Monetary Regimes and External Shocks Reaction: Empirical Investigations on Eastern European Economies

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Abstract

In the late 90's, after severe financial crisis, accompanied by inflation and exchange rate instability, Eastern Europe emerged into two radically contrasting monetary regimes (Currency Boards and Inflation targeting). The task of our study is to compare econometrically the performance of these two regimes in terms of their resilience to the external real and nominal shocks, coming from Euro area. In other words, we test the non-neutrality of exchange rate regimes with respect to these connections. Our PVAR model results reveal that the choice of monetary regimes indeed determines the ability of a country to absorb the external shocks.

Keywords: GDP Growth, Interest rate, monetary regimes, Eastern Europe.

Jel Code: C22; C51; C52; E0

1. Introduction

In the late 90's, after severe financial and economic crisis, accompanied by inflation and exchange rate instability, Eastern Europe emerged into two groups of countries with radically contrasting monetary regimes (Orlowski, 2004; Roaf et al., 2014). The first group was formed by the countries with Currency Boards and strongly fixed exchange rate regimes (Estonia, Lithuania, Bulgaria and Latvia) and the second one was composed of Inflation targeting countries (Poland, Czech Republic, Hungary and Romania). The reasons behind these choices were complex and in many respects political (Abdelal, 2001; Grittersova, 2014). One of leading purely economic arguments was the belief about the ability of two regimes to provide low inflation and to anchor inflationary expectations. This was viewed as a prerequisite for successful nominal and real convergence towards the EU integration and as a whole for sustainable economic growth. Over time, and especially with the

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launching of accession process and subsequently the EU membership, the differences in achievement and performance of both groups began to be increasingly subtle and unsystematic. This, in turn, undermined the importance of choosing one or another monetary regime and gave reasons to believe that the hypothesis of neutrality of the monetary regime regarding external shocks reaction cannot be rejected.

The task of the present study is to compare econometrically the performance of these two regimes in terms of their ability to absorb the real and nominal shocks, coming from abroad (EU and common monetary policy). In other words, we test the hypothesis of non-neutrality of monetary and exchange rate regimes with respect to these external connections. Our study has practical meaning as far as actually we observe discussion in Eastern Europe about the possible entry into the Euro zone and the effectiveness of different monetary regimes in respect to that.

For our empirical investigation, we use a vector autoregressive system (VAR) on panel data set. The use of Panel VAR models facilitates the macroeconomists for the approximation of shocks and then observing their impact on the other variables. Besides, due to similar socio-economic structure of our selected sub-samples Eastern European economies, a comparative analysis of the opposing monetary policy regimes becomes easier. Nevertheless, the previous literature on this side only focuses on country-specific analysis and thereby, does not exploit the panel dimension of our selected data set (see Minea and Rault, 2011 and references therein). Lastly, we also test the performance of both these regimes during the financial crisis, 2008 using the pre- and post-crisis sub-periods. Our empirical results show a significant role of monetary policy regimes in determining the resilience of an economy against the external real and nominal shocks.

The article is constructed in three sections. The first section presents the theoretical foundations of the study, especially the main characteristics of both monetary regimes as well as the major theoretical relationships between external shocks and domestic macroeconomic stability. In the second section we set out and discuss empirical results. In the last section we conclude.

2. Theoretical framework

As already pointed out the choice of both polar regimes – Currency Boards and Inflation targeting – was dictated primarily by the necessity to curb inflation, to fix inflation expectations and to accelerate growth.[2] In this line of reasoning credibility of the monetary regime, and its ability to

[2] Putting aside political economy argumentation of monetary regime choice, see for details Grittersova (2014).

establish discipline were the leading motives behind the choice of individual countries. Monetary regime is the primary institutional anchor that is systemic in nature, not only to inflation but also to the overall developments of the economy.

There is little doubt that both monetary regimes, namely Currency Board and Inflation targeting are very contrasting in their mechanics. The aim of Currency Board is to import credibility and discipline from abroad by legally fixing exchange rate to the leading foreign currency and by means of full monetary base coverage with liquid foreign reserves. The monetary policy is eliminated because the balance sheet of central bank contains no domestic assets. The Central bank cannot perform open market operations; although some elements of monetary policy are available through the manipulation of reserve requirements and banking regulation. Currency Board relies on an automatic link between balance of payments and money supply, real exchange rate and interest rates are supposed to quickly address all imbalances. Balance sheet separation of the Treasury from the Central bank, obligates the government to pursue conservative fiscal policy, and as a rule to maintain fiscal surpluses and low public debt. Proponents of Currency board consider that it produces high levels of discipline and credibility (Nenovsky and Hristov, 2002; Hanke, 2012; Gedeon, 2013).

Likewise, Inflation targeting pursues the same objectives (high credibility and discipline), but with others, and above all internal to the country mechanisms. These are clearly defined inflation target, transparency, as well as active conduct of monetary policy. It relies on good knowledge of the economic model and transmission mechanisms. In purely theoretical terms Inflation targeting requires fully floating exchange rate.[3] Supporters consider this monetary regime appropriate to combine the power of enhancing the level of fiscal discipline and credibility without eliminating the possibility for discretionary reaction in shocks.

