Fiscal Policy in CEE Countries.
Evidence from Czech Republic, Hungary, Poland and Romania[1,2]

Dr. Petre Caraiani[3*]

I investigate the fiscal policy in CEE countries using evidence from the four most important economies, Czech Republic, Hungary, Poland and Romania. A two-country open economy model with a Taylor fiscal rule is estimated on quarterly data for these countries. I explore the potential of counter-cyclical fiscal policy in the context of the ongoing financial crisis, the reaction of the fiscal policy to negative demand shocks or to a more relaxed monetary policy, as well as the impact of fiscal shocks. I show that the fiscal rule can act as an automatic stabilizer in the context of negative domestic and external demand shocks. The results also show that in these countries the fiscal policy can positively influence the output when negative shocks from Euro Area affect the economy. There are differences with respect to the reactions of macroeconomic variables in these economies, with respect to both the magnitude and persistence of responses. Based on the historical decomposition, there are evidences that fiscal shocks during the last years behaved in a pro-cyclical way and it appears that the countercyclical potential of fiscal policy during the financial crisis remained largely unused. Running counterfactual scenarios confirms that a considerable government spending effort would have improved the dynamics of GDP during the crisis for three of the countries, namely Czech Republic, Hungary and Romania,. Using the Bayesian comparison approach, I also found evidence in the favor of including the fiscal Taylor rule against the alternative of simple AR(1) processes for the fiscal variable.

Keywords: DSGE models, small open economy, CEE countries, fiscal policy, monetary policy.

JEL Classification: C11, E40, F41.

---

[1] This research was supported by a grant from the CERGE-EI Foundation under a program of the Global Development Network. All opinions expressed are those of the author and have not been endorsed by CERGE-EI or the GDN.

[2] Many thanks to Sergey Slobodyan (CERGE-EI) for his insightful comments which very much helped in refining this paper.

[3] Prof. Lucian Liviu Albu, Institute for Economic Forecasting, Dr. Elena Pelinescu, Institute for Economic Forecasting and Hyperion University, Cristian Stănică, National Institute for Statistics and Radu Lupu, Academy of Economic Studies were also actively involved in this project.

[*] Researcher at the Institute for Economic Forecasting, Romanian Academy; email at: Caraiani@ipe.ro.

1. Introduction

The accession of the CEE countries to the European Union brought in the forefront the necessity of right economic policies. This asks for a good evaluation of the reaction of macroeconomic variables to the different shocks. These economies are in a process of harmonization of economic policies and of ensuring the economic convergence. In this context the analysis of the differences between the fiscal policies from the CEE countries offers a basis for understanding the particular reaction mechanisms to the internal shocks in these economies. Moreover, the interest in the fiscal policy potential for stabilization was spurred by the ongoing crisis which showed that simple counter-cyclical monetary policy are not enough.

Until recently the topic of fiscal shocks was mostly addressed from a VAR perspective, see Perotti (2004), Giuliodori and Beetsma (2004), Corsetti and Muller (2005) or Mountford and Uhlig (2008), most of them for the case of US and OECD.

A more and more used framework to study the modeling of fiscal policy is the structural approach, namely the dynamic stochastic general equilibrium approach (DSGE, hereafter). The first papers focused on the real business cycles (RBC, hereafter) model where markets are competitive and no frictions are present. The standard RBC model was augmented with a fiscal side and the model calibrated usually on data from US economy. However, the predictions of the RBC model with respect to the impact of fiscal policy contrasted with those implied by the standard IS-LM model. For example, in the RBC model, like Baxter and King (1993), a rise in the government spending leads to a reduction in final consumption.

Gali, Lopez-Salido and Valles (2007) showed that in a New Keynesian model (NK, hereafter) with sticky prices and augmented with rule of thumb consumers, there was a positive effect of government spending on consumption.

Forni, Monteforte and Sessa (2007) extended the contribution of Gali, Lopez-Salido and Valles (2007) to a more complex DSGE model, inspired by Smets and Wouters (2003). The model was estimated on Euro Area data using Bayesian techniques. They showed that, although fiscal shocks were persistent, the impact of government purchases had small and short lived expansionary effects on private consumption. They

also showed that most fiscal policy variables do not contribute too much to the variability of the main macro variables. A similar approach was that in Straub and Coenen (2005) who augmented the model in Smets and Wouters (2003) to the case of heterogenous consumers and studied the impact of fiscal policy in this framework.

In the open economy setting, one of the first contributions was that in Furlanetto (2006). He extended the model in Gali and Monacelli (2005) in order to study the impact of government spending in small open economy NK model with sticky prices. He found a positive but lower than one impact of fiscal policy on output. The positive fiscal shock also leads to an increase in the nominal interest rate and an appreciation of the nominal exchange rate through the uncovered interest parity which lowers the overall impact of fiscal shocks on consumption.

Herz, Roeger and Vogel (2004) discussed the issue of short-term stabilization potential of fiscal policy in an open economy NK model with Ricardian households. They considered two types of fiscal variables, tax rates (on income and on consumption) and public expenditure. They showed that in their model, the fiscal policy had both demand-side and supply-side effects. They also showed that state-dependent expenditure policies outperform the optimal tax policies for demand side shocks. Also, state-dependent expenditure policies, according to their model, perform similarly to monetary policy under discretion or under commitment. At the same time, state-dependent tax policies are efficient in stabilizing supply side distortions for monetary policy under commitment.

Most of the studies on fiscal policy within the NK framework considered US or Euro Area. During the last years, some studies were also undertaken for emerging economies. One good example is that of Garcia and Restrepo (2007) who estimated a small open economy NK model for the case of Chilean economy. They extended the standard model by including rule of thumb consumers, sticky wages and distortionary taxes. They showed that the impact of government spending on consumption depends on the degree of price elasticities of exports and imports, the share of rule of thumb consumers, the share of domestic goods in government consumption, the presence of distortionary taxes and on the fiscal and monetary rules.

At the same time the literature on CEE countries is limited. Several DSGE models were recently estimated for some of the CEE countries, like Hradisky et al. (2007) or

Musil and Vasicek (2006) for Czech Republic, Kolasa (2008) for Poland, Jakab and Vilagi (2008) for Hungary, or Caraiani (2008) for Romania. Some of these models discussed fiscal issues, but their focus was not on fiscal policy.

This paper extends the ongoing development of literature on fiscal policy for the case of the CEE countries. I consider an open economy two-country DSGE model with a fiscal side which I estimate for the cases of Czech Republic, Hungary, Poland and Romania on quarterly data using Bayesian techniques.

This paper is organized as follows. The following section outlines the model and discusses its building blocks. I estimate the model in the third section using Bayesian techniques and discuss significance of the estimations. In the fourth section I analyze the reaction of fiscal policy given the impact of domestic and external shocks on the domestic economy. The fifth section discusses how much fiscal policy contributes to the overall performance of the model as well as its role in stabilizing the economy. In the last section I conclude and draw some possible policy implication.

2. The Model

Initially, the applied work on DSGE models focused more on topics like business cycles, monetary policy, international economics, or forecasting. Less importance was accorded to fiscal policy. However, the interest in the fiscal policy may increase, as in the ongoing crisis, when the monetary policy tools seem not to be enough to stop the downturn in the national economies.

I use an open economy DSGE model as in Moons et al. (2007). The purpose of their article was an analysis of the monetary policy in the Euro Area, using a NK model with a Taylor monetary policy rule and a Taylor fiscal rule. The model was estimated on quarterly data for Euro Area, and different optimal and ad-hoc monetary rules were discussed. The model considers simple AR (1) rules for the foreign economy. The model is presented below in the following equations:

$$y_t = \psi y_{t-1} + (1-\psi)E_t y_{t+1} - \alpha\left(r_t - E_t\Delta p_{t+1} - r\right) + \mu g_t + \sigma y_t^* + \delta\left(e_t + p_t^* - p_t\right) + u_t^d \quad (1)$$

$$\Delta p_t = \omega\Delta p_{t-1} + (1-\omega)E_t\Delta p_{t+1} + \gamma y_t + \tau\Delta\left(p_t^* + e_t\right) + u_t^s \quad (2)$$

$$E_t(e_{t+1}) - e_t = r_t - r_t^* + u_t^e \quad (3)$$

$$r_t = \rho_r r_{t-1} + (1-\rho_r)(\chi_\pi \Delta p_t + \chi_y y_t + \chi_e \Delta e_t) + u_t^r \quad (4)$$

$$g_t = \lambda_g g_{t-1} - (1-\lambda_g)\chi_g y_t + u_t^g \quad (5)$$

$$y_t^* = \rho_{yf} y_{t-1}^* + u_t^{df} \quad (6)$$

$$p_t^* = \rho_{pf} p_{t-1}^* + u_t^{pf} \quad (7)$$

$$r_t^* = \rho_{rf} r_{t-1}^* + u_t^{rf} \quad (8)$$

The first equation is an open economy IS curve. Since the IS curve result from the optimizing decision of household who maximize their lifetime utility, a forward looking element appears, y_{t+1}. The backward looking element y_{t-1} is the result of external habit formation. Moreover, since it characterizes an open economy, the domestic output is influenced by both the real exchange rate and by the foreign output y^*_t. The fiscal balance g_t also influences the output since this model includes the government side.

Equation (2) is an open economy New Keynesian Phillips Curve, where p_t stands for domestic prices. This curve is derived from the profit maximization decision of the domestic firms under the monopolistic competition and sticky prices. The NK Phillips curve is forward looking, as expectations about future inflation influence the current inflation. It also comprises a backward looking element in inflation, so that past inflation matters for current inflation. This extension due to Gali and Gertler (1999) improves the inertia of the inflation. As Moons et al. (2007) pointed out, the element y_t can be interpreted as demand pull inflation. Since it is an open economy Phillips curve, the inflation of import prices appears too, namely $p_t^* + e_t$.

Equation (3) specifies the dynamics of the exchange rate e_t. The exchange rate follows the uncovered interest parity to which a shock is added, the so called risk premium shock, which takes into account the measurement errors.

The monetary policy rule, equation (4), is a typical Taylor rule. Here, the standard Taylor formulation is modified to allow for interest rate smoothing, as proposed by Clarida et al. (1999). The monetary rule also comprises the exchange rate element, which is a reasonable hypothesis in the context of CEE countries.

The fiscal rule is given in equation (5), following the proposal in Taylor (2000). Moons et al. (2007) considered also the structural fiscal balance $\bar{g}$ which is reasonable in the light of the Stability and Growth Pact. However since our sample data includes years for which such a rule was not considered by these countries, and since in this paper I focus on the cyclical aspects of fiscal policy, I ignored this element. Thus the fiscal rule reduces to the deficit smoothing element and the cyclical fiscal stance.

Equations (6) – (8) specify the foreign economy, in this case, the Euro Area, which is considered as a large open economy. As in Moons et al. (2007), I considered simple AR(1) rules for foreign production y^*, foreign prices p^*, and foreign interest rate r^*.

3. Data and Estimation of the Model

3.1. Estimation for Romania

I estimate the model given in the equations (1)-(8) using Bayesian techniques. In order to obtain data which is similar in interpretation to the variables in the model, I apply the logarithm, and de-trend all the variables in the model, except the nominal interest rate in the Euro Area. The nominal interest rate in Romania is de-trended due to the fact that it contains a decreasing trend.

The estimation is done for the period between 2000 Q1 and 2009 Q4, using quarterly data on prices, domestic GDP, interest rate, Euro Area GDP, Euro Area interest rate and domestic government spending. For prices I used the quarterly GDP deflator.

The parameters of the foreign block were calibrated using results from running OLS on AR(1) processes on foreign production, foreign prices and foreign nominal interest rate. Thus, ρ_{rf} was calibrated to 0.91, ρ_{yf} to 0.92 and $\rho_{\pi f}$ to 0.69. The standard deviations for these three shocks were calibrated to 0.30, 0.30 and 0.50, which is in line with what estimation would result in.

I run two Metropolis Hastings chains each of 500000 draws. The average acceptance ratio was for the chains of about 40.67% and 40.72% respectively. As for the convergence statistics, the multivariate convergence and univariate statistics proposed by Brooks and Gelman (1998), Annex B, indicate that the convergence was achieved. We

also observe, see Annex A, that the marginal posterior distributions indicate that there are differences between posterior means and prior means.

The estimates of the Taylor rule for Romanian economy indicate that the weight on inflation is considerable confirming the fact that the National Bank of Romania (NBR, hereafter) followed first of all to stabilize the prices as it prepared for and then it adopted the inflation targeting regime during the studied sample. Since χ_π=0.93, which is less than one, the estimate implies a passive monetary policy. At the same time the weight put on the output gap is high compared to the usual findings in the literature, as χ_y=0.86. The estimation also suggests that NBR reacted to changes in the exchange rate, as the mean estimate for χ_e is 0.18.

The estimation for the IS curse indicates that half of the agents are backward looking; however the estimate for ψ is equal to the prior mean 0.50. The coefficient related to the influence of the fiscal variable has a considerable value, with a mean estimate for μ of 0.38. The parameter σ related to the impact of foreign demand on domestic output shows a value significantly different from zero, but close to the prior mean. The coefficient δ related to the open economy elements is rather low, with a mean estimate at 0.05.

For the case of the Phillips curve we notice that most of the firms are forward looking, ω=0.25, which is similar to the case of Euro Area, see Moons et al. (2007). The coefficient associated to the output gap is significantly different from zero, γ=0.19, and slightly higher than that for the case of the Euro Area.

