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Too small to be independent? On the influence of ECB monetary policy on interest rates of the EEA countries

Abstract: The paper discusses the problem of lack of independence of monetary policy in the context the global effects of the ECB monetary policy. It then presents the results of an empirical analysis examining the relationship between interest rates in interbank markets in the euro area and selected European countries – non-euro members of the European Economic Area that follow the inflation targeting policy. The study uses monthly data for the years 2000-2015 and investigates the issue with second generation panel cointegration methods. We find evidence for the lack of monetary independence in these countries and test robustness of this result in various specifications.

Key words: panel cointegration, monetary policy, interest rates

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INTRODUCTION

The debate on monetary integration in Europe has been dominated by the issue of losing monetary independence due to the common currency. This independence is regarded a crucial factor in judging the desirability of pursuing economic and monetary integration in the inflation targeting countries of the European Union that have not entered the EMU. However, the absence of independent national monetary policy does not need to be a major concern if country-specific (idiosyncratic) shocks are relatively unimportant or there is no monetary independence to speak of. The recent wave of financial, balance of payments and sovereign debt crises, which were asymmetrical in their scope, has revived the discussion whether small open economies are able to carry out an independent monetary policy despite growing financial integration across the world (Rey, 2013; Edwards, 2015).

Integrated financial markets and foreign exchange lending, vulnerability to swings in terms of trade due to low trade diversification combined with a high degree of openness, are all factors that may exacerbate sudden reversal of investor sentiment in small open economies. These violent swings of capital flows can have both a direct result of the negative impact on aggregate demand and indirectly on the balance sheet of financial institutions. These factors may induce negative phenomena leading to a full-blown currency crisis and are therefore crucial for macroeconomic stability in these countries. For that reason it is indispensable to question whether these small countries are able to withstand this turmoil and at the same time preserve monetary policy independence.

Therefore the aim of the paper is to investigate actual level of monetary independence in the non-euro members of the European Economic Area (EEA) that pursue the inflation targeting policy. We follow Aizenman et al. (2013) and define the monetary policy independence as the ability of the central bank to set interest rates independently of international rates, however we use different approach.[3] First, we assume that interbank interest rates might be treated as a realization of monetary policy in a given country. Second, we test the hypothesis that home interest rates are linked with a long-term co-integrating relationship to the rates prevailing in the base region. This will also allow us to determine the actual degree of independence of monetary policy in the analyzed countries relative to the euro zone.

The paper discusses the results of an empirical analysis of monetary policy independence in seven non-euro EEA economies, namely Czech Republic, Hungary, Norway, Poland, Romania, Sweden and the UK. All those countries declare floating exchange rate regimes and have switched to the strategy of inflation targeting when it became popular almost two decades ago.

[3] The original study uses simple correlations to measure monetary policy independence.

This change in central bank strategy should, at least in theory, ensure the adequate credibility to their policies, and thus provide more flexible response to external shocks. As Masson et al. (1997) pointed out, the independent monetary policy is major prerequisite for successful inflation targeting framework.

The study uses monthly of interbank interest rates for the years 2000-2015. Due to heterogeneity of the expected adjustments in the short and long run and unobservable cross-correlation between the units, three heterogeneous panel estimators are used - namely Pooled Mean Group (PMG, Pesaran et al., 1999), Augmented Mean Group (AMG, Bond and Eberhardt , 2009; Eberhardt and Teal, 2010), and Mean Group (MG, Pesaran et al., 1995) and compared with standard Dynamic Fixed Effects model. Estimation was preceded by testing stationarity, cross sectional dependence, and panel cointegration.

The results point to the fact that in the long run the domestic interbank interest rates simply follow the euro interest rates. This implies a low level of true monetary independence despite the adoption of floating exchange rate regime associated with the inflation targeting policy framework.

The paper is organized as follows. The next section reviews monetary policy independence experience and some fundamental choices faced by small open and financially integrated economies. Section two provides a description of the methodology. The third section presents the results of the analysis of monetary independence. The fourth section concludes with possible explanations and policy implications.

1. LITERATURE REVIEW

Until recently, the monetary policy independence has been mainly invoked in the context of monetary integration as one of the major costs associated with an introduction of a common currency. In addition, the recent resurge of the debate on the macroeconomic and financial stability in developing countries, especially in the framework of the open economy macroeconomics trilemma, indicated once again the importance of monetary independence in the time of financial turmoil. However, both at the best and worst of times the policy makers face an impossible task of maintaining stability with appreciating currencies during global booms due to capital inflows and sudden reversals and capital flights. As Stiglitz (2000) states, capital flows to emerging countries are markedly pro-cyclical and exacerbate economic booms, and financial liberalization exposes countries to the changes in economic circumstances outside the country. Rey (2013) argues that capital flows´ boom and bust pattern is determined by a global financial cycle, which depends mainly, on monetary conditions of the

central country. These monetary conditions are transmitted to the rest of the world through gross credit flows and leverage, irrespective of the exchange rate regime. The same imperfection causes the exchange rates to be sensitive to imbalances in financial markets and seldom perform the shock absorption role that is central to traditional theoretical open economy macroeconomic analysis (Gabaix, Maggiori 2014).

