other hand the similar behavior of domestic and foreign interest rates may be simply the consequence of inflation targeting.

It is worth to mention that fear of floating and inflation targeting could be equivalent in terms of results (exchange rate stability), while different in terms of purposes. If domestic and external economies experience disturbances, interest rates will change in similar way. In case of the fear of floating phenomenon, the changes in domestic interest rates follow changes in foreign interest rates simply to stabilize exchange rate. The question therefore arises whether the fear of floating phenomenon can be inflation targeting in disguise and whether reaching the target is a goal in itself, or a tool used as the exchange rate stabilization when official exchange rate interventions are disinclined.

The results obtained for countries that pursue the inflation targeting by Ball and Reyes (2008) show that because of fear of floating the volatility of interest rates is higher than the changes in inflation and appears to be strongly associated with exchange rate volatility. The fear of floating phenomenon is also confirmed by the results obtained by d'Adamo (2011). European countries that have not adopted the euro show higher exchange rate volatility (pursuing the inflation targeting policy), but it is not as high as in other non-European countries. It seems that a certain

weight in monetary policy is given to the stability of the exchange rate against the euro. Moreover, van Dijk et al. (2011) show that correlation between the exchange rates of the main EU countries outside the euro area against the dollar and the euro rose after the introduction of the euro. Countries outside the area may wish to keep the exchange rates of their currencies stabilized to the euro, which results in a lower exchange rate volatility without a definite need for a full abandonment of independent monetary policy.

On the other hand, the observed co-movement of foreign and domestic interest rates may be endogenous. For example, the Eastern European EU countries' monetary policy is strongly correlated with the one of the ECB, probably due to external conditions and increasing integration with the Eurozone (Goczek and Mycielska, 2014b). The first explanation is growing business cycle correlation. In this sense, similarity of domestic and foreign interest rates can be a result of increased economic integration through trade and financial channels, which resulted in the synchronization of business cycles, as suggested by the endogenous theory of optimum currency areas (see Frankel and Rose, 1998). Another possible cause may be an endogenous component of the global inflation – in such cases the central banks of both regions react in the same way to disturbances that are exogenous to their decisions. Thus observed comovement of interest rates of domestic and foreign central banks might be simply the reflection of the symmetry of shocks affecting the domestic and foreign economies.

Frankel et al. (2004) showed a complete international transmission of interest rates in the long term. They proved that only three economies (United States, Japan and the euro area) may enjoy a fully autonomous monetary policy[1]. The monetary policy of other countries is therefore similar in the long term, and what's more - strongly determined by the dominant economies' policies. Moreover, the authors demonstrated that developing countries, operating within a floating exchange rate regimes, have not enjoyed full monetary policy freedom even in the short term.

Similar arguments are put forward by Edwards (2010). The study on the impact of the FED's interest rates on the interest rates in the developing countries of Latin America and Asia showed a complete pass-through of the FED's monetary policy, even for countries with a floating exchange rate. The interest rates differential was decreasing (increasing) when the FED's rates were increasing (decreasing) and dynamics of adjustment have differed between countries. This would suggest heterogeneity of monetary policy in the short term.

Buscher and Gabrisch (2011) tested monetary policy independence for Sweden, Denmark, and the UK. The study confirmed the presence of a high level of

[1] However, Taylor (2007) goes as far as even to say that the EBC prior to the financial crisis was not carrying out an independent monetary policy stance but was merely copying the decisions made by the FED.

correlation between short-term EURIBOR rates and short-term interbank interest rates in these countries. The authors confirmed the existence of this dependence not only in times of peace but also in times of disturbances, indicating that the ECB's policy has a significant impact on the domestic interest rates and, therefore, the monetary policy independence cannot be indicative of the benefits of staying outside the euro area. Similar conclusions were obtained by Reade and Volz (2010), who use the VAR method to show that the market interest rates in Sweden are correlated with the EURIBOR rates, and monetary policy in Sweden is largely a copy of the decisions made by the ECB.