As for the fiscal rule, we can notice that there is a significant estimated value for the parameter related to the cyclical fiscal stance as χ_g=0.59, while fiscal inertia is rather low, λ_g=0.23.

3.2. Estimation for Czech Republic

The data for the estimation for the model for the case of Czech Republic is similar in definition and interpretation as in the previous case. The data for Euro Area block is identical with that for Romanian case.

For data regarding the domestic block I choose quarterly data starting with 1996 quarter 1. The bigger length of the sample was possible due to the data availability from Eurostat.

I estimated the model in equation (1) to (8) using Bayesian techniques, as motivated above, after calibrating the values for the parameters corresponding to the foreign block in a similar was as in the previous section. As in the case for Romania, the estimation was based on two Metropolis Hastings chains, each one with 500000 draws. The average acceptance ratio was of about 40.2%, and 40.1% respectively for the two blocks. Annex B shows the multivariate and univariate Brooks-Gelman statistics which indicate that convergence was achieved.

The estimation of the IS curve shows that the backward looking element is more important for the agents, suggesting an important degree of inertia, as the posterior mean for ψ was estimated at 0.63. There is stronger influence of government expenditures as the posterior estimate for μ is 0.46.

For the case of the Phillips curve, the estimation shows that most of the firms are forward looking, ω=0.21. The coefficient characterizing the forward-lookingness is stronger than for the case of Romania. The mean estimate for the output-gap coefficient is significantly different from zero, but, at the same time, close to the prior mean, γ=0.16.

The Taylor rule estimation resulted in rather expected values the case of inflation coefficient. The inflation targeting regime is suggested to have been followed again, while monetary policy can be characterized as mildly active, χ_{pi} estimated at 1.09. The coefficient related to the output gap is high but much smaller than the one for Romania, χ_y estimated at 0.67. The Czech National Bank also reacted to changes in the exchange rate but in a weaker manner than Romanian authorities, χ_e =0.09.

The estimation of the fiscal rule is close to that for Romania, with a similar coefficient related to the cyclical fiscal stance, a posterior mean of χ_g=0.59 and a higher coefficient related to fiscal inertia λ_g=0.23.

3.3. Estimation for Poland

The data for the estimation for the model for the case of Poland is similar in definition and interpretation as in the previous two cases. The data for Euro Area block is identical with that for the previous cases.

For data regarding the domestic block I choose quarterly data starting with 1999 quarter 1 since this is the sample that provided the best Bayesian estimation.

I estimated the model in equation (1) to (8) using Bayesian techniques, as motivated above, after calibrating the foreign economy block. As in the other cases, the estimation was based on two Metropolis Hastings chains, each one with 500000 draws. The average acceptance ratio was of about 35.6%, and 35.7% respectively for the two blocks. Annex B shows the multivariate as well as the univariate Brooks-Gelman statistics which indicate that convergence was achieved.

The estimation of the IS curve shows that backward looking element is slightly more important than the forward looking element, ψ=0.54, however the value is very close to the prior mean. Again, the coefficient related to the fiscal side is considerable, with a posterior mean of 0.46 for γ.

For the case of the Phillips curve, the estimation shows that most of the firms are forward looking as for the previous cases, as the posterior mean for ω is 0.20. The coefficient related to the output gap is moderate, as γ is estimated at 0.19.

The Taylor rule estimation gives a value for the inflation coefficient that is close to the one for the Czech Republic, χ_{pi} estimated at 1.16. The National Bank is shown to have followed the inflation targeting regime, as suggested by the parameter related to inflation. At the same time, the estimation suggests a rather weakly active monetary policy. It also reacted to changes in the exchange rate, as the mean estimate for χ_e is 0.13. The output gap coefficient is very strong; the posterior mean of χ_y was estimated at 0.98.

As for estimation of the fiscal rule, the values are similar with respect to inertia and cyclical fiscal stance with some slight differences relative to the other two countries, with the posterior mean for χ_g=0.56 and the estimate for λ_g=0.35.

3.4. Estimation for Hungary

The data for the estimation for the model for the case of Hungary is similar in definition and interpretation as in the previous three cases. The data for Euro Area block is identical with that for the previous cases.

For data regarding the domestic block I choose quarterly data starting with 1995 quarter 1. In this case, the best approach was to use the chain index quarterly GDP deflator with the base in 2000 for inflation. The quarterly interest rates data series was again taken from Central Bank.

I estimated the model in equation (1) to (8) using Bayesian techniques, as motivated above, after calibrating the foreign economy block. As in the other cases, the estimation was based on two Metropolis Hastings chains, each one with 500000 draws. The average acceptance ratio was of about 41.7%, and 41.5% respectively for the two blocks. Annex B shows the multivariate as well as the univariate Brooks-Gelman statistics which indicate that convergence was achieved.

The estimation of the IS curve shows that backward looking element is as important as the forward looking element, basically, in line with the findings for the other countries. Here the posterior mean for ψ was estimated at 0.49, which suggests a weak identification. There is also a significant coefficient for government expenditures, with a mean estimate for μ of 0.39.

For the case of the Phillips curve, the estimation shows that most of the firms are forward looking as for the previous cases, ω=0.19. The coefficient related to the output gap is also considerable, as the posterior mean for γ was estimated at 0.16, which is however close to the prior mean.

The Taylor rule estimation gives a rather low inflation coefficient, χ_{pi} estimated 0.72 which implies a passive monetary policy. The reaction to the output gap changes seems to be stronger in this case, as the posterior mean for χ_y was estimated at 0.88.

As for estimation of the fiscal rule, the values are similar with respect to inertia and cyclical fiscal stance with some slight differences relative to the other three countries, with the posterior mean estimates for χ_g at 0.59 and for λ_g at 0.24. Thus, the estimates for the four economies confirm the findings in Staehr (2008) who showed that, for the case

of the New Member states, there was less inertia in the fiscal rule and the fiscal policy was more counter-cyclical than for the older member states.

4. The Analysis of Fiscal Policy Using the Impulse Response Functions

In this section I analyze the impulse response functions of the endogenous variables to a set of selected domestic and external shocks. I focus on those types of shocks which I considered to be providing evidence for the fiscal policy in Czech Republic, Hungary, Poland and Romania. The set of shocks to focus on are: the domestic demand shocks, the domestic interest rate shocks, the fiscal policy shocks, the domestic monetary policy shocks, the external demand shocks and, respectively, the foreign interest rate shock.

I simulate the model with the parameters set to the mean values of the posterior distributions. Shocks are unanticipated and appear in period one. For all the cases, they represent 1% temporary shocks and they are not auto correlated. In each cases the y-axis in given in percentage points. At the same time, given the current context of a global crisis, and since the economists are interested in the way the fiscal policy reacts to such challenges, I considered specific shocks, with demand shocks considered as negative, the interest rate shocks appearing as negative due to the use of monetary policy as a tool to stimulate the economy, while the fiscal policy shocks are positive, reflecting the use of fiscal policy to counteract the negative effect of the economic crisis.

4.1. The Domestic Demand Shocks

A negative demand shock leads to a drop in domestic output in all cases, see Annex C. The monetary authority responds by lowering the interest rate. The government also uses an expansionary fiscal policy to counteract this drop in demand.

In all countries we see that the output returns to the steady state after 2-3 quarters. The reaction is almost similar in these countries. However there is a stronger response of

output and prices in Romania. At the same time, inflation reacts more persistently in Czech Republic and Hungary.

4.2. The Domestic Interest Rate Shocks

In the present context of the financial crisis, the usual reaction of the central banks is to lower the interest rate. We discuss here the impact of a negative shock in the interest rate, corresponding to laxer monetary policy (see Annex D).

The impact of the lower interest leads to a rise in the output, with the strongest response for the case of Romania. The prices rise in the four countries, with the strongest magnitude for Romania, while the larger persistence is produced for the other countries.

4.3. The Fiscal Policy Shocks

Given the inherent limits in the use of monetary policy to stabilize the economies during a financial crisis, a second tool available to the authorities is the fiscal policy.

The prices and exchange rates rise in these countries with a realistic hump-shaped reaction, see Annex E. The maximum point is reached in all countries after four – five quarters. The interest rate reacts positively to counter the rise in prices. The strongest reaction of prices is again in Romania, while for the other three countries the response is moderate but more persistent.

The strongest impact on output appears in the case of Romania, but its persistence is very low (a few quarters).

4.4. The Foreign Monetary Policy Shocks

I simulate here the impact of an unanticipated 1% temporary negative shock in the Euro Area interest rate, see Annex F. Since in this model the Euro Area economy is the large economy, while Romanian, Czech and Polish economies are small open economies, shocks that are produced in the Euro Area economy influence the two economies, while the reverse is not true.

The lower interest rate in Euro Area leads to an appreciation in the domestic exchange rate. The output in all four countries reacts initially positively, with the maximum reached at the initial moment, and afterwards it diminishes gradually, fading away after 5-10 quarters. The strongest reaction is in the case of Poland for both prices and output.

4.5. The Foreign Demand Shock

In the ongoing crisis, the CEE countries can also be affected through the lower demand in the Euro Area. I simulate here the impact of an unexpected negative shock in the Euro Area demand, see Annex G.

The negative shock on foreign demand leads to a negative impact on domestic demand. The impact is slightly stronger for Poland, and it is also considerable for Czech Republic and Romania.

For the case of prices, we can again a hump-shaped reaction, with a stronger and more persistent impact for the cases of Czech Republic, Poland and Romania. The fall of prices and the output leads to a both relaxation in monetary policy and an expansionary fiscal policy.

5. The Importance of Fiscal Policy

In this chapter we address the importance of fiscal policy for the studied countries. We study several aspects. First of all we question whether the inclusion of fiscal policy rule in the DSGE model improves the fit of the model. Second, we look at how much fiscal deficit matters for the variation of the main macroeconomic variables. We also look at the historical decomposition of output for the sample considered in the estimation. Finally, we run several counterfactuals scenarios in order to simulate the impact of different assumption regarding the fiscal policy on the output dynamics.

5.1. The Fit of the Model

Annex H presents the results of the estimated DSGE model with and without the Taylor fiscal rule. For the case of the model without the fiscal rule, equation (5) is reduced to a simple AR process as stated below:

$$g_t = \lambda_g g_{t-1} + u_t^g$$

The modified version of the model was estimated for the four countries using the same data, priors as well as estimation procedure. The estimation led to good results in terms of multivariate and univariate convergence, posterior distributions or average acceptance ratio.

The models are compared using the bayesian factor expressed in logs, following Jeffreys (1961). We find the log-Bayes factors of around 5 for Romania, Hungary and Poland, implying that we would need a prior probability of M2, the model with fiscal rule as a simple AR(1) process, to be 148 ($=e^5$) times larger than the prior probability of M1, the model with Taylor-like fiscal rule, in order to prefer M2 based on posterior odds. This can be interpreted as evidence in the favor of the model featuring a Taylor fiscal rule.

For the case of Czech Republic, the evidence in favor of a fiscal Taylor rule is much stronger, implying a prior probability of M2 being 1850 ($=e^{7.5}$) times larger than the prior probability of M1 in order to prefer M2.

We can conclude that the DSGE model featuring a fiscal rule is favored for all countries considered against the simple AR processes.

5.2. Explaining the Variation of Macroeconomic Variables

We discuss here how much the different shocks (including the fiscal shocks) explain from the variation of main macroeconomic variable, namely, production, inflation, or the interest rate. The Annex I shows the variance decomposition for the main macroeconomic variables in the three countries. The variance decomposition computed here is an asymptotic one.

The results show that the fiscal shock has an important role in explaining the variation of output for the three economies: it explains about 26% of output variation for

the cases of Romania, Hungary and Poland, and it has a slightly smaller explanative power for Czech Republic, with output variation explained in a 22% proportion by government spending. It also has a significant contribution to the explanation of the variance of inflation (for the cases of Romania and Poland) and interest rate (for the cases of Romania, Czech Republic and Poland).

The results for inflation are not so homogenous. Thus, the variation in domestic inflation is explained mostly by its own shocks in Romania, Hungary and Czech Republic. However, for the case of Poland, most of inflation variation is explained by foreign demand and supply shocks. Also, for Czech Republic, a considerable part of variation in inflation is explained by foreign demand and supply shocks.

5.3. Historical Decomposition of Variables

In Annnex J, I present a historical decomposition for the main domestic variable of interest, namely for the output, with contributions of each shock along the studied sample.

Quite interestingly, the fiscal shocks appears to have had a positive effect during the years of economic growth, especially for the last two years of high growth (2007 and 2008), and it did not help at all these economies during the current economic crisis. At the same time, for past periods for some countries, like Hungary between 2000 and 2003 or Czech Republic between 2001 and 2004, there are periods when fiscal shocks behaved in a counter-cyclical way.

The recent literature argues that the fiscal policy is pro-cyclical in the emerging economies see for example Ilzetzki and Vegh (2008) for one of the latest researches on this topic. However, the findings here present mixed evidences. While based on the estimation one could argue that fiscal policy is counter-cyclical, the fiscal shocks, at least for the last years, had a pro-cyclical behavior. Some more research should be undertaken on this topic.

5.4. Some counterfactuals

I compare here the dynamics of the model-economy under different scenarios regarding the path of government spending as well as the parameters characterizing the fiscal rule, see Annex K.