Empirically, Hausman et al. (2001) find that interest rates in countries with floating exchange rate regimes are as dependent on and responsive to US monetary policy shocks as are those countries with fixed currency regimes. Frankel (1999) examines a broad sample of countries and also fails to detect a strong link between exchange rate flexibility and interest rate autonomy. Edwards (2015) analyses whether countries with flexible exchange rates from Latin America are able to pursue an independent monetary policy, as suggested by traditional theory. His results allow him to argue for a significant "policy contagion," and that these countries tend to "import" Fed policies.

Four explanations can be formulated to justify the actual lack of independence of monetary policy. Two of them relate to the phenomenon of fear of floating (Calvo and Reinhart, 2002). In this case, the high correlation between domestic and international interest rates may be the realization of exchange rate stabilization policy. In such cases, against the official standpoints and declarations of the central bank, the monetary policy measures are directed on limiting exchange rate volatility, mainly to avoid large capital flows. On the other hand, similar behavior of domestic and foreign interest rates may be simply the result of monetary regime of inflation targeting. While being equivalent in terms of result, those two strategies are different in terms of purposes. The question whether the fear of floating phenomenon can be inflation targeting in disguise have been discussed both theoretically and empirically. Ball and Reyes (2008) showed that in result 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. D'Adamo (2011) showed that non-euro EU countries with inflation targeting framework exhibit higher exchange rate volatility, but not as high as in other non-European countries. That implies that exchange rates in the analyzed countries are to some extent stabilized against the euro.

Two other possible justifications for the lack of independence of monetary policy are endogenous. 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). Kolasa (2013) analyzed the differences between business cycles in the CEE countries and euro area. Though business cycles in the CEE countries still differ from those of euro area, the

synchronization with the EMU countries significantly increased after the accession to the EU. 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. The high degree of similarity in policies between the domestic and foreign central bank can therefore be a reflection not so much of a lack of independence in an institutional sense, but rather of the symmetry of shocks affecting the domestic and foreign economies.

The extent to which a country can preserve the independence of monetary policy depends on the degree of economic and financial integration with dominant economies (Ehrmann and Fratzscher, 2002). In such circumstances it is even questioned if countries such as the UK, Sweden, Italy, the Netherlands or France had any independence in their monetary policy from decisions introduced by the Bundesbank before the adoption of the euro (Buscher and Gabrisch, 2011; Reade and Volz, 2011).

Frankel et al. (2004) showed that the developing countries, operating within a floating exchange rate systems, have not enjoyed full monetary policy freedom even in the short term. They also showed that independent monetary policy in the long run can be only achieved by three economies (United States, Japan and the euro area)[4]. The long run monetary policy of other countries is therefore strongly determined by the dominant economies' policies and thus dependent.

The dependence of the domestic interest rates from the dominant country's monetary policy was also emphasized 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 the 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.

Goczek and Mycielska (2014) attempted to estimate the actual independence of the monetary policy in Poland. Using VEC model they analyzed changes in interbank interest rates and discussed similarities between the ECB and National Bank of Poland monetary policies. The results indicate the presence of unilateral long-term relationship between interest rates. This means that Polish interest rates follow directly the euro-area rates with a slight delay and the full transmission cannot be excluded.

[4] However, Taylor (2010) 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.

The above mentioned analyses show that monetary policy must take into account factors that are specific to the given country, but also the external conditions. It seems that allowing for volatility in exchange rate 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. This high dependency on external factors amounts to the fact that despite the attempts to raise its credibility with the inflation targeting strategy, the monetary policy of small open economies is in fact not credible, since they are not able to react to external disturbances in a way that would be different from the large monetary area they are linked to.

While in short term the domestic goals may be prevailing, in the long term the external factors might be crucial for monetary policy. This 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 the 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. **EMPIRICAL METHODOLOGY AND SPECIFICATION**

Let us consider the following Uncovered Interest Parity condition:

$$i_t = i_t^* + E_t(e_{t+1} - e_t) + \rho \tag{1}$$

where i is the domestic nominal interest rate, i^* is the foreign nominal interest rate, E is the expectation operator, e is the nominal exchange rate, ρ is the risk premium and t is the time index.

Moving (1) into first differences we obtain:

$$\Delta i_t = \Delta i^* + \Delta E_t(e_{t+1} - e_t) + \Delta\rho \tag{2}$$

where Δ is the difference operator,

In a fixed exchange rate regime, the exchange rate is constant, and the depreciation term becomes zero. Assuming that the risk premium does not affect the change in interest rates and

the expected future exchange rate remain the same, the domestic interest rate moves one on one with the foreign rate change, that is, there is a full transmission of foreign interest rates:

$$\Delta i_t = \Delta i_t^* \tag{3}$$

According to the target zone models, the interest rates may diverge persistently under a flexible exchange rate regime only if the domestic policies are credible and the monetary authority primarily targets domestic economic variables such as inflation and output. Therefore, the size and the length of the deviation can be used to measure the degree of monetary policy independence. This may be interpreted as the degree to which domestic interest rates follow international interest rates. Based on this result almost all empirical analyses of monetary policy independence restrict themselves to interest rates alone. So as to measure monetary policy independence it is therefore necessary to investigate the relationship between money market interest rates. If a long run relationship exists between interest rates in the two monetary areas, and furthermore one country adjusts to this relationship while the other does not, then this can be viewed as the evidence of monetary dependence of the adjusting country on the non-adjusting one (and thus lack of independence). Putting it in simpler terms - if domestic interbank interest rates react to changes in the domestic monetary policy stance according to expectations then the country enjoys a large degree of monetary policy independence. However, if money market interest rates react mostly to foreign interest rate changes or if the two economies are intricately linked, it is unlikely that domestic monetary policy exerts much independence.[5]

Currently the most common method of estimating dynamic macroeconomic models on panel data is the System Generalized Method of Moments estimator (Blundell and Bond, 1998). Nevertheless, it could be argued that this estimator has become far too common in relation to its actual range of applications in macroeconomics. The problem of model estimation with macroeconomic data may be the small size of panel in terms of both periods, as well as units. In contrast, the GMM methods were in fact developed to estimate models using microeconomic samples in which there are thousands of units.