Focusing on our sample countries, we can say that the Currency Board regimes are generally small and highly open peripherals economies pursuing quick integration into the monetary system of the developed European countries. For example, Currency Boards in Estonia (1992) and Lithuania (1994), were introduced at the beginning of transition, the main objective explicitly was to break the influence of Russia and the Russian economy (Abdelal, 2001). Bulgaria, in turn, introduced Currency Board in mid-1997afterdeep financial and monetary crisis, period of hyperinflation and sharp devaluation of national currency

[3] In practice, the small and open economies such as in Eastern Europe still monitor and intervene on the foreign exchange market.

(Berlemann and Nenovsky, 2004).[4] Here the main task was to break with years of inflation, monetary instability and lack of structural reforms. In this sense, the choice of the Currency Board in Bulgaria could be seen as a decisive geostrategic integration into the European monetary zone.

Regarding the three countries with Inflation targeting (Poland, Czech Republic and Hungary, and to some extent Romania)[5], we see that they have the characteristics of Central European countries, they have some traditions in an economic and monetary policy prior to period of communism, and clear aspirations for independent and equal cooperation with leading European economies. Poland and Hungary began the transition with a fixed rate (to varying degrees) and progressively gained knowledge and experience in implementing monetary policy. These countries put much effort in building macroeconomic models serving the base for the later implementation of Inflation targeting regime. The case of Romania is somewhat peculiar. Romania has a number of characteristics similar both to Central European countries as well to Bulgaria that explains oscillations and late implementation of Inflation targeting.

Turning to a theoretical background, a substantial amount of literature investigates into the relationship between external shocks and the domestic macroeconomic stability. This work, starting at least from Hamilton (1983), mainly focuses on the transmission of oil price shocks to the domestic macroeconomic indicators (see Segal, 2007; Kilian, 2008, for survey). A parallel stream of literature tests the relevance of external monetary and real shocks to the domestic economic stability of the small open economies. Among the earlier works, Dornbusch (1985) confirms the influence of large economies on world prices, and consequently on the real output fluctuations of the emerging economies. Similarly Calvo et al. (1993) examine the impact of external shocks on the real exchange rate variation of the Latin American countries. Their results show a strong connection between the two variables for the selected economies. The other examples include Reinhart and Reinhart (2001) and Frankel and Roubini (2001) who illustrate a negative influence of the U.S interest rate changes on the GDP of emerging economies (see Horváth and Rusnák, 2009 and references therein).

The presence of a strong relationship between external shocks and domestic macroeconomic variables led to the extension of this work and the subsequent studies focused on testing the role of monetary regimes in this nexus. Several

[4] Latvia carried out a similar policy of a fixed exchange rate it is not the subject of our reflections notably because it does not represent Currency board in its pure form.

[5] Poland decided to move to Inflation Targeting in 1998 and introduce it in 2000, Hungary also passed in mid-2000,and Romania introduced this scheme in 2005.

country-specific studies have analysed how opting for a particular monetary policy regime improves the economic performance of a country. Some comparative analyses in this context can be found for the pegged and floating exchange rate regimes of Hong Kong and Singapore, respectively. Devereux (2003), for example, note that due to the differences in the monetary strategies of these two countries, Hong Kong experienced higher volatility of GDP growth and lower variation in the real effective exchange rate than Singapore between 1983 and 1998. Gerlach and Gerlach-Kristen (2006) re-visit the relationship between monetary policy regimes and macroeconomic performance for the same two economies over 1984-2004. Their results show a positive role of Singapore's active monetary policy stance in buffering the effect of external shocks on the inflation variability, although the output variability remains similar in both regimes. Hoffmaister and co-authors (1998) complement these results for the bi-polar monetary regimes of the sub-Saharan Africa, namely, CFA franc economies versus non-CFA countries.

However, to the best of our knowledge, similar comparative studies for our selected bi-polar monetary regimes do not exist in the literature, although these economies provide a natural laboratory to test this relationship. The literature rather opted for analysing only one of the two competing regimes. Mamoudou et al. (2009), for instance, use a structural vector autoregressive (SVAR) model for the three inflation target countries, the Czech Republic, Poland and Hungary, in order to study the link between instruments of monetary policy and inflation. Their results show a strong exchange rate pass-through especially for Poland and Hungary. The relationship between domestic interest rate and prices is found weak, however. Similarly, on the Currency board economies, Minea and Rault (2011) test the effect of ECB and Fed interest rates changes on the Bulgarian macroeconomic variables. The results, based on the impulse response functions, show that the effect of ECB interest rate shocks has been less significant and persistent compared to the shocks coming from the Fed (see also Lättemäe, 2003, for Estonia). In the similar line of empirical investigation, Figuet and Nenovsky (2006) test for nominal and real convergence of different Eastern European Countries and compare Bulgaria and Romania. The authors note that the Currency Boards countries have faster and stronger nominal convergence to the EU core.