I consider the path of GDP between 2007Q1 and 2009Q4 (basically, two years before the crisis, and the year of the crisis in these countries) under two alternative scenarios:

a) the path of GDP if there is no Taylor fiscal rule, namely χ_g is equal to 0.001. In this case the fiscal rule collapses to an AR(1) process;

b) the path of GDP if the government would have kept a constant positive considerable government spending effort. This is assumed to be at 3% positive gap for government spending and it is based on the average figures for countries like Romania and Poland for which the average government spending gap during 2008 was between 2% and 3%.

The results for the four countries are pretty consistent. For the cases of the Czech Republic, Hungary and Romania, the path of GDP, during the crisis year 2009, under no fiscal rule is worse than that of actual GDP, with the biggest impact for Romania by about 0.10%. Also, a constant positive budgetary effort would have increased the GDP, with the biggest impact for the case of Hungary by 3.5%.

For the only country where the GDP did not decrease although there was a slowdown in the economy (implying an actual negative output gap), namely Poland, the no-fiscal-rule case would have also led to a negative impact on GDP during the crisis year 2009. However, a constant government spending effort would have not improved the path of GDP during 2009, which may also be explained through the fact that the countercyclical scenarios used data calibrated on Poland case.

6. Conclusion

The current economic crises was not only unpredicted but it also surprised through the scale and complexity of the issues it raised. In the face of a recession that

threatens to become a depression, policy makers are forced to find quick solutions to complex problems.

The CEE economies were, until recently, the fastest growing economies in Europe and had bright prospects. However, the severity of the ongoing crisis put in evidence the weaknesses in these economies and how fragile was their stability.

In this paper I explored the effects of fiscal policy in CEE countries in the context of the ongoing financial crisis by using evidence from an estimated DSGE model for Czech Republic, Poland and Romania. The estimation and the simulations showed that the fiscal policy can counteract not only the negative domestic shocks, but also adverse shocks from Euro Area (like negative demand shocks).

Running counterfactual scenarios confirms that a considerable government spending effort would have improved the dynamics of GDP during the crisis, except for the case of Poland which continued to enjoy, at a smaller scale, economic growth. Using the Bayesian comparison approach, I also found evidence in the favor of including the fiscal Taylor rule against the alternative of simple AR(1) processes for the fiscal variable.

References

[1] Baxter, M. and R.G. King. 1993. "Fiscal Policy in General Equilibrium," *American Economic Review 83(3):* 315-334.

[2] Brooks, S.P., and A. Gelman. 1998. "General Methods for Monitoring Convergence of Iterative Simulations," *Journal of Computational and Graphical Statistics 7*(*4): 434–455.*

[3] Buncic, D. and M. Melecky, 2008. "An Estimated New Keynesian Policy Model for Australia," *The Economic Record 84 (264):* 1-16.

[4] Caraiani, P. 2008. "An Analysis of Domestic and External Shocks on Romanian Economy Using a DSGE Model," *Romanian Journal of Economic Forecasting, 9 (3):* 100-114.

[5] Clarida, R., J. Gali and M. Gertler. 1999. "The Science of Monetary Policy: A New Keynesian Perspective," *Journal of Economic Literature 27(4)*: 1661-1707.

[6] Corsetti, G. and G. Muller. 2005."Twin Deficits: Squaring Theory, Evidence and Common Sense," *Economic Policy 21 (48)*: 597-638.

[7] Forni, L., L. Monteforte, and L. Sessa. 2007. “The general equilibrium effects of fiscal policy: Estimates for the euro area,” *Banca d’Italia Discussion Paper 652*.

[8] Furlanetto, F. 2006. “Fiscal Shocks in a Small Open Economy,” University of Lausanne, *DEEP Working Paper*.

[9] Gali, J. and M. Gertler. 1999. “Inflation Dynamics: A Structural Econometric Approach,” *Journal of Monetary Economics 44 (2)*: 195-222.

[10] Gali, J. and T. Monacelli. 2005.”Optimal Fiscal Policy in a Monetary Union”, working paper.

[11] Galí, J., J.D. López-Salido and J. Vallés. 2007. “Understanding the effects of government spending on consumption,” *Journal of the European Economic Association 5(1)*: 227-270.

[12] García, C.J. and J.E. Restrepo. 2007. “How Effective is Government Spending in a Small Open Economy with Distortionary Taxes” manuscript.

[13] Giuliodori, M. and R. Beetsma. 2005.”What Are the Spillovers from Fiscal Shocks in Europe? An Empirical Analysis,” *De Economist 153(2):* 167-197.

[14] Herz, B., W. Roeger and L. Vogel. 2004. “Optimal Simple Rules for Fiscal Policy in a Monetary Union” *BGPE Discussion Paper No. 21*.

[15] Hradisky, M., R. Girardi and M. Ratto. 2007. “Think Twice, the EMU has its Prices: The Czech Republic Case,” [Working Paper.] Ispra (Italy): Euro-area Economy Modeling Centre, Joint Research Centre, European Commission.

[16] Jakab, Z.M. and B. Vilagi. 2008. “An Estimated DSGE Model of the Hungarian Economy,” *MNB Working Paper 2008/9*.

[17] Jeffreys, H. 1961. *Theory of Probability*. Oxford University Press.

[18] Gali, J. and T. Monacelli, 2005. "Optimal fiscal policy in a monetary union," *Federal Reserve Bank of San Francisco Proceedings*.

[19] Ilzetzki, E. and C.A. Vegh. 2008. “Procyclical Fiscal Policy in Developing Countries: Truth or Fictions?” NBER Working Paper 14191.

[20] Kolasa, M. 2008. “Structural Heterogeneity or Asymmetric Shocks? Poland and the Euro Area through the Lens of a Two-Country DSGE Model,” *National Bank of Poland Working Paper No. 49*.

[21] Monacelli, T. 2003. “Monetary Policy in a Low Pass-Through Environment,” *European Central Bank Working Paper 227*.

[22] Moons, C., H. Garretsen, B. van Aarle and J. Fornero. 2007. "Monetary policy in the New-Keynesian model: An application to the Euro Area," *Journal of Policy Modeling 29(6)*: 879-902.

[23] Mountford, A. and H. Uhlig. 2008. “What are the Effects of Fiscal Policy Shocks?“ *NBER Working Papers no. 14551*.

[24] Perotti, R. 2004. ”Estimating the Effects of Fiscal Policy in OECD Countries,” *CEPR Discussion paper 4842*.

[25] Rabanal, P. and J.F. Rubio-Ramirez. 2003. “Comparing New Keynesians Models in the Euro Area: A Bayesian Approach,” *Federal Reserve Bank of Atlanta Working Paper 2003-30*.

[26] Smets, F. and R. Wouters. 2003. “An Estimated Stochastic Dynamic General Equilibrium Model for the Euro Area,” *Journal of the European Economic Association 1 (5)*: 1123-1175.

[27] Staehr, K. 2008. “Fiscal Policies and Business Cycles in an Enlarged Euro Area,” *Economic Systems 32 (1):* 46-69.

[28] Straub, R. and G. Coenen, G. 2005. “Non-Ricardian Households and Fiscal Policy in an Estimated DSGE Model of the Euro Area,” *Computing in Economics and Finance 2005 no. 102.*

[29] Taylor, J. 2000. „Reassessing discretionary fiscal Policy,” *Journal of Economic Perspectives* 14 (3): 21-36.

[30] Vasicek, O. and K. Musil. 2006. “Behavior of the Czech Economy. New Open Macroeconomics DSGE Model,” Prague: Research Center for Competitiveness of Czech Economy *Working Paper, No. 23*.

ANNEX A. Results of the Bayesian Estimation

Annex A.1. Tables

Table A.1

Bayesian Estimation Results for Romania

PARAMETERS	PRIOR MEAN	POSTERIOR MEAN	CONFIDENCE INTERVAL	CONFIDENCE INTERVAL	PRIOR DISTRIBUTION	STANDARD DEVIATION
ψ	0.50	0.50	0.31	0.70	Normal	0.10
α	0.50	0.55	0.40	0.71	Normal	0.10
μ	0.50	0.38	0.30	0.48	Normal	0.05
σ	0.25	0.26	0.10	0.42	Normal	0.10
δ	0.25	0.05	0.01	0.09	Normal	0.10
ω	0.50	0.25	0.14	0.35	Beta	0.10
τ	0.15	0.05	0.03	0.08	Beta	0.05
γ	0.15	0.19	0.10	0.29	Beta	0.05
λg	0.50	0.23	0.09	0.36	Normal	0.10
χg	0.40	0.59	0.35	0.82	Normal	0.15
χpi	1.50	0.93	0.54	1.31	Normal	0.20
χy	0.50	0.86	0.57	1.18	Normal	0.20
χe	0.15	0.18	0.02	0.10	Normal	0.10
σd	0.1	0.048	0.033	0.063	Inv. Gamma	Infinite
σs	0.1	0.030	0.021	0.038	Inv. Gamma	Infinite
σg	0.1	0.094	0.076	0.111	Inv. Gamma	Infinite
σe	0.1	0.084	0.023	0.153	Inv. Gamma	Infinite
σr	0.1	0.084	0.061	0.108	Inv. Gamma	Infinite

Source: Own Computation

Table A.2

Bayesian Estimation Results for Czech Republic

PARAMETERS	PRIOR MEAN	POSTERIOR MEAN	CONFIDENCE INTERVAL	CONFIDENCE INTERVAL	PRIOR DISTRIBUTION	STANDARD DEVIATION
ψ	0.50	0.63	0.45	0.83	Normal	0.10
α	0.50	0.59	0.42	0.76	Normal	0.10
μ	0.50	0.46	0.38	0.54	Normal	0.05
σ	0.25	0.24	0.10	0.37	Normal	0.10
δ	0.25	0.02	0.01	0.03	Normal	0.10
ω	0.50	0.21	0.13	0.29	Beta	0.10
τ	0.15	0.02	0.01	0.02	Beta	0.05
γ	0.15	0.16	0.08	0.23	Beta	0.05
λg	0.50	0.35	0.23	0.47	Normal	0.10
χg	0.40	0.61	0.40	0.81	Normal	0.15
χpi	1.50	1.09	0.79	1.40	Normal	0.20
χy	0.50	0.67	0.41	0.91	Normal	0.20
χe	0.15	0.09	0.02	0.16	Normal	0.05
σd	0.1	0.016	0.013	0.020	Inv. Gamma	Infinite
σs	0.1	0.017	0.013	0.020	Inv. Gamma	Infinite
σg	0.1	0.023	0.019	0.027	Inv. Gamma	Infinite
σe	0.1	0.060	0.024	0.098	Inv. Gamma	Infinite
σr	0.1	0.026	0.020	0.032	Inv. Gamma	Infinite

Table A.3

Bayesian Estimation Results for Poland

PARAMETERS	PRIOR MEAN	POSTERIOR MEAN	CONFIDENCE INTERVAL	CONFIDENCE INTERVAL	PRIOR DISTRIBUTION	STANDARD DEVIATION
ψ	0.50	0.54	0.37	0.72	Normal	0.10
α	0.50	0.60	0.46	0.75	Normal	0.10
μ	0.50	0.46	0.38	0.54	Normal	0.05
σ	0.25	0.21	0.09	0.34	Normal	0.10
δ	0.25	0.01	0.00	0.02	Normal	0.10
ω	0.50	0.20	0.12	0.28	Beta	0.10
τ	0.15	0.02	0.01	0.03	Beta	0.05
γ	0.15	0.19	0.10	0.27	Beta	0.05
λg	0.50	0.35	0.22	0.48	Normal	0.10
χg	0.40	0.56	0.34	0.79	Normal	0.15
χpi	1.50	1.16	0.83	1.48	Normal	0.20
χy	0.50	0.98	0.70	1.24	Normal	0.20
χe	0.15	0.13	0.06	0.20	Normal	0.05
σd	0.1	0.022	0.017	0.026	Inv. Gamma	Infinite
σs	0.1	0.018	0.014	0.021	Inv. Gamma	Infinite
σg	0.1	0.024	0.020	0.028	Inv. Gamma	Infinite
σe	0.1	0.060	0.024	0.096	Inv. Gamma	Infinite
σr	0.1	0.028	0.022	0.034	Inv. Gamma	Infinite