Moreover, a key issue in macroeconomics is the distinction between short and long run. This is such a relevant phenomenon that most of the basic textbooks on macroeconomics make this divergence the cornerstone of the whole discussion. In contrast, the GMM estimators were derived under the assumption of homogeneity of short and long run, which stands in total

[5] An alternative to this approach would be to use reference rates of the relevant central banks. These variables, however, change very infrequently and demonstrate low variance. Moreover, it could be argued that these do not take into account market expectations; however, most importantly, it could be that the central bank does not have any policy effectiveness despite setting its reference interest rates relatively far from the interest rate parity. Hence, interbank interest rates provide an effective means for investigating monetary policy independence and, based on the above listed reasons, it could be argued that the measures of interest rates chosen for the empirical model estimated in the article are indeed appropriate.

contradiction with the tested macroeconomic models. This is crucial, because one of the main findings of the econometric literature devoted to research on 'long' panels is that the assumption of homogeneity of the parameters is incorrect.[6]

As far as the problem of independence of monetary policy is concerned, it is important to distinguish between the short-run 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 empirically between the short-run and long-run effects, a family of panel cointegration estimators could be used: Mean Group (MG, Pesaran and Smith, 1995), Pooled Mean Group (PMG, Pesaran et al., 1999), and Augmented Mean Group (AMG, Bond and Eberhardt, 2009; Eberhardt and Teal, 2010).

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 survey and therefore $\beta_j = \beta_i$ for each *j* and *i*. However, Pesaran et all. (1999) note that this does not have to be in line with the reality, especially in the short term. For this reason the commonly used estimators may not be consistent and thus long-run coefficients could be biased. They proposed the new estimator (PMG) that assumes that constant, short run coefficients and variance of error terms differ between units, while the restriction is imposed on the long-term coefficient to be the same for all units. In terms of the relationship between domestic (r) and foreign (r*) interest rates, estimated equation is as follows:

$$\Delta r_{i,t} = \sum_{z=1}^{p-1} \gamma_i \Delta r_{i,t-z} + \sum_{z=0}^{q} \tau_i \Delta r^*_{i,t-z} + \varphi_i \left(r_{i,t-1} - \alpha_i - \sum_{j=1}^{k} \beta_j r^*_{i,j,t-1} \right) + \varepsilon_{i,t} \qquad (4)$$

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, long-term coefficients seem to converge to the average. Due to this characteristic, the PMG estimator seems to be the most appropriate for analyses where the short run data are complex and country-specific. In contrast to the MG estimator, which involves averaging in groups, PMG estimator imposes equality of long-term coefficients between countries and imply common cointegrating relationship, represented by the error-correction mechanism. Eberhart and Teal's (2012) Augmented Mean Models accounts for cross-section dependence by including a "common dynamic process" in the regression.

[6] Confirmation of this can be found in Pesaran and Smith (1995); Im, Pesaran and Shin (2003); Pesaran , Shin , and Smith (1997, 1999); and Phillips and Moon (2000).

A prerequisite for the estimation of these models is cointegration between the variables of interest. The first step of analysis is to find a unit root for all of the series to be at least first order integrated. The second is to test for cross-sectional independence. If cross sectional dependence exists, it is most appropriate 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. EMPIRICAL RESULTS

The investigation was based on a sample of three-month interbank nominal interest rates for the Eurozone, and seven European economies pursuing inflation targeting policy with floating exchange rates - Poland, Czech Republic, Hungary, Norway, Romania, Sweden and United Kingdom for the period of 2000:01-2015:09 with monthly frequency. Figure 1 plots these variables.

Conventional panel estimators such as fixed or random effects can be inconsistent in presence of cross-sectional dependence. These correlations across units in the panel may well have serious consequences on the 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. Therefore, the Pesaran's(2004) 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 (CD test statistic 47.09 with p-value 0.000). Thus, the presence of cross-sectional dependence was confirmed.