3. Empirical analyses and interpretations

3.1) Methodology

In order to analyse the ability of opposing monetary policy regimes to absorb foreign real and nominal shocks, we choose a panel vector autoregressive (PVAR) model. The PVAR models, introduced by Pesaran and Smith (1995) enable researchers to approximate the shocks and then to see their effects on the

macroeconomic variables (see Rebucci, 1998; Prasad and Gable, 1998). Using a PVAR model rather than the time series VARs offers great advantage since it provides a greater degree of freedom and allows getting more precise response of variables to different shocks. Due to all these reasons PVAR models have been frequently used in this literature (see also Hoffmaister and Roldos, 1997).

A simple form of a k-variate PVAR of order *p* with panel-fixed effects can be represented by the following system of equations:

$$Z_{it} = Z_{it-1}A_1 + Z_{it-2}A_2 + ...Z_{it-p+1}A_{p-1} + Z_{it-p}A_p + X_{it}B + u_{it} + e_{it} \quad i \in \{1,2,...,N\}, t \in \{1,2,....,T_i\} \quad (1)$$

where Z_{it} is a $(k \times 1)$ vector of dependent variables; X_{it} is a $(l \times 1)$ vector of exogenous covariates; u_i and e_{it} are $(1 \times k)$ vectors of dependent variable-specific fixed effects and error terms, respectively. Innovations are assumed to have the following characteristics: $E[e_{it}] = 0, E\left[e_{it}^{'} e_{it}\right] = \sum$ *and* $E\left[e_{it}^{'} e_{it}\right] = 0$ for all $t > s$ (see Abrigo and Love, 2015 for details).

In the estimation of impulse response functions we drop exogenous variables and focus only on the autoregressive structure of the equation (1). The remaining Y_{it} vector consists of four endogenous variables such as $Z_{it} = [EU_i, \pi_{it}, \Delta\pi_{it}, Y_{it}]$ which include European interest rate (EU_i), inflation rate (π_{it}), inflation uncertainty $(\Delta\pi_{it})$ and output growth (Y_{it}). Similarly, for the real shocks, European output growth (EU_Y) replaces (EU_i).

For our empirical estimation of the PVAR model, we use the Stata program proposed by Abrigo and Love (2015). The presence of country-fixed effects in a VAR framework – where dependent lags appear on the right hand side – causes the coefficients biased if we use standard mean-differencing procedure to eliminate these fixed-effects. Arellano and Bover (1995) propose a solution to this problem where untransformed lagged regressors are used as instruments because the variables are forward mean differenced and the coefficients are estimated through a system of Generalized Method of Moments (GMM). The standard errors (SEs) of the impulse response functions are drawn from Monte Carlo estimation, with 95% confidence interval (see Mora and Logan, 2012, for details).

3.2) Data

We use monthly data of eight Eastern European economies over the period from January 1999 to March 2017, taken from Eurostat online Database. The selected

sample includes three Currency Board economies (Bulgaria, Estonia, Latvia and Lithuania), and three Inflation Targeting countries (Czech Republic, Hungary, Poland and Romania).[6] For these economies, Deseasonalized inflation series are calculated from these indices using $\ln(P_{t+12} / P_t)$ the definition of inflation (see Silver and Ioannidis, 2001). For the output growth, we take monthly data of industrial production index (IPI) and calculate it using $\ln(P_{t+12}/P_t)$.

For the estimation of inflation uncertainty (σ_π) and output uncertainty (σ_Y), we use Generalized Autoregressive Conditional Heteroscedasticity (GARCH) model. GARCH models have been increasingly used in the literature to estimate the uncertainty, following their use by Grier and Perry (1998); Fountas (2001); Karansos et al. (2004) and Conrad and Karansos (2005). A main advantage of this method is that it takes into account the unpredictable component of uncertainty in the spirit of Friedman (1977). Grier and Perry (1998) note that the conventional measures of uncertainty that include moving standard deviation and dispersion of individual forecast from surveys do not account for this stochastic uncertainty. Moreover, GARCH models also allow us observing whether the conditional variation in a variable is statistically significant to be used for further analysis.

Table 1: Data Description

Countries	Inflation	Output Growth	European Output	European I. Rate
Inflation Targeting				
Mean	0.025	0.002	0.001	-0.017
Standard Deviation	0.024	0.022	0.01	0.157
Currency Board				
Mean	0.035	0.003	0.001	-0.017
Standard Deviation	0.035	0.033	0.01	0.157

In order to test how the opposing monetary regimes of these small open economies respond to external disturbances, we need to introduce some real and nominal shocks. To this end, we introduce European interest rate and European output growth. Our stationarity tests indicate that the inflation rate, European interest rate and output growth are non-stationary at their level and stationary at first difference,

[6] Among the selected currency board counties, Estonia joined the Euro Area in 2014 so we restricted the sample till the official joining date. Similarly, Romania started inflation targeting in 2006 and therefore our sample starts from there. This make our panels unbalanced for the both monetary policy regimes.

hence we use first difference of these variables in the analysis.[7] Table 1 reports the summary statistics of our main variables. Both the mean and standard deviation series of inflation and output growth are high Currency Board countries compared to the inflation targeting regimes. The Inflation Targeting regimes assure close link between actual and target inflation rates and thereby minimize the average inflation rate. However, since these central banks mainly focus on stabilizing the inflation rate, the output growth remains relatively low and less stable regimes. This is evident from the comparison of output growth in the both regimes. This complements the theoretical results of the previous literature that supports a stability trade-off between real and nominal uncertainties (see Akerlof et al. (1996); Clark and Terry, 2010).