The autonomy of monetary policy was also studied by Crespo Cuaresma and Wojcik (2006). Based on the DCC - MGARCH model authors analyzed the real interest rates for Germany and three selected economies of the Central Europe: Poland, Czech Republic and Hungary. The results pointed to the fact that none of the analyzed countries experienced full independence of monetary policy in the analyzed period.

Goczek and Mycielska (2014a) estimate the de facto independence of the monetary policy in Poland. Using VEC model they analyzed changes in interbank interest rates and discussed similarities in monetary policies between the ECB and Narodowy Bank Polski. The results indicate the presence of unilateral one-to-one long-term relationship between interest rates. This means that NBP intentionally or unintentionally follows directly the ECB with a slight delay and the full transmission cannot be excluded.

Presented analyses show that monetary policy must take into account factors specific to given country, but also - external conditions. While in short term the former is prevailing, in the long term the latter might be crucial for monetary policy. That implies that the lack of monetary policy independence will be more visible in a long term, as interest rates in short term will exhibit more independence. Therefore for the European countries outside the Eurozone the heterogeneity of monetary policy might be observed. It may be that the objectives of the monetary policies of those countries are similar in the long term to the ECB policy, but in the short term monetary policies in those countries are country-specific and thus divergent. Therefore the proposed analysis not only considers the lack of monetary policy in a long run but also the similarity of changes in interest rates in a short run.

2. Methodology

If the problem of co-movement of interest rates is considered it is important to distinguish the short and long-run effects. The independence of monetary policy in small open economy may be maintained only in the short run and in the long-run small country follows policy of a larger monetary area (see discussion in Goczek and Mycielska, 2014b). In order to distinguish the effects of short and long-run

the panel cointegration estimators could be used. A large number of potential factors may guide the behavior of interest rates and the variable list may be extended indefinitely. The effects of these factors that have not been explicitly allowed for may be individual specific and time varying. In fact, one of the crucial issues in panel data analysis is how the differences in behavior across individuals and/or through time that are not captured by the explanatory variables should be modeled. Most estimators allow only for fixed time effects, while in the Random Coefficient (Swamy 1970) and Augmented Mean Group (Bond and Eberhardt, 2009; Eberhardt and Teal, 2010) models the time-varying dynamics across panels are allowed.

As it was already mentioned, in typical applications the homogeneity of short and long run coefficients is assumed: the estimated coefficients are the same for all units in the sample. However, Pesaran et al. (1999) note that this does not have to be in line with reality, especially in the short run. For this reason, commonly used estimators may not be consistent and thus long-run coefficients could be biased. They proposed the new estimator (Pool Mean Group) that assumes that constant short run coefficients and variance of error terms differ between observational units, while the restriction imposed on the long-term coefficient to be the same for all units in the sample. In terms of the relationship between domestic (r) and foreign (r^*) interest rates, the estimated equation is as follows:

$$\Delta r_{i,t} = \gamma_i \Delta r_{i,t} + \tau_i \Delta r^*_{i,t} + \phi_i \left(r_{i,t-1} - \alpha_i - \sum_{j=1}^{k} \beta_j r^*_{i,t-1} \right) + \varepsilon_{i,t} \qquad (1)$$

where the subscript t relates to the time period, the i relates to the country cross section, ε is the error term. α is the deterministic part of the cointegrating equation while γ is the persistence of domestic interest rates and shows smoothing behavior. τ relates to the instantaneous impact of foreign interest rates on domestic ones and ϕ relates to the adjustment speed to the cointegrating relation. Coefficient β shows the long-run transmission of foreign interest rates on domestic ones.

The use of error-correction mechanism model and possibility of different adjustment coefficients for different countries allows for estimating separately the short-term dynamics (coefficients γ, τ and ϕ) and long-term dynamics of dependent variable (coefficient β). In terms of equation 1, short-term coefficients of interest rates adjustments may be different for different countries. However, the interest rates may move in unison due to common global shocks resulting in large cross-sectional dependence.