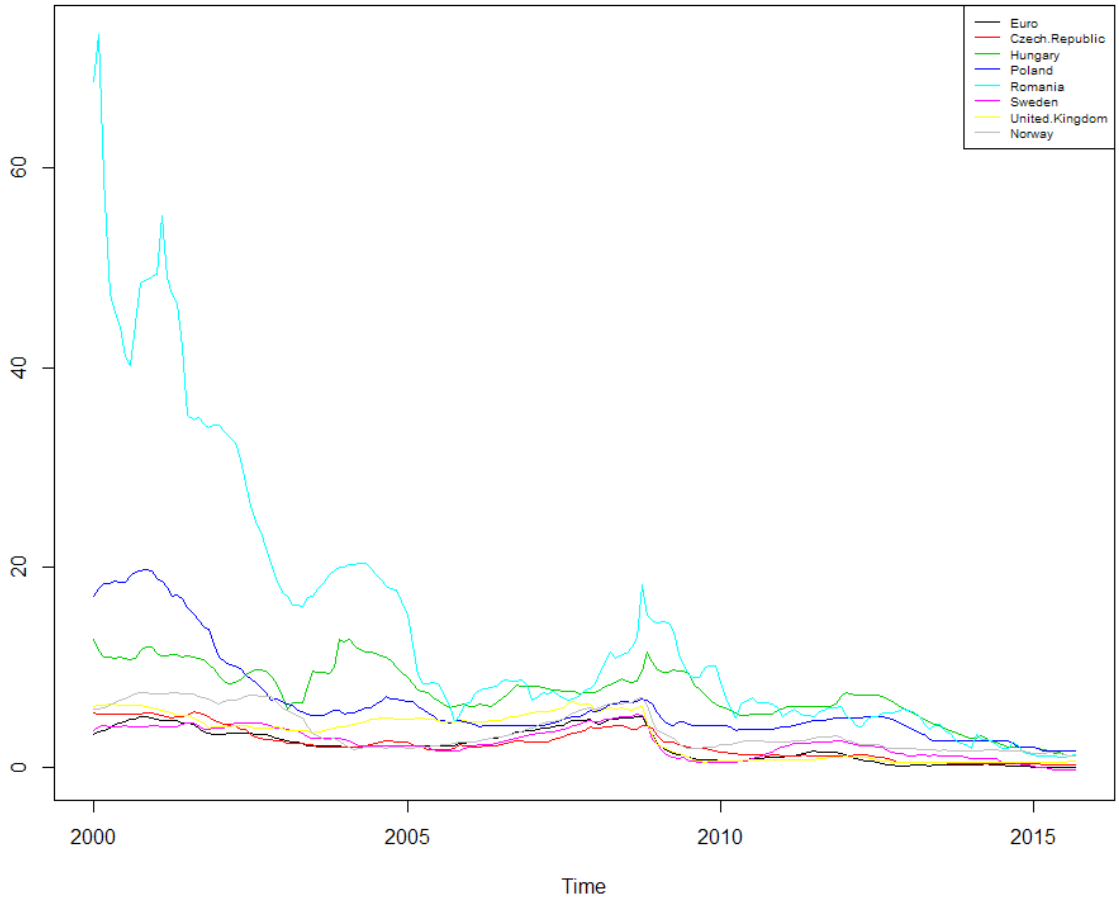

Figure 1 Three-month interbank nominal interest rates during the period 2000-2015:09 (Monthly quotations)
Source: Eurostat

Next, the stationarity of the data was investigated. In the case of EURIBOR unit root tests for time series were used (ADF, PP, KPSS), because for all panel units adjustment coefficient is the same.[7] The tests resulted in the following p-values-(0.39, 0.68, 0.01) for the series and (0.01, 0.01, 0.1) for the first difference. Inclusion of trend or additional lags provided similar results. This allows us to conclude that the stochastic process guiding the behavior of interest rates in Eurozone is integrated of the first order. As for the panel itself, a second-generation Pesaran (2007) unit root test for heterogeneous panels was applied to the domestic interbank interest rates in the four countries data. 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, significant risk that

[7] All observational units are a pair of values, domestic interest rates and EURIBOR.

there is an unit root in the panel exists. Thus panel was deemed to be non-stationary and this provided the necessary backing for the cointegration existence verification.

Table 1. The results of the Pesaran (2007) panel unit root tests (CIPS) for the nominal interest rates

	Constant		Trend	
Lags	Zt-bar	p-value	Zt-bar	p-value
0	0.775	0.781	0.922	0.822
1	-2.283	0.011	-1.749	0.04
2	-0.671	0.251	-0.085	0.466
3	-0.573	0.283	-0.015	0.494
4	-0.862	0.194	-0.446	0.328
5	-1.593	0.056	-1.219	0.111
6	-1.791	0.037	-1.546	0.061

Source: own calculations

Westerlund (2007) derived four new panel cointegration tests that correspond to structural rather than residual cointegration and do not require the assumption of equal dynamics for all groups of observation. These tests allow for cross dependencies. In all tests the null hypothesis is that the error correction mechanism is zero - meaning no cointegration. The results in Table 2 indicate cointegration with a constant on the left panel and constant and trend specification on the right panel.

Table 2. The results of the Westerlund (2007) panel cointegration tests between nominal domestic interest rates and EURIBOR

	Constant			Trend		
Statistic	Value	Z-value	P-value	Value	Z-value	P-value
Gt	-2.325	-1.611	0.054	-2.206	0.523	0.700
Ga	-7.63	-0.237	0.406	-8.456	1.383	0.917
Pt	-6.745	-2.932	0.002	-4.916	0.77	0.779
Pa	-8.335	-2.446	0.007	-7.565	0.59	0.723

Source: own calculations

The next step after the confirmation of the hypothesis about cointegration with the constant was to estimate the short and long run effects of the EMU interest rates on domestic interest rates. To accomplish that, a family of estimators based on second generation panel cointegration was used. Four panel models were estimated: PMG, MG, AMG, and dynamic fixed effects (DFE) model. The results are presented in Table 3. The MG panel model assumes that the parameters of the regression are different for each country. The PMG model assumes the equality of long-term coefficients between countries. AMG models introduces the common dynamic process in the regression.