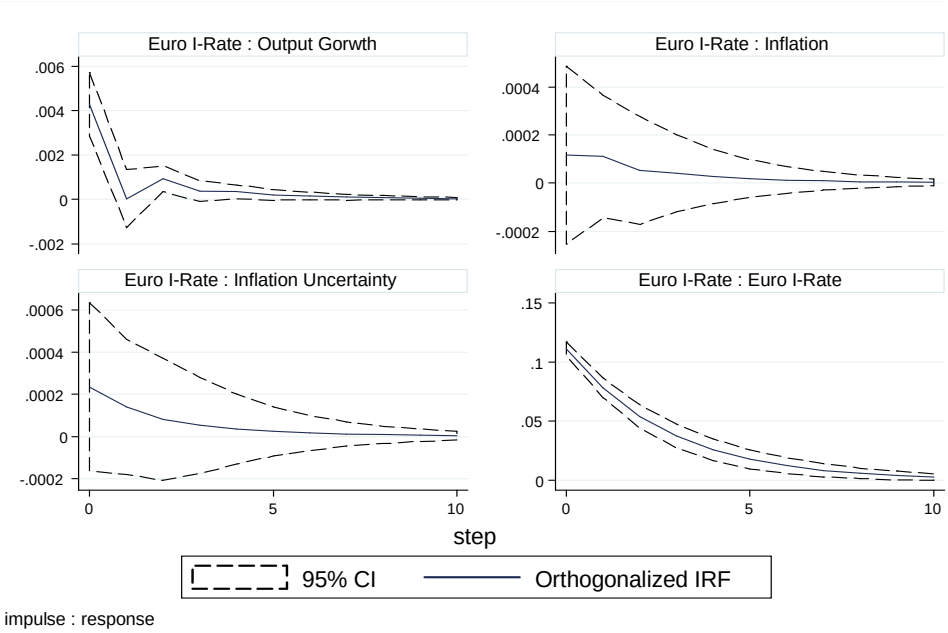
3.3) Empirical Results:

Our main results comprising the impulse response functions of both the Currency Board and the Inflation Targeting panels are shown below. Figure 1 reports the response of the Inflation Targeting countries to a one standard deviation shock in the Euro interest rate. Here we report the response of the two nominal variables, inflation and inflation uncertainty, and one real variables output growth when Euro interest rate observes a shock. The ordering of the variables is as follows: Euro interest rate, inflation, inflation uncertainty, output growth. The variables in the figure assume a Choleski order implying that Euro interest rate influences the macroeconomic variables contemporaneously but is affected by them only after one period, and so on.[8] As can be drawn from the top-left panel, when the Euro interest rate increases, the demand of these small open economies' goods in the Euro area countries reduces, resulting in a reduction of output growth for these countries. The response of the output growth, however, remains quite small in magnitude and dies out quickly. The dashed bands depict 95% confidence intervals around the estimate. A positive shock to the Euro interest rate therefore does not exert significant reduction in the GDP for the Inflation Targeting sub-sample. Indeed, since these countries exercise independent monetary policies, their active response to the foreign shocks reduces the net impact of these shocks.

[7] We use Augmented Dickey Fuller (ADF) and Phillips-Peron (PP) tests for stationarity. The results are available on demand.

[8] Although our ordering selection is based on the economic theory, the results are robust with respect to the ordering of our variables. For brevity, we do not report the results of the alternative ordering schemes.

Figure 1: Response of the domestic variables to shocks in the Euro interest rate (Inflation targeting regimes)



Concerning our nominal variables, inflation and inflation uncertainty, we observe their positive response to the tightening of monetary policy by the European Central Bank (ECB). This positive response can be explained through exchange rate pass-through phenomenon, which is widely discussed in the literature (see Mamoudou, et al. 2009). A high interest rate by the ECB causes appreciation of Euro and, thereby increases the price of tradable goods in these small open economies.

This puts upward pressure on the domestic prices. This is particularly true for the selected European economies that enjoy close integration with the other member states.[9] Here again, the magnitude of this response is not so large. Similarly, a high inflation can also lead higher uncertainty about future prices, as advocated by the monetarists (Friedman, 1977; Ball, 1992). The response of inflation uncertainty is more persistent and remains significant till 5-periods after the shock. An overall weak response of these emerging European countries' macroeconomic variables to

[9] A vast majority of literature finding a positive connection between monetary policy tightening and inflation rate denotes it the so-called 'price puzzle'. However, there exist some recent studies, initiated by Barth and Ramey (2000), claiming that a higher interest rate reflects increasing cost of capital causing more inflation in the future.

the external shocks has also been emphasized by some previous empirical studies (see Egret and MacDonald, 2009, for a survey).