Source: Own Computation

Table A.4

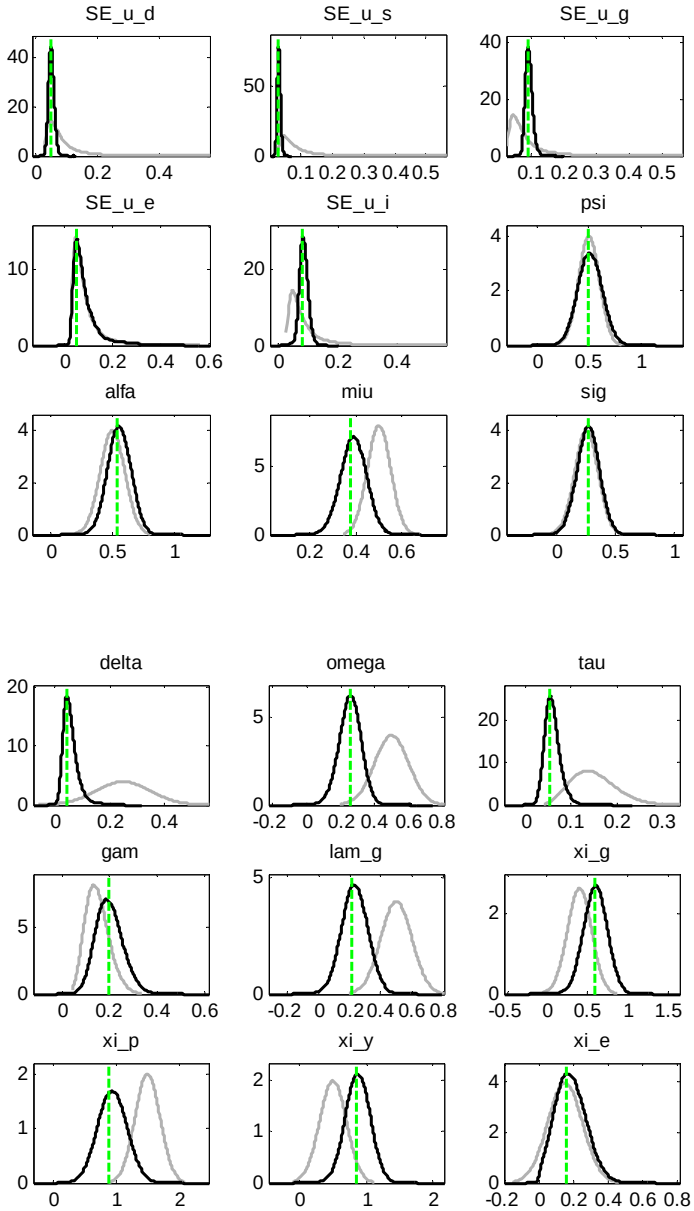
Bayesian Estimation Results for Hungary

PARAMETERS	PRIOR MEAN	POSTERIOR MEAN	CONFIDENCE INTERVAL	CONFIDENCE INTERVAL	PRIOR DISTRIBUTION	STANDARD DEVIATION
ψ	0.50	0.49	0.30	0.68	Normal	0.10
α	0.50	0.71	0.56	0.86	Normal	0.10
μ	0.50	0.39	0.31	0.47	Normal	0.05
σ	0.25	0.13	0.00	0.26	Normal	0.10
δ	0.25	0.02	0.01	0.04	Normal	0.10
ω	0.50	0.19	0.11	0.26	Beta	0.10
τ	0.15	0.02	0.01	0.04	Beta	0.05
γ	0.15	0.16	0.08	0.24	Beta	0.05
λg	0.50	0.24	0.12	0.37	Normal	0.10
χg	0.40	0.59	0.36	0.83	Normal	0.20
χpi	1.50	0.72	0.42	1.01	Normal	0.20
χy	0.50	0.88	0.61	1.15	Normal	0.20
χe	0.15	0.03	0.00	0.06	Normal	0.05
σd	0.1	0.018	0.014	0.022	Inv. Gamma	Infinite
σs	0.1	0.019	0.016	0.023	Inv. Gamma	Infinite
σg	0.1	0.038	0.032	0.044	Inv. Gamma	Infinite
σe	0.1	0.067	0.023	0.112	Inv. Gamma	Infinite
σr	0.1	0.028	0.021	0.034	Inv. Gamma	Infinite

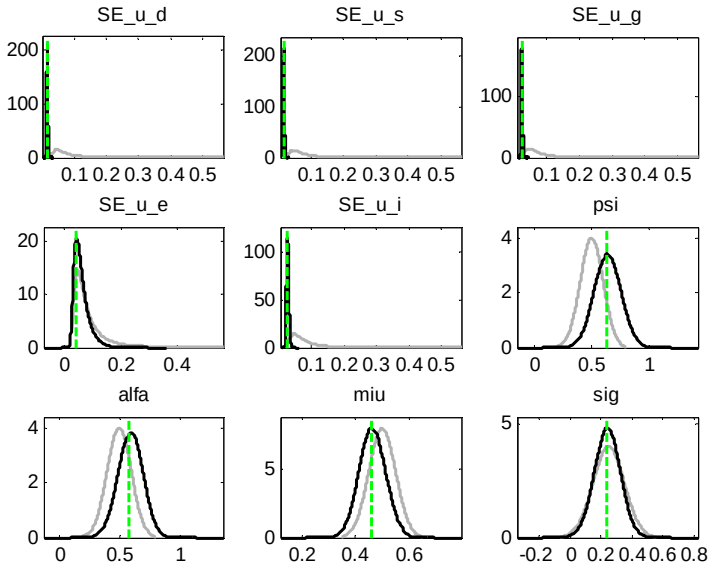
Source: Own Computation

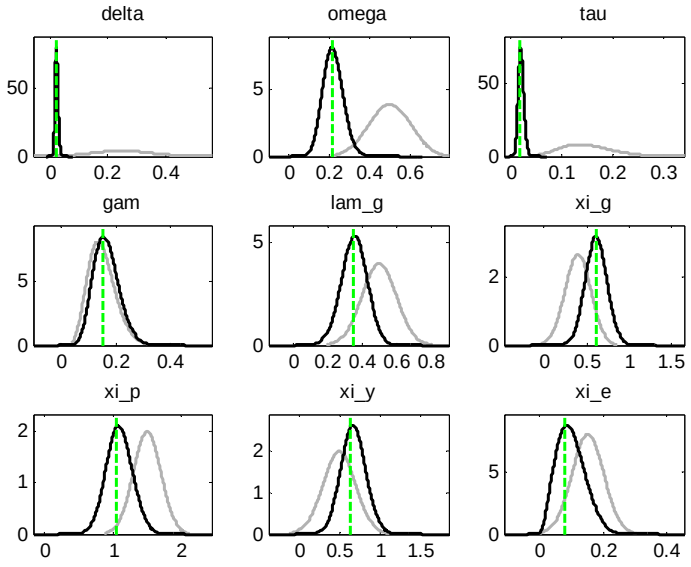
Annex A.2. Prior and posterior distributions

Estimation for Romania

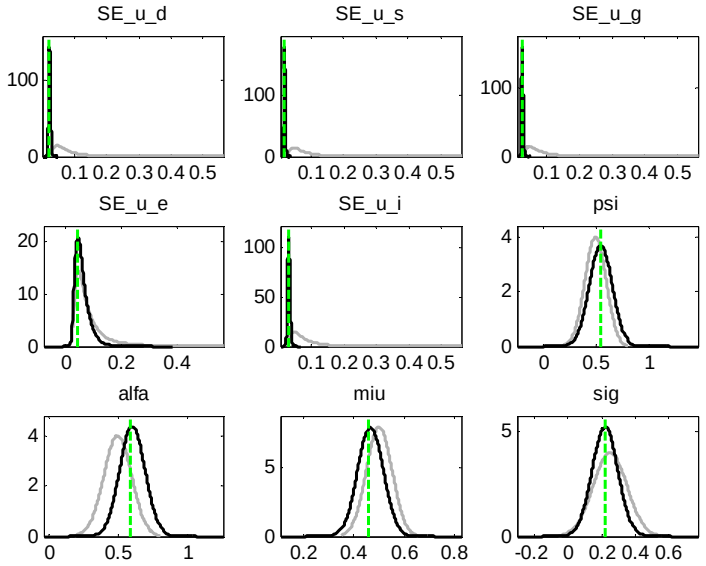


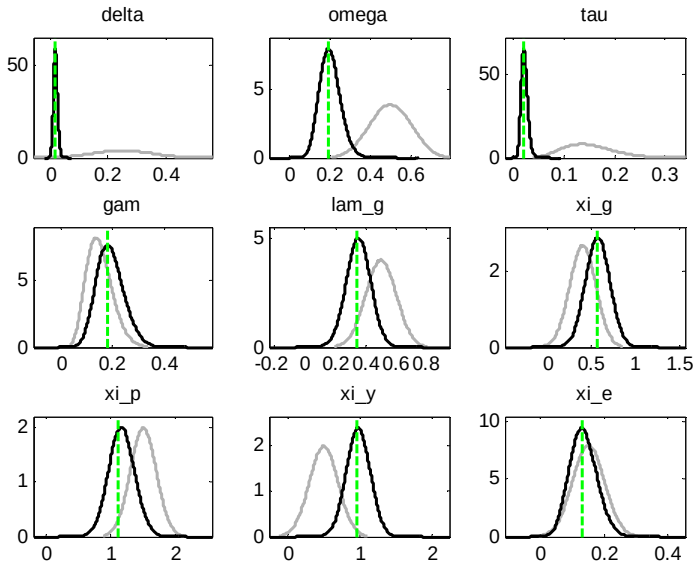
Estimation for Czech Republic



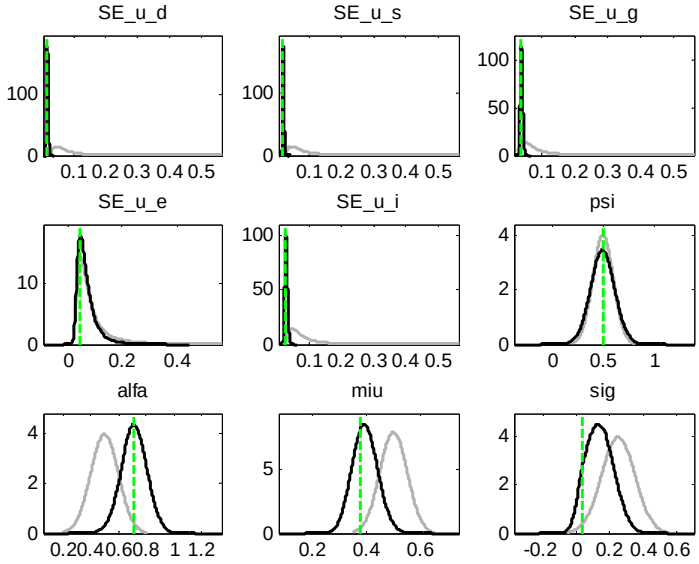


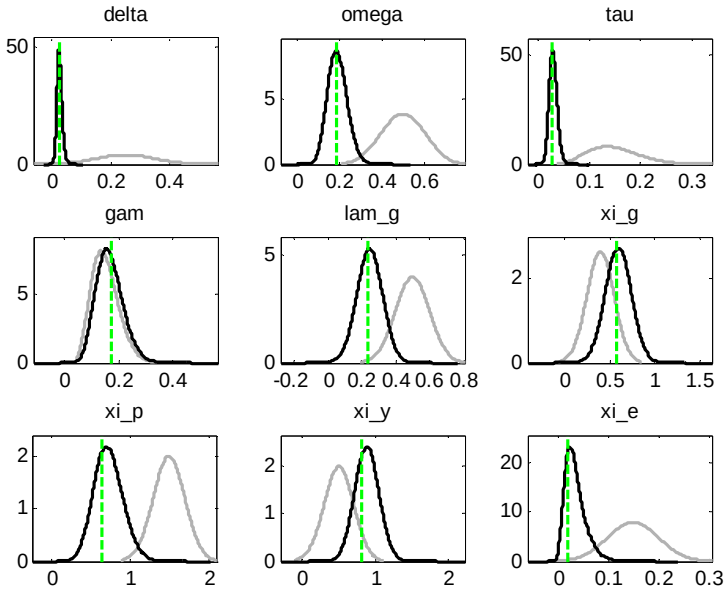
Estimation for Poland





Estimation for Hungary




delta
omega
tau
gam
lam_g
xi_g
xi_p
xi_y
xi_e

Annex B. *Brooks Gelman statistics for convergence*

Annex B.1. *Multivariate statistics for convergence*

Figure B.1.

Estimation for Romania

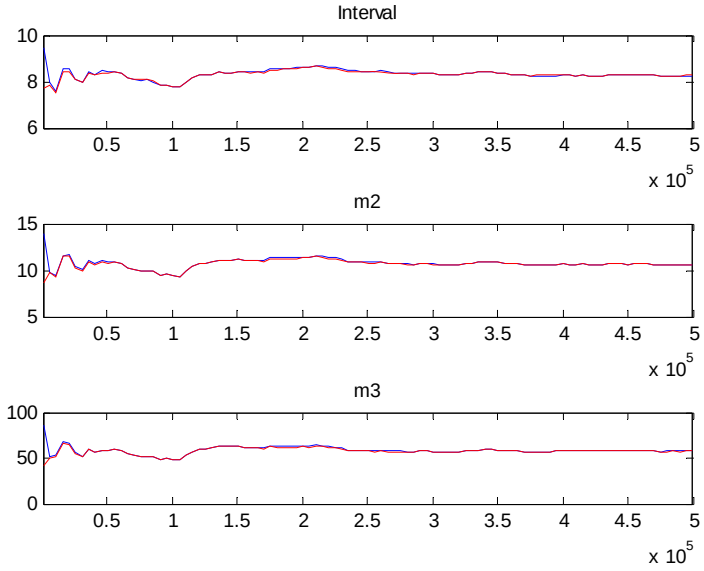


Figure B.2.

Estimation for Czech Republic

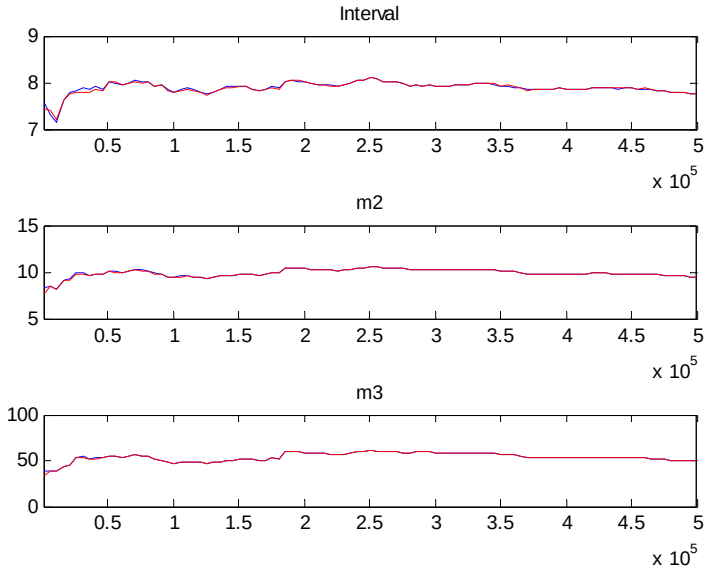


Figure B.3.