Table 3. Results of the estimation for the nominal interest rates

Nominal Interest Rate	PMG	MG	AMG	DFE
LR				
β (EURIBOR)	2.055***	0.857	3.121	1.654***
	(0.325)	(1.022)	(2.747)	(0.204)
SR				
φ (ECM)	-0.0167*	-0.0320***	-0.115	-0.0547***
	(0.0100)	(0.00942)	(0.0746)	(0.00368)
τ (D.EURIBOR)	0.532***	0.528***	1.002**	0.543***
	(0.110)	(0.113)	(0.436)	(0.111)
γ(L.D. Interest Rate)	0.301***	0.296***	0.300***	0.228***
	(0.0673)	(0.0647)	(0.0674)	(0.0243)
Common Process			0.579	
			(0.554)	
Constant	0.0503	0.0292**	-0.0354	0.0489
	(0.0449)	(0.0147)	(0.0882)	(0.0312)
N	1309	1309	1309	1309

Notes: Standard errors in parentheses* p < 0.10, ** p < 0.05, *** p < 0.01
Source: own calculations

Results presented in Table 3 are mixed. The least efficient estimators - MG and AMG do not indicate significant cointegration coefficients. The more efficient estimators – PMG and DFE indicate the cointegration relation between the interest rates. Firstly, the hypothesis that there

is a common dynamic process in the estimation is rejected. This means that other factors, for instance relating to other aspects of the real or nominal global business cycle in the Eurozone and the investigated 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. As this feature is unnecessary, the AMG model should not be used for inference.

Secondly, we use Hausman specification test to check for consistency of the estimators used in the data. Should there be no systematic difference between consistent and efficient estimators, the efficient estimators will be used for conclusions. Hausman test p-value between MG and PMG model is 0.228, indicating that there are no reasons to reject the constraints imposed by the PMG model (restriction that estimated long-term flexibilities are equal in all countries.). Therefore the PMG estimator is more consistent than the MG estimator. Next the MG and DFE models were compared. The DFE estimator similarly imposes a restriction of equality of long run coefficients, but imposes also equality of short term coefficients. The Hausman tests p-value is 0.640, indicating that there are no systematic differences between those estimators and that the DFE model should be used, as it is more efficient.

Results of the estimation of the model with the use of the DFE estimator indicate that there is cointegration between nominal interest rate. The value of the coefficient is more than one and points to a significant overreaction of domestic rates to the EMU interest rate shock. One interpretation of this could be that there is a risk premium between Eurozone and the countries in the panel, so the nominal interest rates converge to a higher value. One of the causes of this results could be the high inflation of the early 2000s in Romania, Poland and Hungary that is increasing the value of the long run coefficients. The short run adjustments are smaller than the long run coeficients, indicating growing influence of the change in EURIBOR rates in time.

To check the robustness of the results, the same estimation has been conducted on real instead of the nominal rates. Short run real interest rates are one of the indicator of the monetary policy stance and influence real economy in a short run. As ultimately we are interested in transmission of monetary policy, this check allows us to verify whether the cointegration between nominal rates is caused by the transmission of inflation from Eurozone or by the similarity of the monetary policy stance. This also reduces the influence of the zero lower bound on nominal interest rates on the estimation.

Figure 2 shows the real interest rates in the sample, obtained by subtracting inflation from the nominal interest rate. Inflation was measured by HCPI index from Eurostat. As expected, the differences between initial real rates are significantly smaller and should have smaller impact on the estimation. In Table 4 the results of Westerlund(2007) cointegration tests are

shown. The results are much stronger than for the nominal rates and it could be concluded that there is cointegration between domestic real rates and Eurozone real rates in both specifications (with a constant and with a constant and a trend).