Figure 2: Response of the domestic variables to shocks in the Euro interest rate (Currency board regimes)

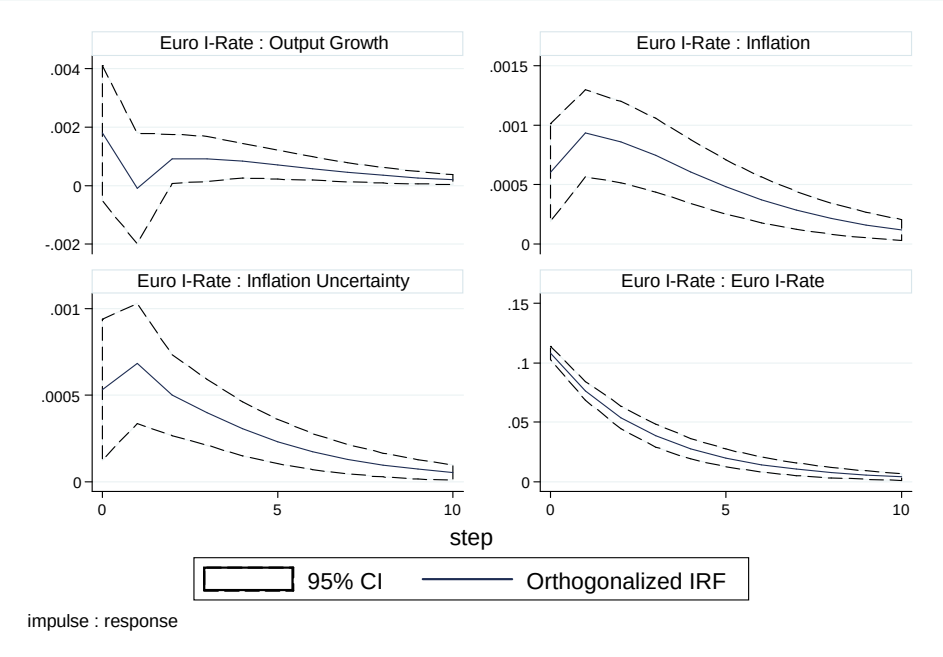


Figure 2 repeats the same exercise for the Currency Board sub-sample and reports startlingly different results from those of the Inflation Targeting countries. In case of Currency Board countries, the domestic monetary policy is silent to respond the external shocks and the effects of interest rate changes can be directly transmitted to the domestic real and nominal variables. The is evident from the Figure 2, for instance, the response of output growth is more pronounced and persistent, compared to the one from Inflation Targeting countries, reported earlier. Same is the case with the nominal variables, namely, inflation and inflation uncertainty. To illustrate, an increase in the Euro interest rate significantly increases the inflation rate in the Currency Board economies and the effects lasts for several months. A standard monetary policy shock, emanating from the Euro area, is therefore more relevant for the Currency Board economies than for the Inflation Targeting regimes of the Eastern Europe.

In the next step, we analyze the effects of real shocks for the both sub-samples. Once again, we introduce one standard deviation shock in the Euro area output growth and analyze the ability of both these regimes to absorb this shock. As we are dealing with the real-shocks, we replace inflation uncertainty with the output growth variability. Concerning our main results of the impact of external real shocks, we note that the Inflation Targeting regimes again perform well by extenuating the magnitude of these shocks on the domestic macroeconomic variables. To illustrate, the output uncertainty of these countries is not significantly affected by the shocks to Euro area output growth whereas, in case of Currency board economies, this response is positive and significant. Overall, these results complement the previous literature that favours the adoption of Inflation Targeting regimes in order stabilize inflation and output growth (see Ball, 1999). Alternatively, the studies comparing the macroeconomic performance of different exchange rate regimes also support flexible exchange rate systems for the open economies (see Tornell and Velasco, 2000; Edwards and Levy-Yeyati, 2003) although the contradictory evidences favouring the pegged exchange rate regimes also exist, as discussed earlier.

Figure 3: Response of the domestic variables to shocks in the Euro area output growth
(Inflation targeting regimes)