Estimation for Poland

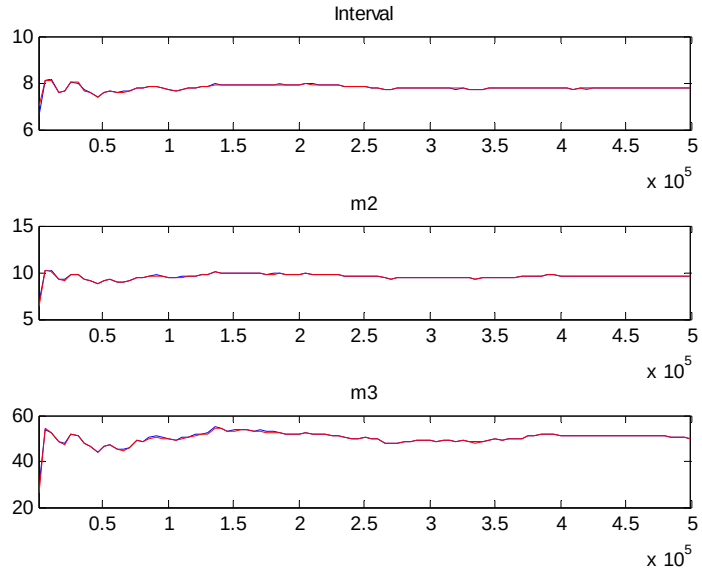
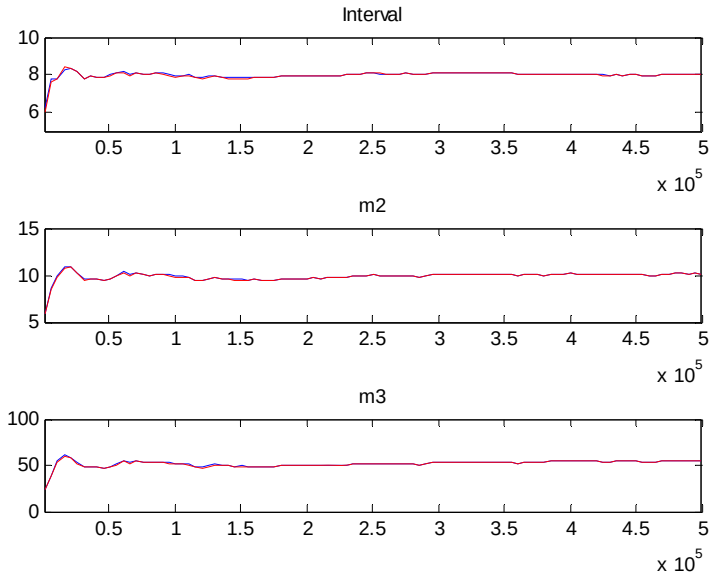


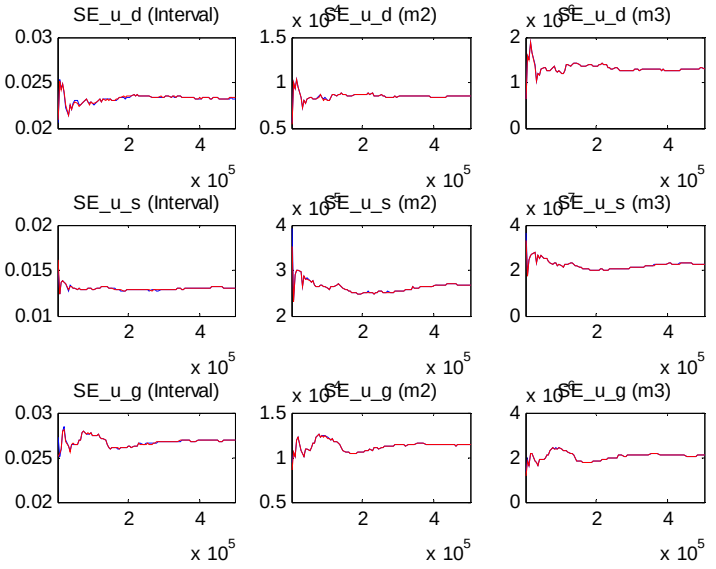
Figure B.4.

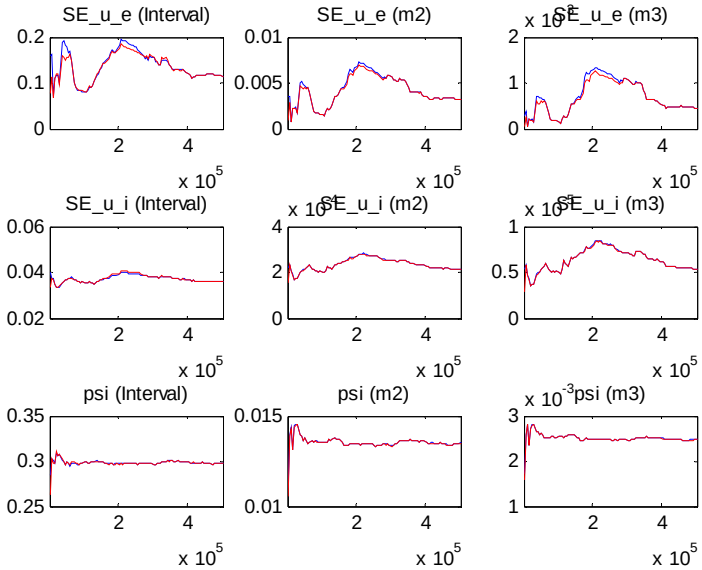
Estimation for Hungary

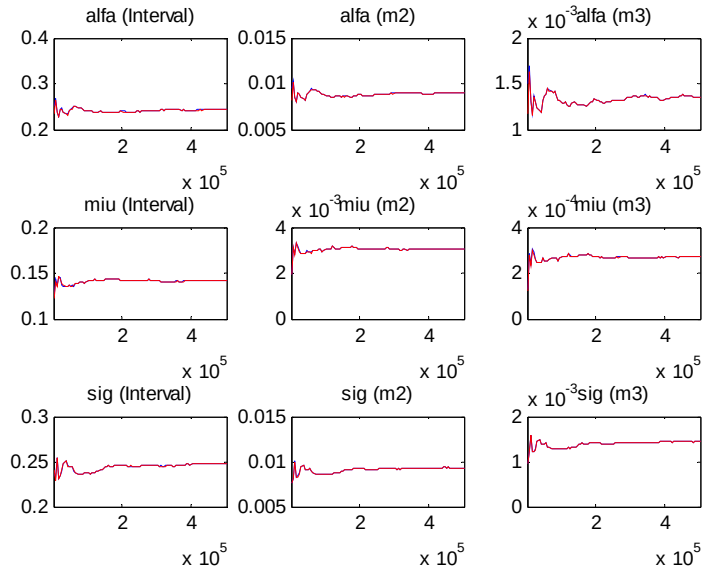


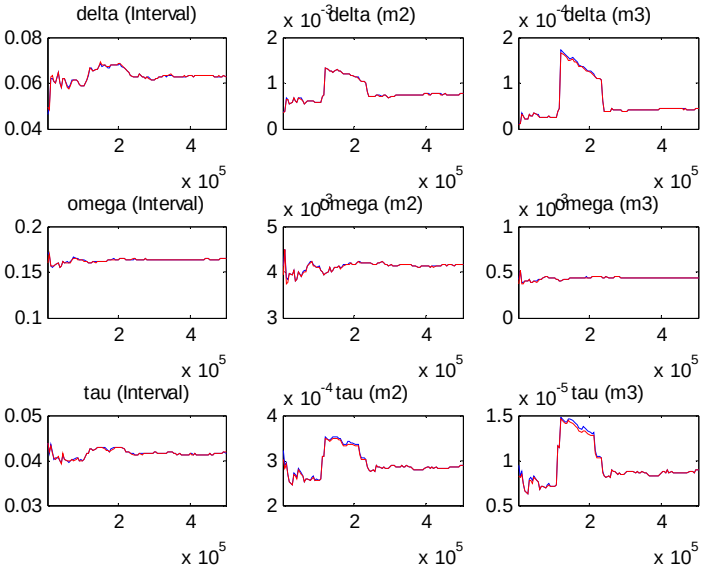
Annex B.2. *Univariate statistics for convergence*

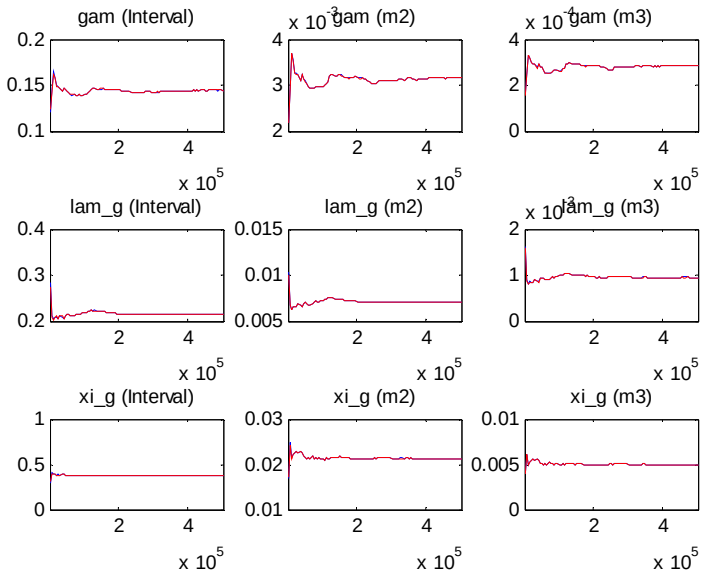
Annex B.2.1. *Results for Romania*

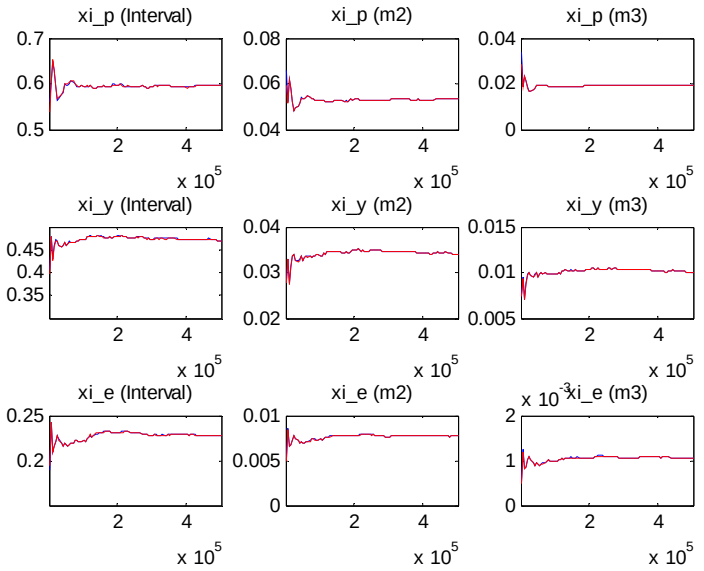




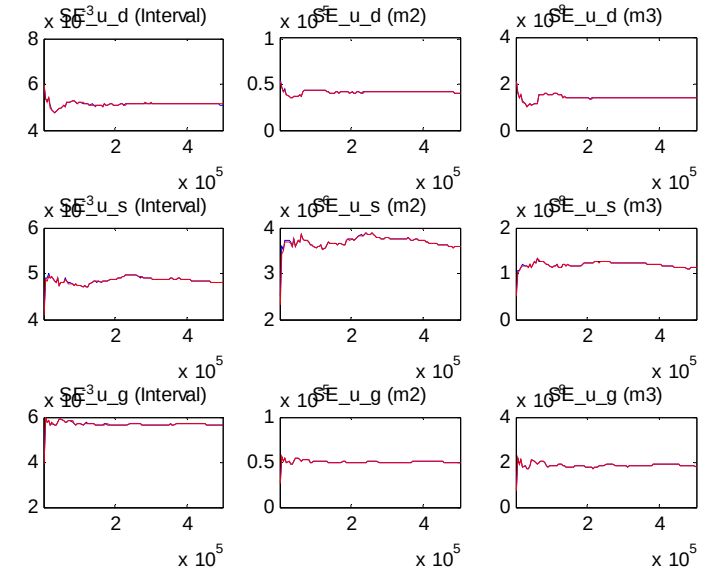

alfa (Interval)
alfa (m2)
x 10^-3 alfa (m3)
miu (Interval)
x 10^-3 miu (m2)
x 10^-4 miu (m3)
sig (Interval)
sig (m2)
x 10^-3 sig (m3)
x 10^5