Two methods are proposed to deal with the problem. One is the Augmented Mean Model (Eberhart and Teal, 2010), which accounts for cross-section dependence by including a "Common Dynamic Process" in the regression. The validity of using the Augmented Mean Group method can by verified by testing whether

the "Common Dynamic Process" is significantly different from zero. The second method used in cross-dependent and heterogeneous environment is the rarely used Swamy (1970) Random Coefficients estimator. In random-coefficients models, the parameter vector is treated as a realization (in each panel) of a stochastic process. The validity of using this model can be tested using parameter constancy hypothesis - by calculating the difference between the OLS estimate of regression coefficients, ignoring the panel structure of the data and the matrix-weighted average of the panel-specific OLS estimators (Hsiao and Pesaran 2004). Therefore the comparison between the validity of the two models allows for drawing some conclusions on the common unobserved dynamic in the sample, which results in cross-sectional dependence. However, it is worth noting that the AMG and the Swamy estimators are in fact algebraically equivalent for sufficiently large time series dimension of the panel.

A prerequisite for the estimation of these models is cross sectional dependence and cointegration between the variables of interest. Therefore, the first step of analysis is to verify the existence of a unit root in the stochastic data generating process for all of the series, a necessary precondition for cointegration testing. The second is to test cross-sectional independence. If cross sectional dependence exists, the most appropriate is to run the cointegration test proposed by Westerlund (2007). Once cointegration is detected, depending on the long-run and short-run assumptions it is possible to estimate the parameters of a dynamic panel error correction model.

3. Results

The investigation was based on a sample of three-month interbank interest rates for the Eurozone and four small open economies pursuing inflation targeting policy with floating exchange rates - Poland, Czech Republic, Hungary, and Romania for the period of 2001-2014 with weekly frequency. Figure 1 plots these variables.

Conventional panel estimators such as fixed or random effects can result in inconsistent results in presence of cross-sectional dependence. These correlations across units of panels may well have serious consequences on frequently used panel unit root tests, since most of the existing tests assume independence. In consequence, these tests applied to cross-sectionally dependent hetoreogenous panels can suffer from considerable distortions.

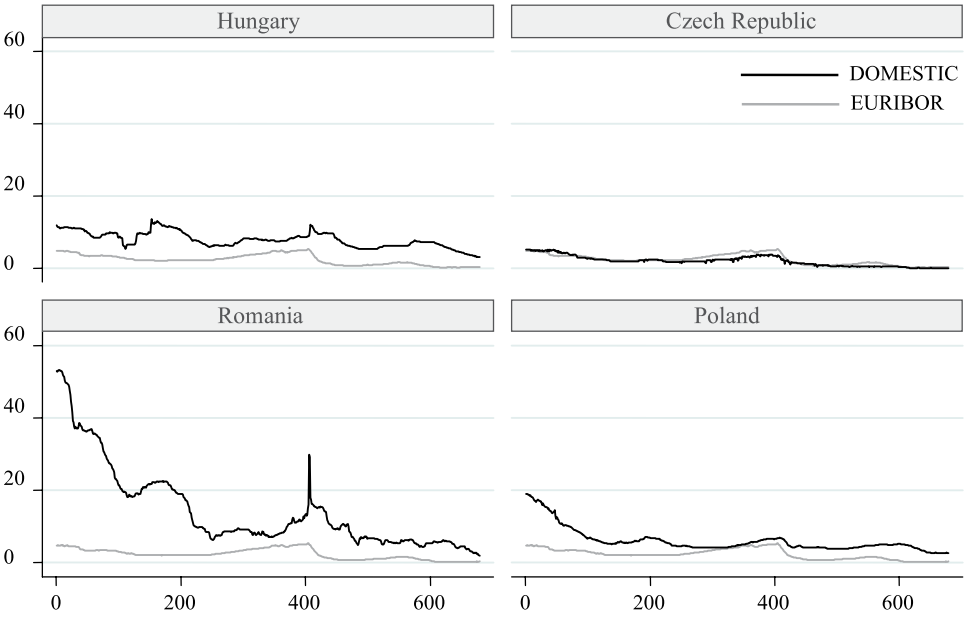

Figure 1. Three-month interbank interest rates and Euribor during the period 2001-2014 (weekly quotations)

Source: own calculation.