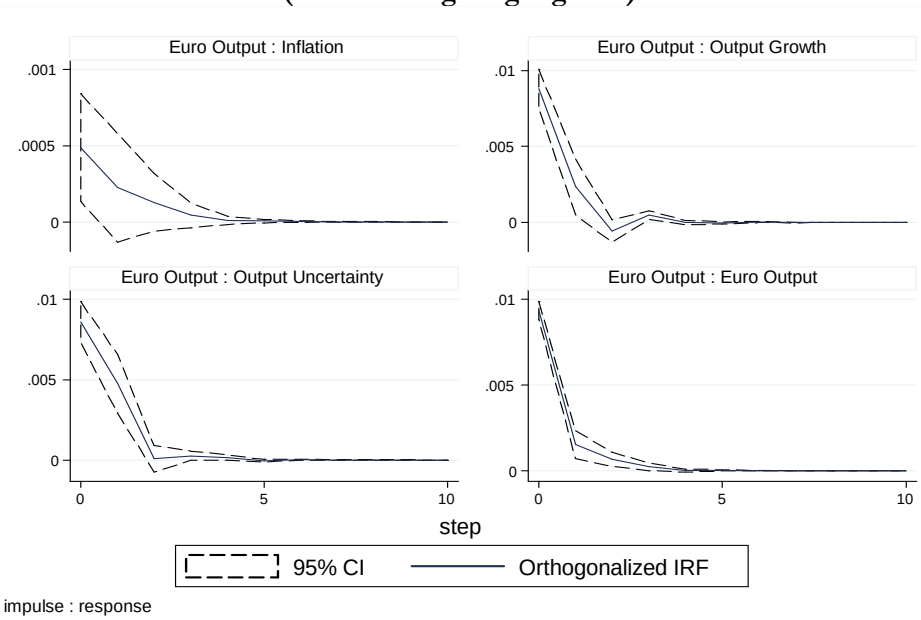
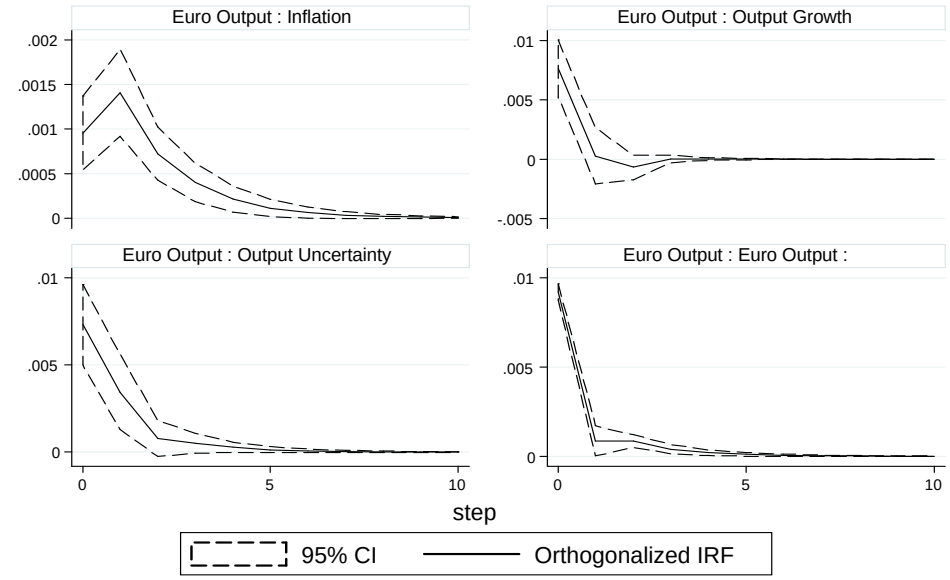


Figure 4: Response of the domestic variables to shocks in the Euro area output growth
(Currency Board regimes)



Lastly, for robustness purposes, we conduct a sub-sample analysis and divide both the panels into pre- and post-crisis periods. The pre-crisis period comprises January 1999 to December 2007 while the post-crisis period includes January 2008 to March 2017. The results of both these sub-samples – for Inflation Targeting countries as well as the Currency Board economies – are presented in the Appendix. These results are generally consistent with our previous findings. Particularly during the post-crisis periods, the Inflation Targeting regimes outperform the Currency Board economies in terms of mitigating the effects of external monetary shocks.

4. Concluding remarks

At the end of 1990, the bipolarity of monetary regimes in Eastern Europe became a well-established fact. Estonia, Latvia Lithuania and Bulgaria established – the last three countries still use – Currency Board regime. Hungary, Czech Republic, Poland, and later Romania, from their side preferred Inflation Targeting. Each group of countries defends the advantages of the chosen monetary regime and stresses on the capacity of the selected regime to deal with shocks and to assure low inflation and sustainable growth.

Normally the advocates of Currency Boards and hard peg regimes pointed and still point out the capacity of the regime to follow the business cycle and the monetary

policy impulses coming from the developed and experienced in monetary policy in European core. Curiously, the policy makers in these countries have supposed the core countries will develop in an uptrend and will not suffer the crisis we are seeing today. Similarly, Inflation targeting countries stressed the capacity of the regime to deal with external shocks and to react discretionary on the changing foreign economic conditions.

Substantial empirical research checking the performance of the both monetary regimes has been performed. The current crisis makes this type of research even more interesting. In our paper, building the panel of both regimes, we implemented different tests measuring the impact of nominal and real shocks coming from the EU and European monetary policy. For all the period studied, and especially during the crisis, we find that Currency Boards are more vulnerable to external shocks. Under this regime inflation and output are more volatiles than in countries with Inflation Targeting. Obviously, this does not spare the fact that the Currency Boards have other advantages and that from political economy perspective they are more appropriate in some situations and social configurations.