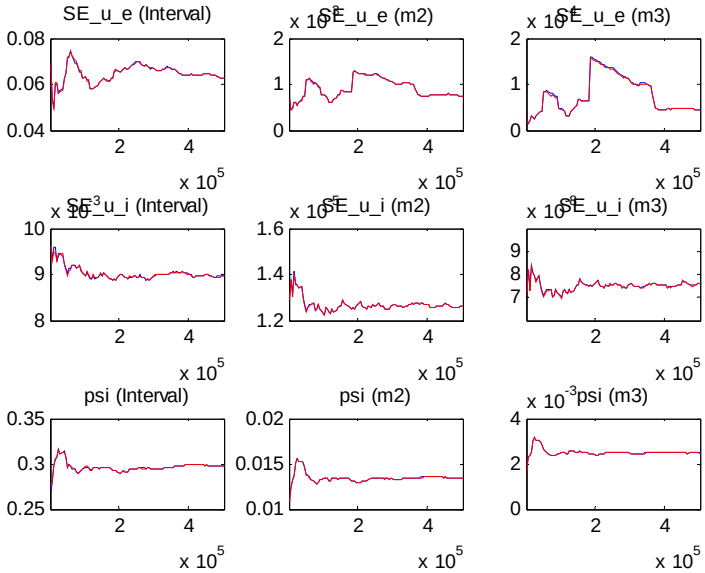

delta (Interval)
x 10^-3 delta (m2)
x 10^-4 delta (m3)
omega (Interval)
x 10^-3 omega (m2)
x 10^-3 omega (m3)
tau (Interval)
x 10^-4 tau (m2)
x 10^-5 tau (m3)
x 10^5

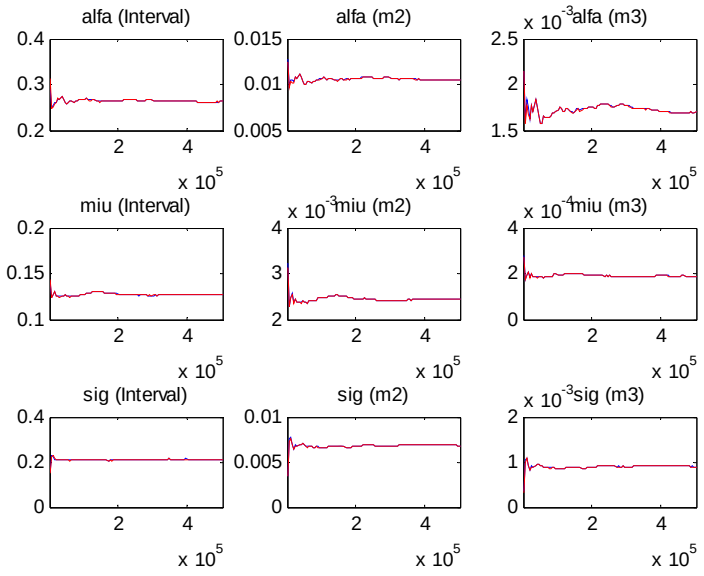

gam (Interval)
x 10^-3 gam (m2)
x 10^-4 gam (m3)
lam_g (Interval)
lam_g (m2)
x 10^-3 lam_g (m3)
xi_g (Interval)
xi_g (m2)
xi_g (m3)
x 10^5

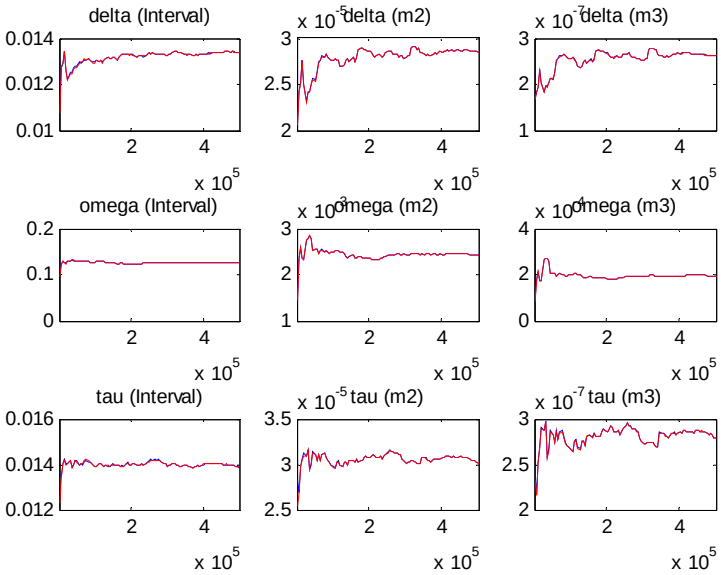

xi_p (Interval)
xi_p (m2)
xi_p (m3)
xi_y (Interval)
xi_y (m2)
xi_y (m3)
xi_e (Interval)
xi_e (m2)
x 10^-3 xi_e (m3)
x 10^5

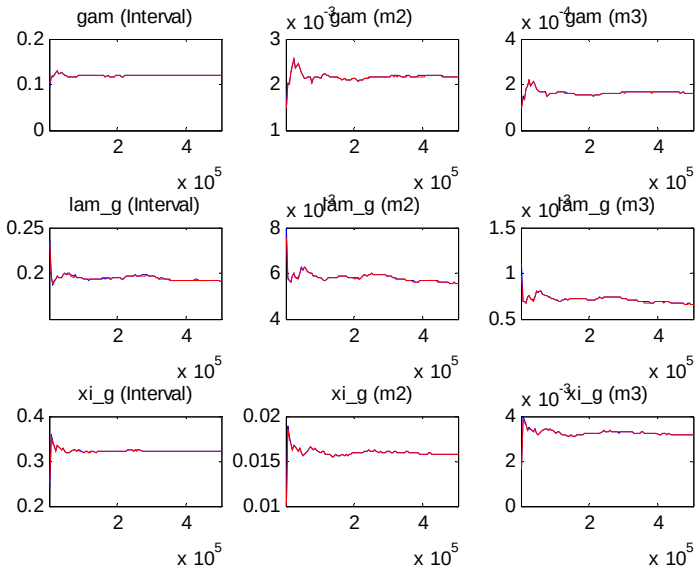
Annex B.2.2. *Results for Czech Republic*

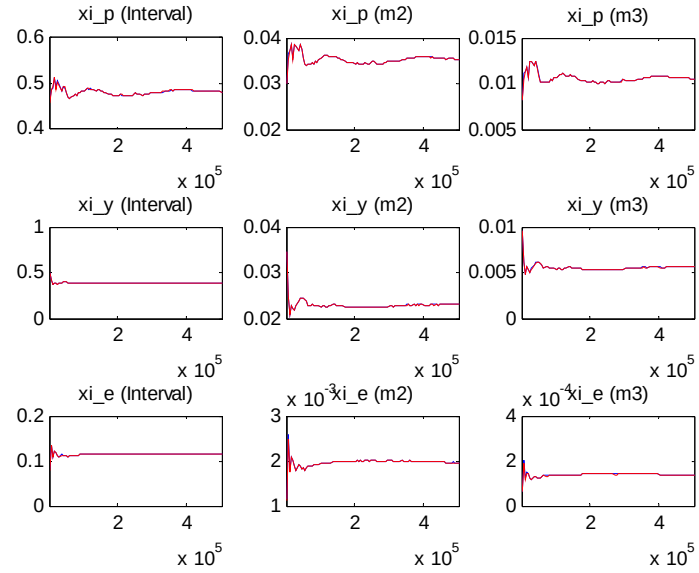




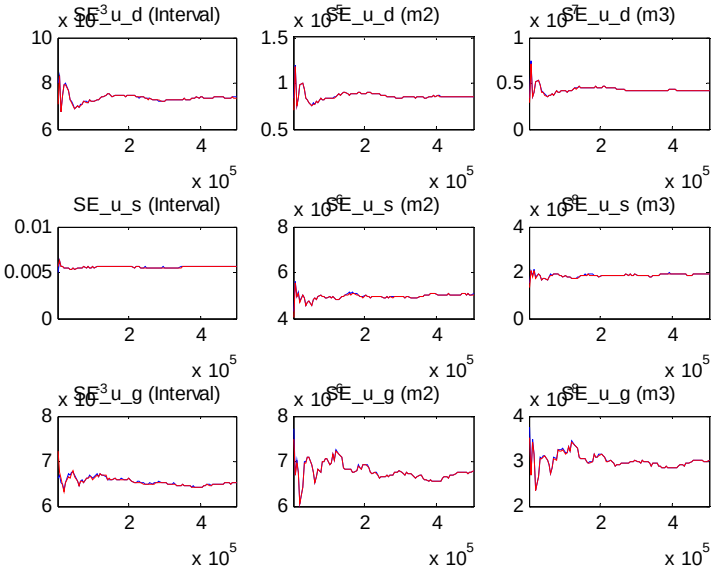

alfa (Interval)
alfa (m2)
x 10^-3 alfa (m3)
miu (Interval)
x 10^-3 miu (m2)
x 10^-4 miu (m3)
sig (Interval)
sig (m2)
x 10^-3 sig (m3)
x 10^5

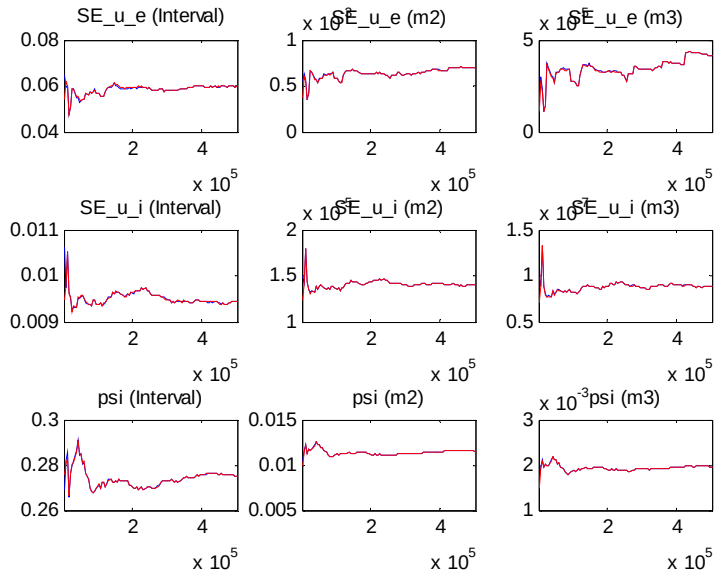

delta (Interval)
x 10^-5 delta (m2)
x 10^-7 delta (m3)
omega (Interval)
x 10^-3 omega (m2)
x 10^-4 omega (m3)
tau (Interval)
x 10^-5 tau (m2)
x 10^-7 tau (m3)
x 10^5

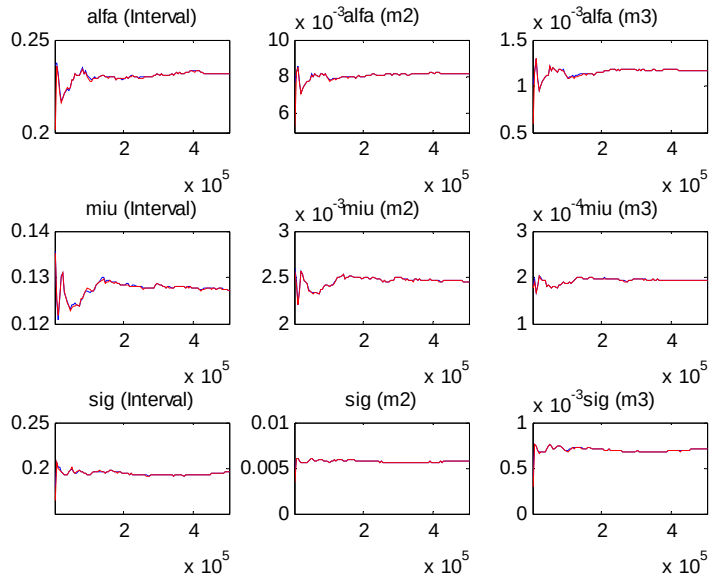

gam (Interval)
x 10^-3 gam (m2)
x 10^-4 gam (m3)
lam_g (Interval)
x 10^-3 lam_g (m2)
x 10^-3 lam_g (m3)
xi_g (Interval)
xi_g (m2)
x 10^-3 xi_g (m3)
x 10^5

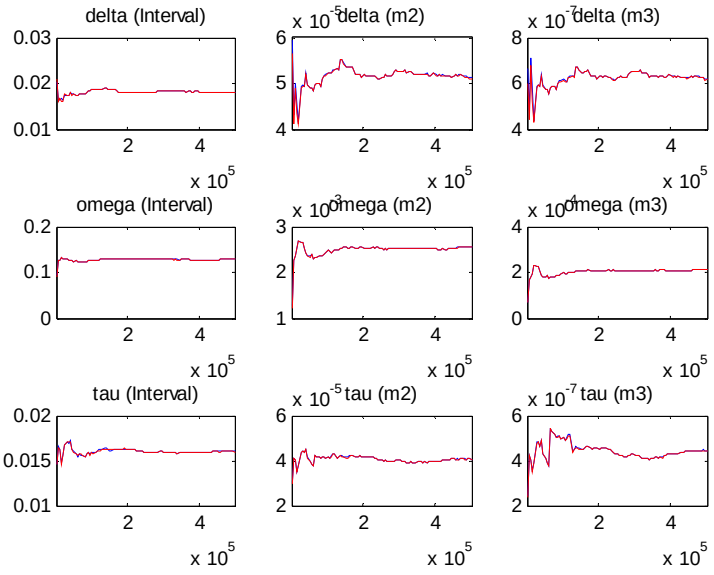

xi_p (Interval)
xi_p (m2)
xi_p (m3)
xi_y (Interval)
xi_y (m2)
xi_y (m3)
xi_e (Interval)
x 10^-3 xi_e (m2)
x 10^-4 xi_e (m3)
x 10^5