Therefore, the Pesaran Cross Dependency test was carried out to determine the existence of cross-sectional dependence. The null hypothesis of no cross-sectional dependence was overwhelmingly rejected. Thus, the existence of cross-sectional dependence was confirmed. In the case of EURIBOR this was not a problem and unit root tests for time series were used (ADF-GLS, PP, KPSS), because for all panel units adjustment of this variable is the same.[2] The average p-value for these tests of unit root existence hypothesis was around 0.72 for the variable in levels and 0.00 for its first differences. This permits for arguing that the stochastic process guiding EURIBOR is integrated of the first order. Since cross sectional dependence was detected, a second-generation Pesaran (2003) unit root test built especially for heterogeneous panels was applied to the panel of domestic interbank interest rates in the four countries. The test is based on the average of individual CADF statistics for each observation unit in the panel. The null hypothesis assumes that each of the time series is non-stationary. The results are shown in Table 1. According to the results, there are no grounds to reject the null hypothesis on 5% significance level and thus all series were considered non-stationary.

[2] For all observations, there is a pair of values for domestic interbank interest rates and the EURIBOR.

Table 1. The results of the Pesaran (2007) panel unit root tests

	Deterministic Components of the Cointegrating Equations			
	Constant		Trend	
Lags	Zt-bar	p-value	Zt-bar	p-value
0	-1.603	0.054	-0.769	0.221
1	-1.514	0.065	-0.658	0.255
2	-0.954	0.17	-0.001	0.5
3	-1.034	0.151	-0.111	0.456
4	-1.231	0.109	-0.29	0.386
5	-1.293	0.098	-0.365	0.358
6	-1.325	0.093	-0.384	0.35
7	-1.271	0.102	-0.29	0.386

Source: own calculations.

Westerlund (2007) derived four robust cross-sectional dependence panel cointegration tests that correspond to the structural rather than the residual cointegration and do not require the assumption of equal dynamics for all groups of observation. In all tests the null hypothesis is that the error correction mechanism is non-different from zero - meaning no cointegration.

The results of this test are gathered in Table 2 in three parts relating to different forms of the cointegrating equation. The significant constant in the cointegrating vector could be understood as an indication that in the state of equilibrium there is still a consistent difference between interest rates of Eurozone and four countries. The significant negative trend in the cointegration vector is suggesting that this difference is decreasing over time.

The test statistics permit for rejecting the null hypothesis of no cointegration for cointegrating equations without constant and with a constant and do not allow for rejecting it for the version of the cointegrating equation with trend. This is an important result, since it shows that there is no nominal convergence in interest rates in the investigated region. The risk premium is therefore a constant or time varying but stationary.

Table 2. The results of the Westerlund (2007) panel cointegration tests

Westerlund (2007) Statistic	Value	Z-value	P-value
Deterministic Components of the Cointegrating Equations: No Constant			
Gt	-3.411	-4.681	0.00
Ga	-7.551	-1.648	0.05
Pt	-8.107	-6.071	0.00
Pa	-6.892	-4.052	0.00
Deterministic Components of the Cointegrating Equations: Constant			
Gt	-3.677	-4.228	0.00
Ga	-9.585	-0.898	0.185
Pt	-8.183	-5.319	0.00
Pa	-7.732	-1.577	0.057
Deterministic Components of the Cointegrating Equations: Constant and Trend			
Gt	-3.32	-2.347	0.009
Ga	-11.941	0.021	0.508
Pt	-7.932	-4.239	0
Pa	-10.06	-0.368	0.357

Source: own calculations

Further, after the confirmation of the hypothesis about the relation between the international and domestic interest rates in short and long run the two panel models were estimated - Augumented Mean Gruop (AMG) and Swamy Random Coefficients (SWAMY). The results are presented in Table 3.