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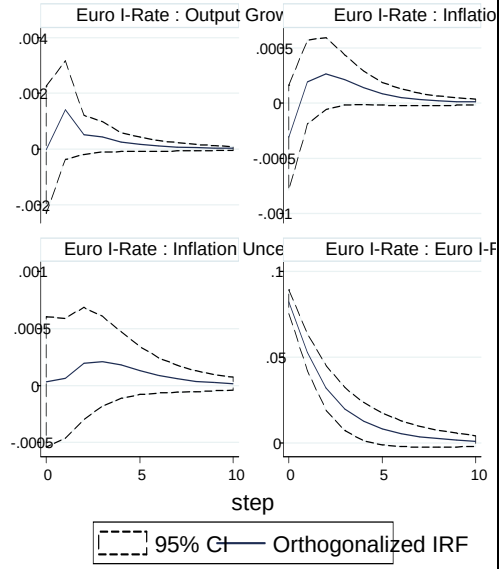
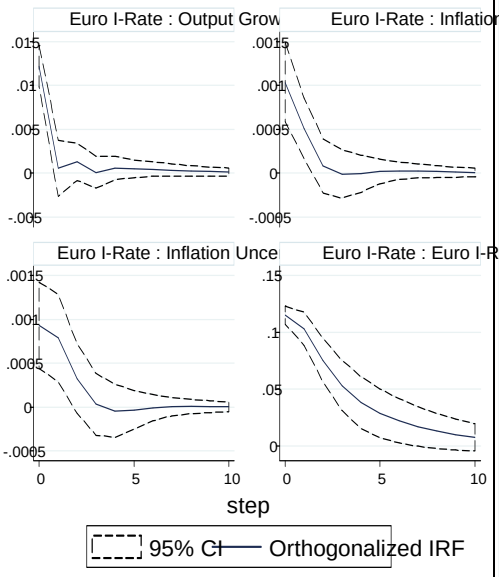
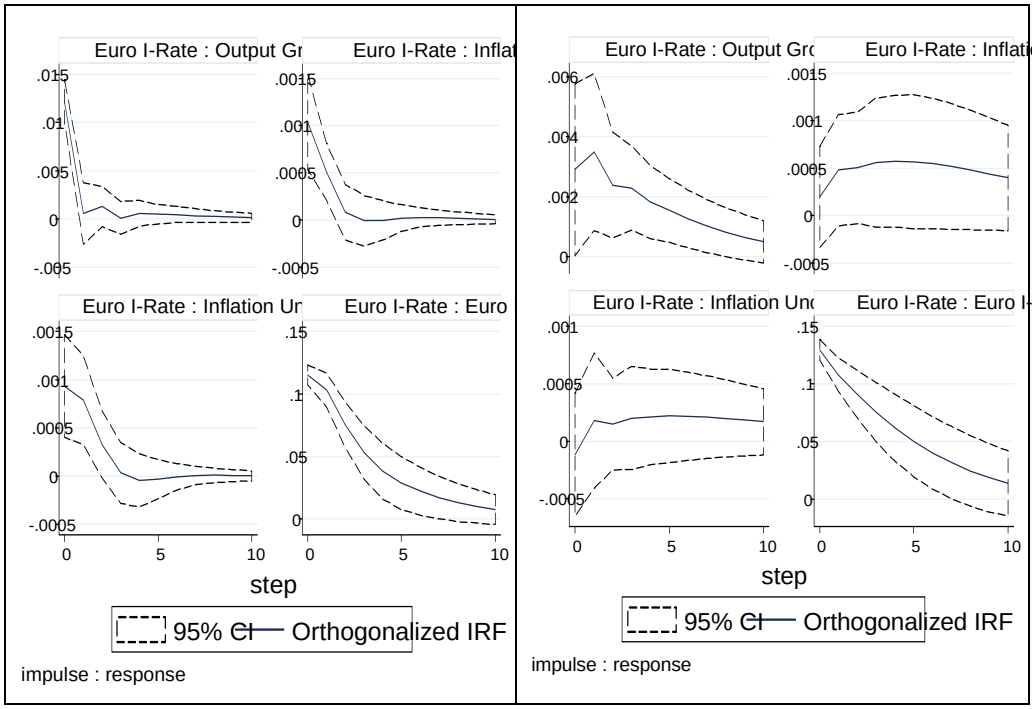
Appendix 1A: Response of the domestic variables to shocks in the Euro interest rate (Pre- and Post-Crisis Periods)

Inflation Targeting Countries (Pre-crisis)	Currency Board Countries (Pre-crisis)
	
Inflation Targeting Countries (Post-crisis)	Currency Board Economies (Post-crisis)