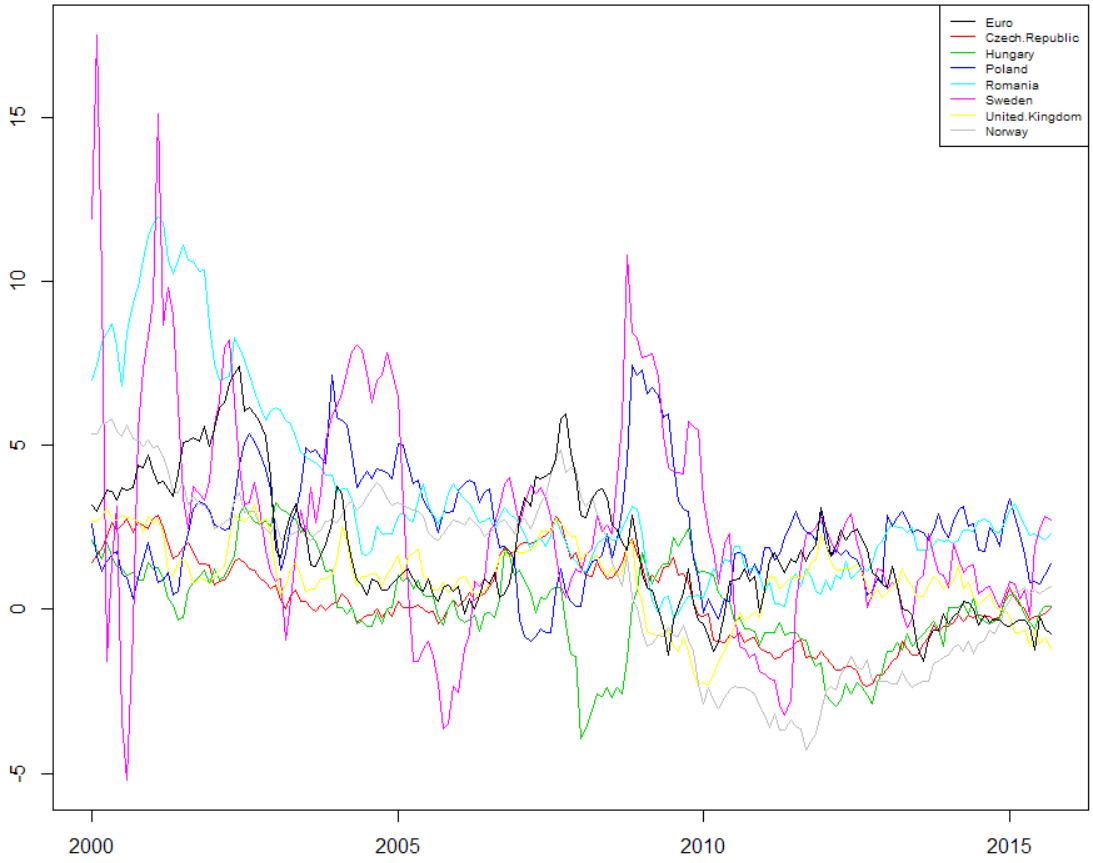

Figure 2. Three-month interbank real interest rates during the period 2000-2015:09 (monthly quotations)
Source: own

Table 4. The results of the Westerlund (2007) panel cointegration tests for domestic real interest rates and Eurozone real interest rates

	Constant			Trend		
Statistic	Value	Z-value	P-value	Value	Z-value	P-value
Gt	-2.586	-2.381	0.009	-2.854	-1.586	0.056
Ga	-14.322	-3.490	0.000	-16.784	-1.857	0.032
Pt	-7.862	-4.055	0.000	-8.787	-3.656	0.000
Pa	-17.710	-8.033	0.000	-22.304	-5.770	0.000

Source: own

Table 5. Results of the estimation for the real interest rates

Real Interest Rate	PMG	MG	AMG	DFE
LR				
β (EUR Real IR)	0.510***	0.419	0.551**	0.769***
	(.190)	(.282)	(0.183)	(.161)
SR				
φ (ECM)	-0.072***	-0.075***	-0.106**	-0.101***
	(0.027)	(0.029)	(0.039)	(0.010)
τ (D.EUR Real IR)	0.492***	.498***	.812***	0.499***
	(0.098)	(0.088)	(0.106)	(0.080)
γ(L.D. Real IR)	0.144***	0.145***	0.150***	0.165***
	(0.037)	(0.037)	(0.037)	(0.026)
Common Process			0.143 *	
			(0.073)	
Constant	0.116*	0.122*	-0.233*	0.139***
	(0.069)	(0.068)	(0.125)	(0.027)
N	1309	1309	1309	1309

Notes: Standard errors in parentheses, * p < 0.10, ** p < 0.05, *** p < 0.01
Source: own

The same methodology as in the case of the nominal rates investigation was used for the real rates. Results presented in Table 5 indicate the existence of the cointegration relation between the real interest rates. The statistics have asymptotically normal distribution. Although the least efficient MG estimator has relatively high standard deviations, other models do reject the hypothesis of no cointegration. In order to compare the models the Hausman test was used. Hausman test p-value between MG and PMG model is 0.665, indicating that there are no reasons to reject the constraints imposed in the PMG model (restriction that estimated long-term flexibilities are equal in all panels). Therefore the PMG estimator is preferred in terms of efficiency over MG estimator. Next the MG and DFE models were compered. The DFE estimator

similarly imposes a restriction of equality of long run coefficients, but also the equality of short term coefficients. The Hausman tests p-value is 0.355, indicating that there are no systematic differences between those models and that the DFE model could be used as it is more efficient.

In case of the AMG model, the hypothesis that there is a common dynamic process guiding the change should not be rejected. This can suggest there could be cross dependence in residuals or omitted variables in the specification. However, the difference in long run coefficients in AMG and DFE models is not systematic, as the p value of 0.858 of Haussmann test indicates. Thus the hypothesis on long run transmission of monetary policy could not be rejected. In the results there is an indication that there might be a common dynamic process involved that is not related to the real interest rates.

As the results of the Table 5 show, the evidence of cointegration between real interest rates appears to be stronger than for the nominal rates. This lead to the conclusion that the cointegration is not led by the transmission of inflation, but by the transmission of the real interest rates. The long run coefficients in Table 5 suggests that Central Banks enjoy some flexibility from incorporating the ECB policy in their own monetary policy (around 25% in the long run as of DFE and up to 45 % as of AMG). The difference in short run coefficients between AMG and DFE indicate different behavior. In AMG there is a more significant reaction in the short run then in the long run., whereas in DFE the long run coefficients are higher than the reaction in the short run.

Another concern about the cointegration of nominal rates is the influence of the exchange rate as a missing variable in our specification. Firstly, there could be systematic capital flows across the border that would influence both interest rates. Secondly, current specification does not control for the influence of interest rate parity. To address those issues, the demeaned log of the exchange rate (FX) will be included into estimation, both in long and short run.

As it is shown in Table 6, there is strong indication of the cointegration between domestic and European nominal interest rates and the exchange rate. This was to be expected as the exogenous change in the exchange rate would influence export profitability, costs of imports and cause flow of capital across the border in the long run.