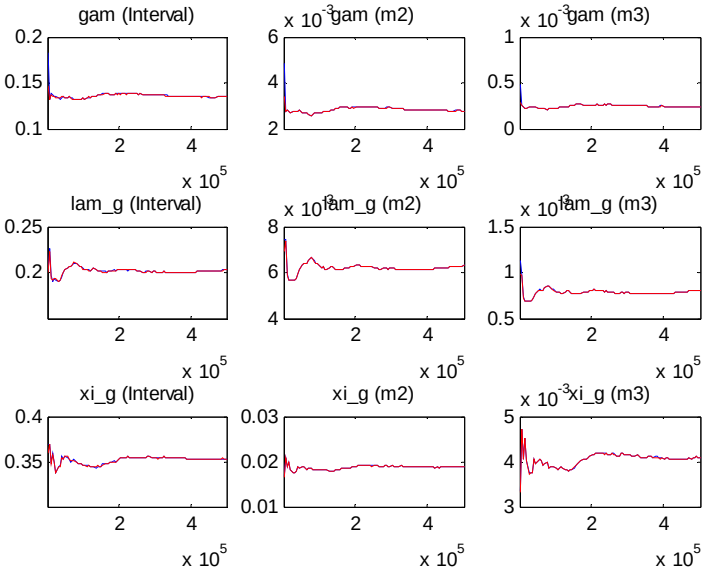
Annex B.2.3. *Results for Poland*

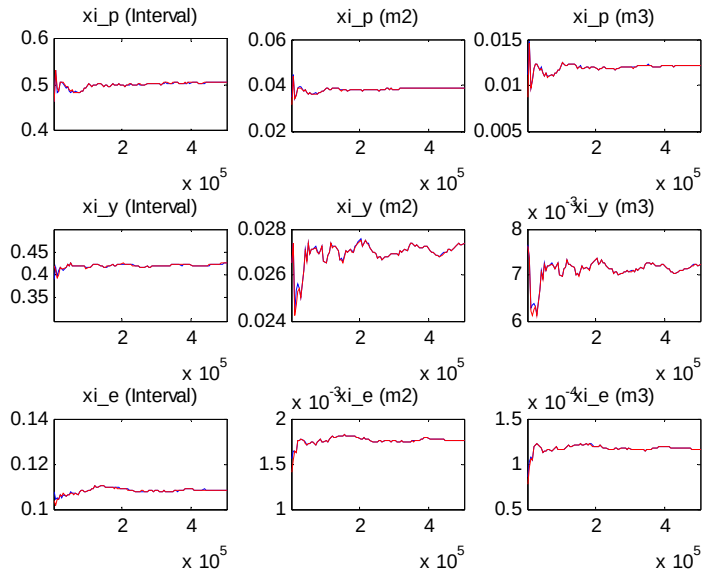




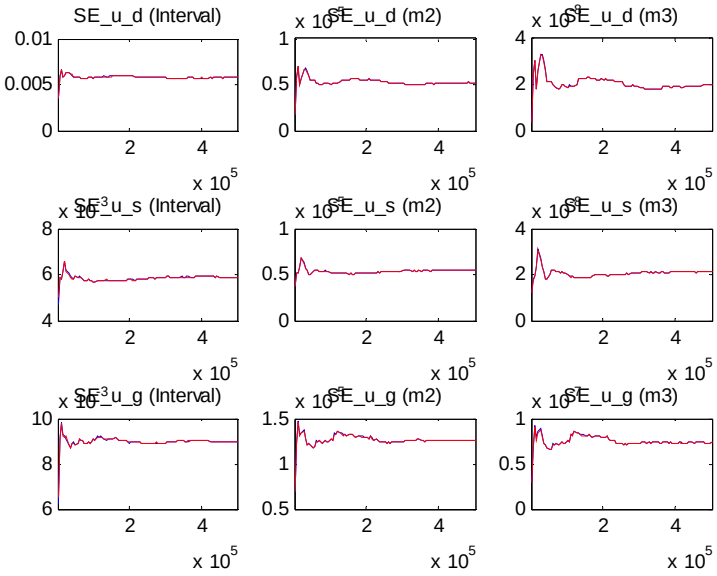

alfa (Interval)
x 10^-3 alfa (m2)
x 10^-3 alfa (m3)
miu (Interval)
x 10^-3 miu (m2)
x 10^-4 miu (m3)
sig (Interval)
sig (m2)
x 10^-3 sig (m3)
x 10^5

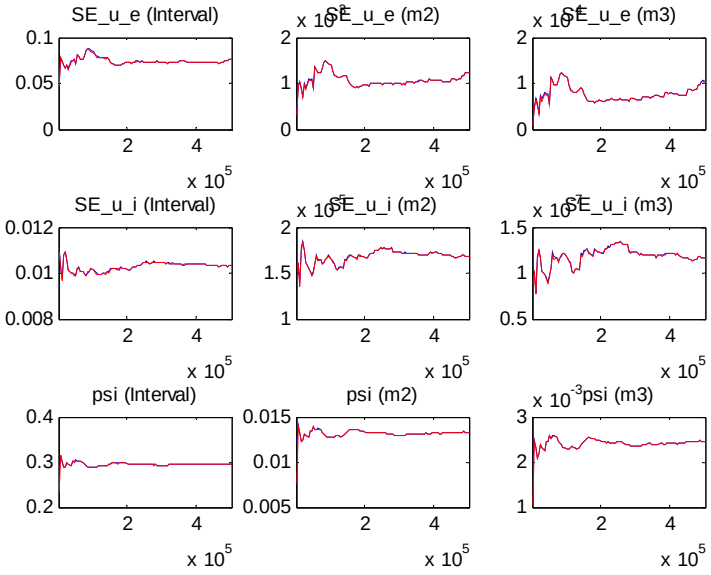

delta (Interval)
x 10^-5 delta (m2)
x 10^-7 delta (m3)
omega (Interval)
x 10^-3 omega (m2)
x 10^-4 omega (m3)
tau (Interval)
x 10^-5 tau (m2)
x 10^-7 tau (m3)
x 10^5

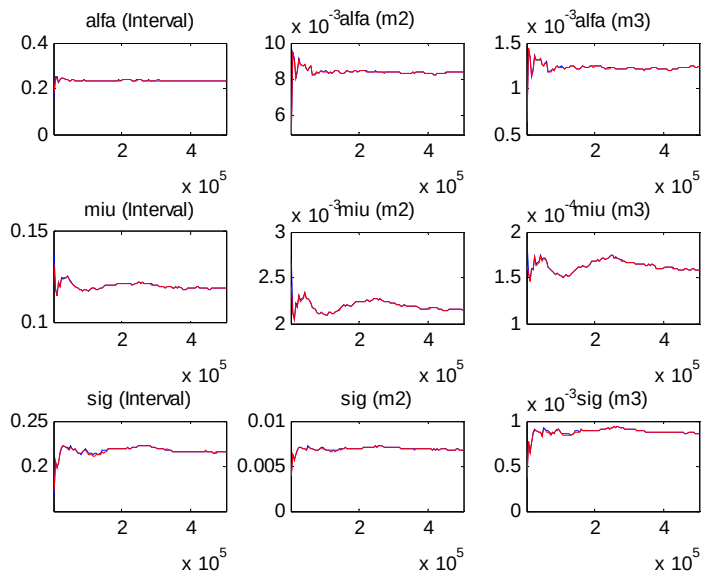

gam (Interval)
x 10^-3 gam (m2)
x 10^-3 gam (m3)
lam_g (Interval)
x 10^-3 lam_g (m2)
x 10^-3 lam_g (m3)
xi_g (Interval)
xi_g (m2)
x 10^-3 xi_g (m3)
x 10^5

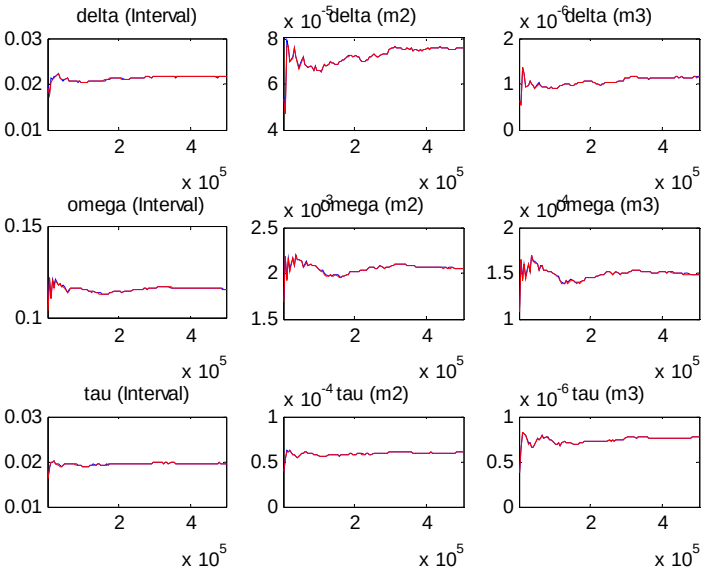

xi_p (Interval)
xi_p (m2)
xi_p (m3)
xi_y (Interval)
xi_y (m2)
x 10^-3 xi_y (m3)
xi_e (Interval)
x 10^-3 xi_e (m2)
x 10^-4 xi_e (m3)
x 10^5

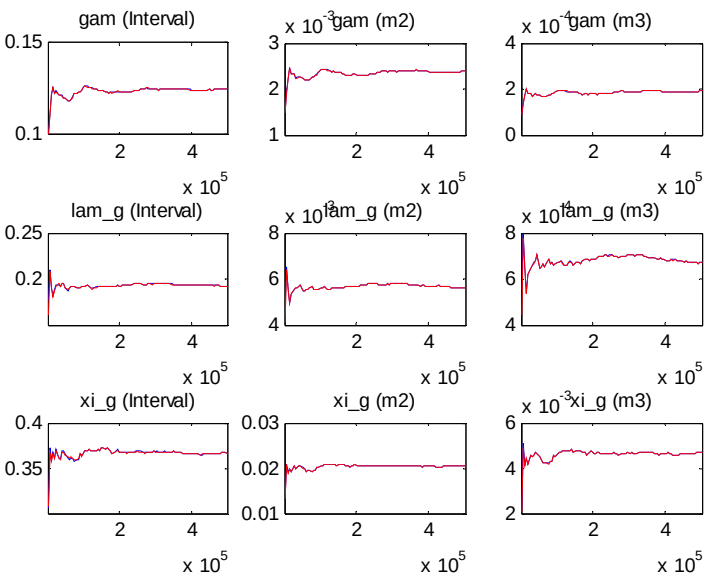
Annex B.2.4. *Results for Hungary*

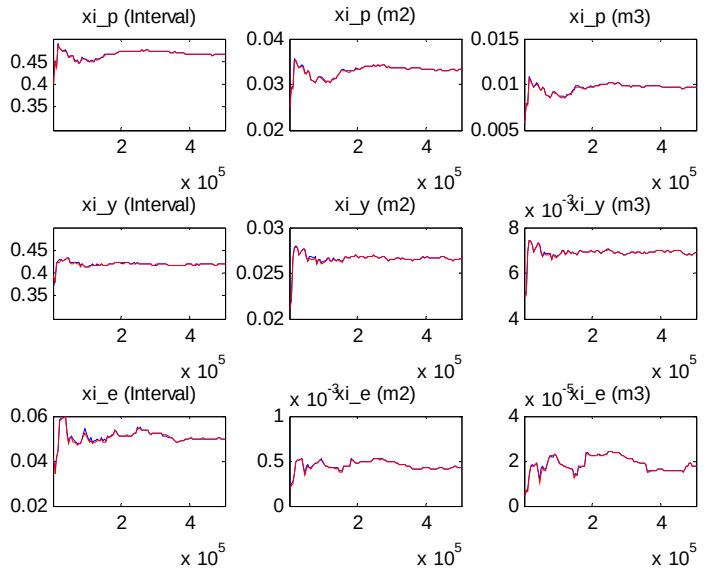





alfa (Interval)
x 10^-3 alfa (m2)
x 10^-3 alfa (m3)
miu (Interval)
x 10^-3 miu (m2)
x 10^-4 miu (m3)
sig (Interval)
sig (m2)
x 10^-3 sig (m3)
x 10^5


delta (Interval)
x 10^-5 delta (m2)
x 10^-6 delta (m3)
omega (Interval)
x 10^-3 omega (m2)
x 10^-4 omega (m3)
tau (Interval)
x 10^-4 tau (m2)
x 10^-6 tau (m3)
x 10^5


gam (Interval)
x 10^-3 gam (m2)
x 10^-4 gam (m3)
lam_g (Interval)
x 10^-3 lam_g (m2)
x 10^-4 lam_g (m3)
xi_g (Interval)
xi_g (m2)
x 10^-3 xi_g (m3)
x 10^5


xi_p (Interval)
xi_p (m2)
xi_p (m3)
xi_y (Interval)
xi_y (m2)
x 10^-3 xi_y (m3)
xi_e (Interval)
x 10^-3 xi_e (m2)
x 10^-5 xi_e (m3)
x 10^5

Annex C. *The Impact of Domestic Demand Shocks*

Figure C.1.