Euro I-Rate : Output Gr
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step
95% CI
Orthogonalized IRF
impulse : response
Euro I-Rate : Output Gr
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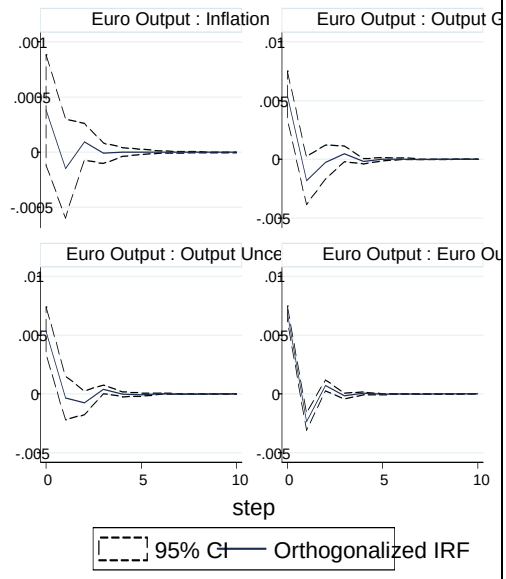
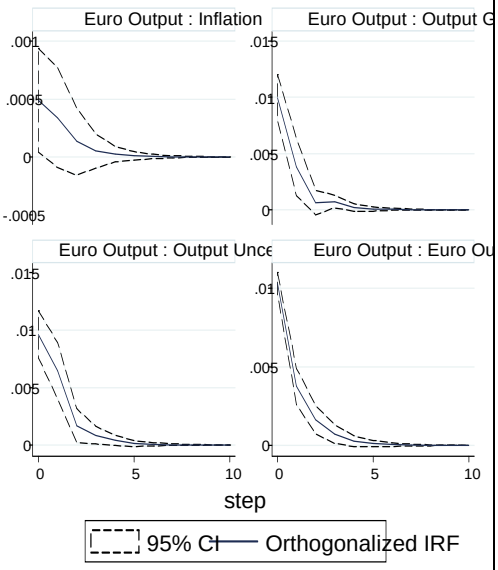
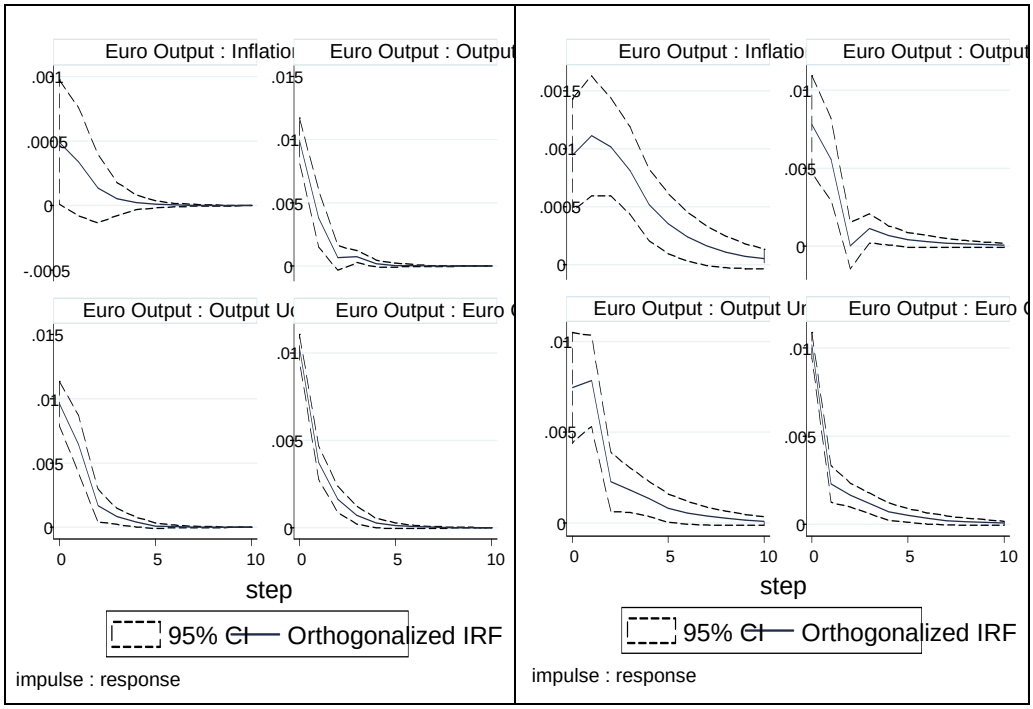
Euro I-Rate : Inflation Un
Euro I-Rate : Euro I
step
95% CI
Orthogonalized IRF
impulse : response

Appendix 1B: Response of the domestic variables to shocks in the Euro Output Growth (Pre- and Post-Crisis Periods)

Inflation Targeting Countries (Pre-crisis)	Currency Board Economies (Pre-crisis)
	
Inflation Targeting Countries (Post-crisis)	Currency Board Economies (Post-crisis)


Euro Output : Inflatio
Euro Output : Output
Euro Output : Output U
Euro Output : Euro
step
95% CI
Orthogonalized IRF
impulse : response
Euro Output : Inflatio
Euro Output : Output
Euro Output : Output Ur
Euro Output : Euro
step
95% CI
Orthogonalized IRF
impulse : response