Table 3. Estimation results of individual models

	AMG	SWAMY
Long Run		
β (EURIBOR)	0.906***	0.906***
	(3.82)	(9.32)
Short Run		
φ	-0.044***	-0.0164***
	(-2.90)	(-2.41)
D.EURIBOR	0.311***	0.267***
	(4.04)	(2.74)
Common Dynamic	0.625	
	(1.22)	
Constant	0.004	0.024
	(1.25)	(1.56)
N	2712	2712

Source: own calculations

The results of the models suggest a full transfer of European interbank interest rates on interest rates in analyzed countries in the long run in an almost one-to-one fashion. This support the results obtained in Goczek and Mycielska (2014a) using Vector Error Correction Mechanism time series models. The coefficients were markedly similar as expected, though the Swamy estimator has much smaller errors. The dynamics bringing the interest rates back to the cointegrating relation are significant and large in economic terms, even though they are smaller in the second model.

To address the validity of the two models two hypotheses were verified as discussed in the previous section. For one, the hypothesis of a common unobserved dynamic in the AMG model was rejected. This means that other factors, for instance relating to the other aspects of the real or nominal global business cycle in the Eurozone and CEE countries, are not relevant to the nature of the transmission of the interest rates and, therefore, the changes in interest rates are solely the result of interest rates of each pair of the monetary areas. Next the Swamy consistency test was carried out. The results overwhelmingly favored the model over the alternatives (chi2(9) = 75.26, Prob > chi2 = 0.0000).

Table 4. Robustness verification results

	AMG				**SWAMY**			
Long Run	Whole sample	2001-2008	2010-2014	Without 2008-2009	Whole sample	2001-2008	2010-2014	Without 2008-2009
β (EURIBOR)	0.906***				0.906***			
	(3.82)				(9.32)			
Short Run								
φ	-0.044***	-0.062***	-0.041*	-0.051***	-0.016***	-0.015**	-0.014*	-0.016**
	(-2.90)	(-2.70)	(-2.01)	(-2.64)	(-2.41)	(-1.93)	(-1.65)	(-2.23)
D.EURIBOR	0.311***	0.178***	0.638	0.303***	0.267***	0.270	0.342	0.230**
	(4.04)	(2.70)	(0.80)	(3.17)	(2.74)	(1.10)	(1.60)	(2.26)
Common	0.625	0.111	0.105	0.093				
Dynamic	(1.22)	(1.22)	(0.96)	(1.12)				
Constant	0.004	0.102	0.222	0.012	0.024	0.017	0.027	0.019
	(1.25)	(1.06)	(0.98)	(0.46)	(1.56)	(1.35)	(0.80)	(1.18)
N	2712	1476	840	2612	2712	1476	840	2612

Source: own calculations

During "normal" times, the three-month interbank interest rates comprise of a good proxy for monetary policy rates. Conversely, the time span of the analysis covers the outbreak of the global financial crisis during which there was almost no transmission from policy rates (which were rapidly cut to the lowest levels in history) to interbank interest rates. These in turn were elevated to historically high levels in advanced economies. This is observable in Figure 1 as peaks in the domestic interest rates, most markedly the Romanian ROBOR rate. This problem was explicitly addressed by performing robustness check for whether the same pattern holds for the whole time span. To this end, the samples were divided into pre-crisis and post-crisis periods. The estimations were run again on each sample and a sample with both pre-crisis and post crisis periods without the crisis period itself (2008-2009). Alternative methods were not available, such as dummies or interaction variables, since both estimation methods require that it is possible to fit OLS regression to each panel without dropping variables due to collinearity.

The results of this exercise assuming a normalization of the long-run cointegrating vector as before were given in table 4. These results reconfirm the earlier results, as they are largely similar both in terms of statistical significance (other than the influence of sample size) and almost identical in terms of economic impact relating to the size of the estimated coefficients. This is mostly visible through the same estimated speed of convergance to the long-run steady state across all samples.

4. Conclusions

In this article we investigated monetary integration of the small non-euro inflation targeting EU economies with the ECB monetary policy. We verified whether interest rates of these four countries exhibit co-movements in relation to Eurozone interest rates. Due to abundance of data two panel estimators were used: AMG and Swamy. The results show that in the long run the interest rates of non-euro EU countries follow the Eurozone interest rates. What is more important, the AMG model's common dynamic insignificance suggests that other factors are not relevant to the nature of the interest rates transmission. Moreover, the hypothesis of nominal convergence was not confirmed, since the models with trend in the cointegrating equations were overwhelmingly rejected.

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