Table 6. The results of the Westerlund (2007) panel cointegration tests between domestic nominal interest rates, EURIBOR and the exchange rate.

	Constant			Trend		
Statistic	Value	Z-value	P-value	Value	Z-value	P-value
Gt	-2.782	-2.146	0.016	-2.454	0.234	0.593
Ga	-10.365	-0.523	0.300	-10.276	1.211	0.887
Pt	-9.012	-4.338	0.000	-8.173	-2.351	0.009
Pa	-14.392	-4.035	0.000	-14.676	-1.639	0.051

Source: own

Table 7. Results of the estimation on uncovered interest parity

Nominal Interest	PMG	MG	AMG	DFE
LR				
β (EURIBOR)	0.894***	2.312**	2.991	1.590***
	(0.0812)	(0.979)	(2.751)	(0.218)
(FX)	0.855	12.81	-0.819	-2.286
	(1.261)	(8.988)	(2.033)	(3.653)
SR				
φ (ECM)	-0.0301***	-0.0314***	-0.119	-0.0564***
	(0.00766)	(0.00720)	(0.0764)	(0.00446)
τ (D.EURIBOR)	0.563***	0.640***	0.923**	0.539***
	(0.0982)	(0.118)	(0.371)	(0.116)
γ(L.D.InterestRate)	0.321***	0.298***	0.304***	0.230***
	(0.0673)	(0.0691)	(0.0727)	(0.0244)
(D.FX)	0.595	0.606	-0.769	0.367
	(1.645)	(1.596)	(0.635)	(0.857)
Common Process			0.574	
			(0.558)	
Constant	0.0846	-0.0649	-0.0150	0.0599
	(0.0529)	(0.0718)	(0.0431)	(0.0354)
N	1309	1309	1309	1309

Notes: Standard errors in parentheses* p < 0.10, ** p < 0.05, *** p < 0.01
Source: own

As it is shown in Table 7, there is no significant difference in the results of the models with exchange rate included. Similarly as before the hypothesis that there is a common dynamic process in the estimation is rejected. Thus the AMG model should not be used for inference. Hausman test p-value between MG and PMG model is 0.369, indicating that there are no reasons to reject the constraints of the equality of long run coefficients. Therefore the PMG estimator is preferred over MG estimator. Next the MG and DFE models were compared. The Hausmman tests p-value is 0.2304, indicating that there are no systematic differences between those models and that the DFE model should be used, as it is more efficient. The conclusion of the Table 7 is that the results of the cointegration between nominal interest rates and Eurozone real interest rates are not related to the exchange rate or interest rate parity and our results of a lack of monetary independence in the EEA are robust to these concerns.

Conclusions

In the article, it has been investigated whether the monetary policies in non-euro European economies are independent from the ECB monetary policy. We verified if there exists a relationship between the domestic and Eurozone interest rates since the inflation targeting framework combined with floating exchange rate should manifest itself in an uncoordinated behavior of the investigated pairs of interest rates. The panel estimators were used: PMG, AMG, and MG and compared with standard Dynamic Fixed Effects model. The results show that in the long run the interest rates of non-euro European countries follow the Eurozone interest rates. We have shown that there is a cointegraion relationship between domestic nominal interest rates and EURIBOR rates. Then it was shown that this long run relationship is driven by the monetary policy and not by the inflation. We found strong evidence for cointegration of real interest rates, concluding that 55 -75% of monetary policy of countries in the panel is driven by ECB monetary policy. We have shown that results are independent of exchange rate fluctuation or interest rate parity.

It should be noted, that the similarity between the ECB and the domestic interest rates of the central banks does not have to be solely the result of lack of independence and "copying" of ECB policy by the monetary authorities of individual countries. This may also result from the growing degree of synchronization of business cycles and the symmetry of shocks that affect the national economy and the euro zone economy. However, the AMG model results suggest that other factors (such as the global financial cycle) are not relevant to the nature of the nominal interest rates transmission. While our framework does not allow us to discriminate any further between hypotheses concerning the reason for the low degree of freedom of monetary policy and the significant overreaction seen in the data we can hypothesize ex post about the role of the

strong financial links between economies in Europe and increasing, correlation of business cycle phases, increasing currency substitution and high level of foreign currency debt, including high level of private foreign currency denominated borrowing. These factors either significantly lower the effectiveness of monetary policy or undermine its credibility through fear of floating behavior. Shallow financial markets and foreign exchange lending, vulnerability to swings in terms of trade due to low trade diversification combined with a high degree of openness, are all factors that may exacerbate a sudden reversal of investor sentiment in small open economies.

The reasons for this relative lack of independence of monetary policy and a behavioral overreaction can be explained in many ways. The first justification refers to volatile inflation expectations; second, trade integration in the framework of intra-industry trade between both areas is large enough that there are fewer asymmetric shocks, which would require the use of discretionary monetary policy in CEE that would be different than in the euro area. However, with the increasing trade flows the fear of sudden change in terms of trade may be high enough for the central bank to fully accommodate EMU interest rate changes. Moreover, the same strategy might be trigger by the high level of foreign currency debt, including high level of private foreign currency denominated borrowing. These factors common to open economies either significantly lower the effectiveness of monetary policy or undermine its credibility through fear of floating behavior.

LITERATURE

Aizenman, J., Chinn M. D., Ito H., 2013. The "Impossible Trinity" Hypothesis in an Era of Global Imbalances: Measurment and Testing. Review of International Economics, 21(3), 447-458.

Ball, C. P., Reyes J., 2008. Inflation targeting or fear of floating in disguise? A broader perspective. Journal of Macroeconomics, 30, 308-326.

Blundell R., Bond S., 1998. Initial conditions and moment restrictions in dynamic panel data models. Journal of Econometrics, 87, 115-143.

Bond, S., Eberhardt M., 2009. Cross-section dependence in nonstationary panel models: a novel estimator, paper presented at the Nordic Econometrics Conference in Lund.

Breitung, J., Pesaran, H., 2005. Unit Roots and Cointegration in Panels, CESIFO Working Paper No. 1565.

Buscher H. S., Gabrisch H., 2011. What Might Central Banks Lose or Gain in case of Euro Adoption – A GARCH-Analysis of Money Market Rates for Sweden, Denmark and the UK. IWH Discussion Papers.

Calvo G., Reinhart R. 2002. Fear of floating, The Quarterly Journal of Economics, 117(2), 379-408.

D'Adamo, G., 2011. Estimating Central Bank preferences in a small open economy: Sweden 1995-2009. MPRA Paper 26575.

di Giovanni J., Shambaugh J. C., 2008. The impact of foreign interest rates on the economy: The role of the exchange rate regime. Journal of International Economics 74(2), 341-361.

Eberhardt, M., Teal F., 2010. Productivity Analysis in Global Manufacturing Production, Economics Series Working Papers 515,

Edwards S., 2010. The international transmission of interest rate shocks: The Federal Reserve and emerging markets in Latin America and Asia, Journal of International Money and Finance, 29(4), 685-703.

Edwards, S. 2015. Monetary Policy Independence under Flexible Exchange Rates: An Illusion?," NBER Working Papers 20893, National Bureau of Economic Research, Inc.

Ehrmann, M., M. Fratzscher, 2002. Interdependence between the euro area and the US: what role for EMU? European Central Bank Working Paper Series 200.

Frankel J., Rose A., 1998. The endogeneity of the optimum currency area criteria. Economic Journal, 108 (449), 1009-1025.

Frankel J., Schmukler S., Serven L., 2004. Global transmission of interest rates: monetary independence and currency regime. Journal of International Money and Finance 23(5), 701-733.

Frankel J., 1999., No Single Currency Regime is Right for All Countries or At All Times. NBER Working Papers 7338.

Gabaix X., Maggiori, M., 2014. "International Liquidity and Exchange Rate Dynamics,"NBER Working Papers 19854, National Bureau of Economic Research, Inc.

Goczek, L., Mycielska D., 2014. Gotowi na euro? Badanie empiryczne faktycznej swobody polskiej polityki pieniężnej, Bank i Kredyt, 45(3), 267-290.

Hausmann, R., Panizza, U. Stein, E., 2001. "Why do countries float the way they float?," Journal of Development Economics, Elsevier, vol. 66(2), pages 387-414, December.

Im, K., Pesaran, H., Shin, Y., 2003. Testing for unit roots in heterogeneous panels, Journal of Econometrics, vol. 115.

Kolasa M., 2013. Business cycles in EU new member states: How and why are they different? National Bank of Poland Working Paper No. 156.

Masson, P., Savastano, M., Sharma, S., 1997. The Scope for Inflation Targeting in Developing Countries, IMF Working Paper No. 97/130.

Moon H. R., Perron B., 2007. An empirical analysis of nonstationarity in a panel of interest rates with factors. Journal of Applied Econometrics 22(2), 383-400.

Pesaran, H., 2003. A Simple Panel Unit Root Test in the Presence of Cross Section Dependence, Cambridge Working Papers in Economics 0346.

Pesaran, H., Shin Y., Smith R., 1999. Pooled mean group estimation of dynamic heterogeneous panels, Journal of the American Statistical Association, 94, 621-634.

Pesaran, H., Smith R., 1995. Estimating long-run relationships from dynamic heterogeneous panels. Journal of Econometrics, 68(1), 79-113.

Pesaran, H., 2004. General Diagnostic Tests for Cross Section Dependence in Panels. IZA Discussion Paper No. 1240.

Reade J., Volz U., 2010. Too Much To Lose, Or More To Gain? Should Sweden Join the Euro? University of Birmingham Discussion Papers,10-13.

Reade J., Volz U., 2011. Leader of the pack? German monetary dominance in Europe prior to EMU, Economic Modelling, 28(1-2), 239-250.

Rey H., 2015. "Dilemma not Trilemma: The global Financial Cycle and Monetary Policy Independence," NBER Working Papers 21162, National Bureau of Economic Research, Inc.

Stiglitz, J. 2000. "Capital Market Liberalization, Economic Growth, and Instability," World Development, Elsevier, vol. 28(6), pages 1075-1086, June.

Taylor J. B., 2007. Globalization and monetary policy: Missions impossible. In: Gertler M., Gali J. (Eds.), The international dimensions of monetary policy. NBER Conference, Girona, University of Chicago Press, 609–624.

van Dijk, D., Munandar H., Hafner C., 2011. The euro introduction and noneuro currencies. Taylor and Francis Journals 21(1-2), 95-116.

Westerlund, J. 2007. Testing for error correction in panel data. Oxford Bulletin of Economics and Statistics 69, 709-748.

Windberger T., Crespo Cuaresma J., Walde J., 2012. Dirty floating and monetary independence in Central and Eastern Europe - The role of structural breaks. Working Papers 2012-21.