Estimation for Romania

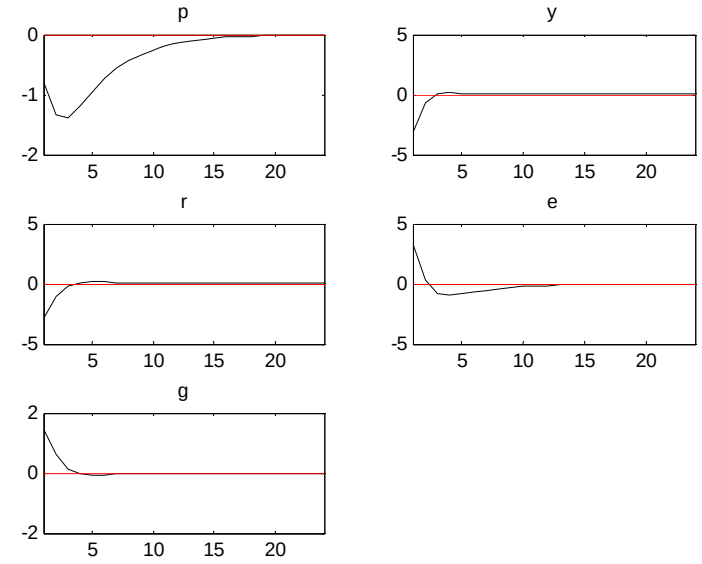


Figure C.2.

Estimation for Czech Republic

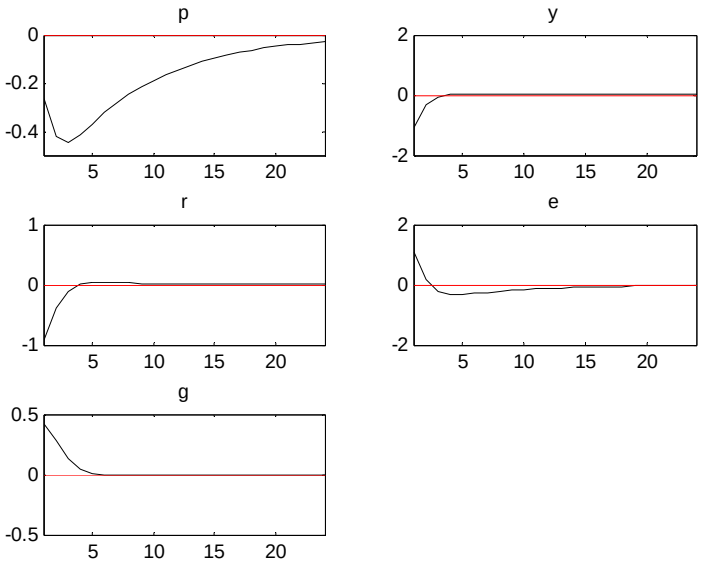


Figure C.3.

Estimation for Poland

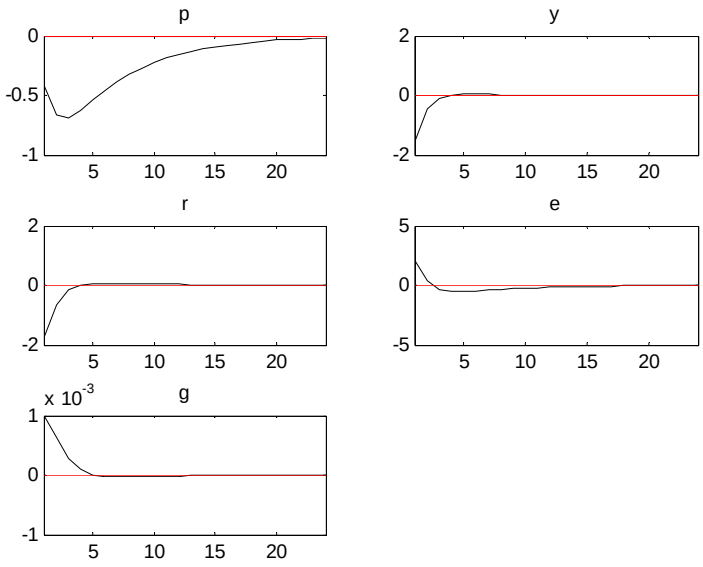
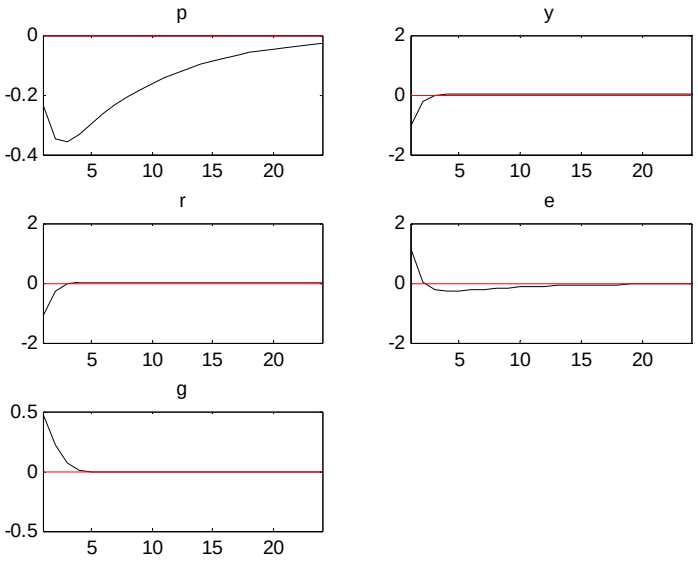


Figure C.4.

Estimation for Hungary



Annex D. *The Impact of Domestic Interest Rate Shocks*

Figure D.1.

Case of Romania

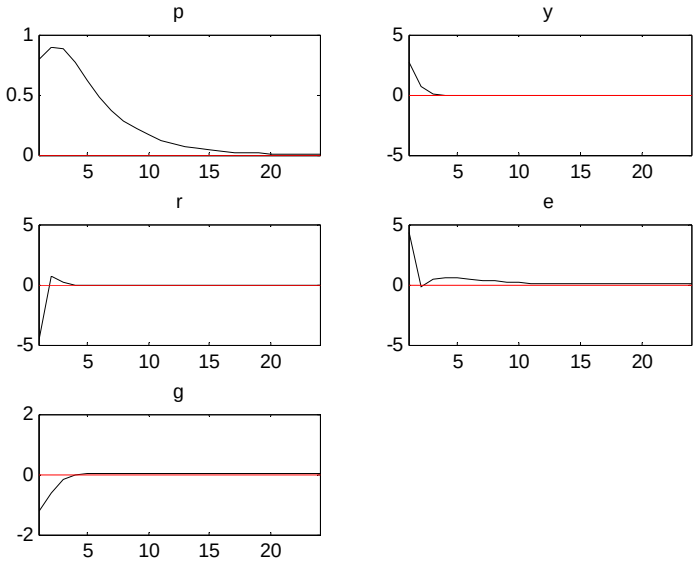


Figure D.2.

Case of Czech Republic

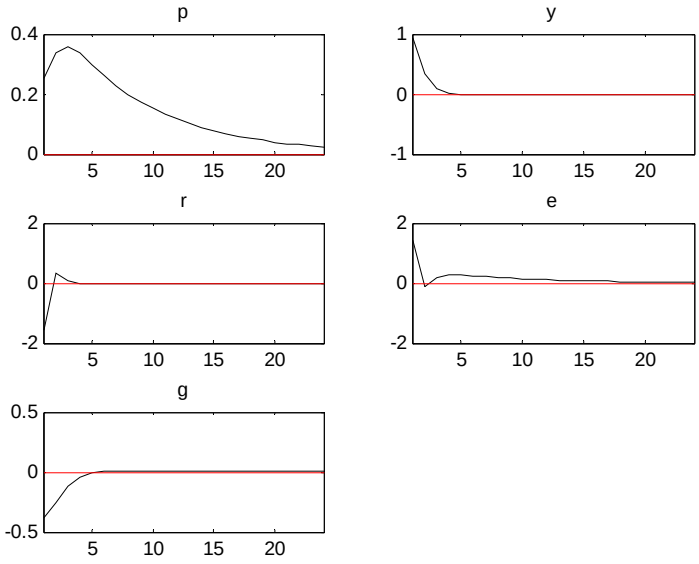


Figure D.3.

Estimation for Poland

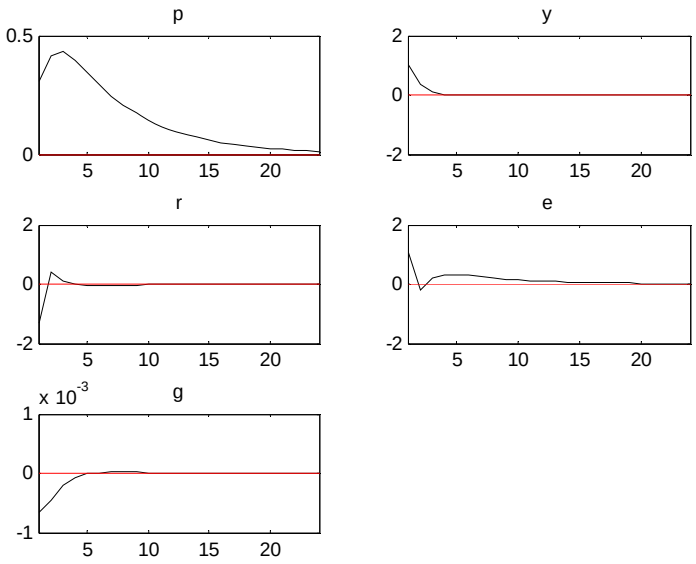
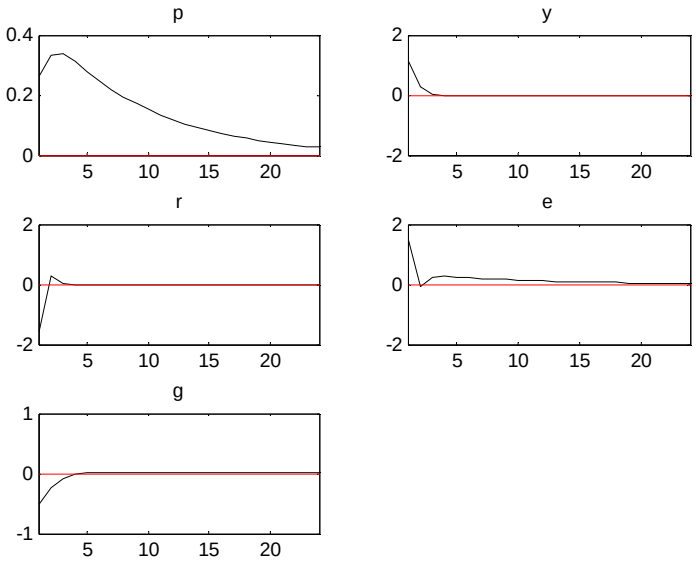


Figure D.4.

Estimation for Hungary



Annex E. *The Impact of Domestic Fiscal Shocks*

Figure E.1.

Case of Romania

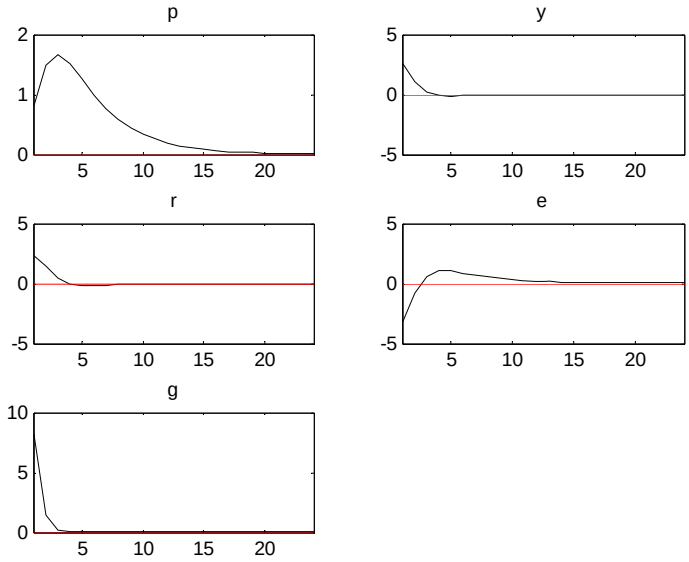


Figure E.2.

Case of Czech Republic

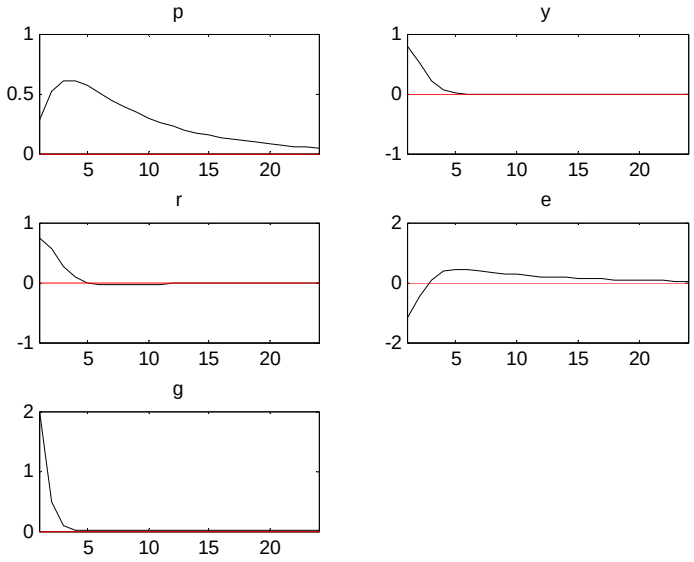


Figure E.3.

Estimation for Poland

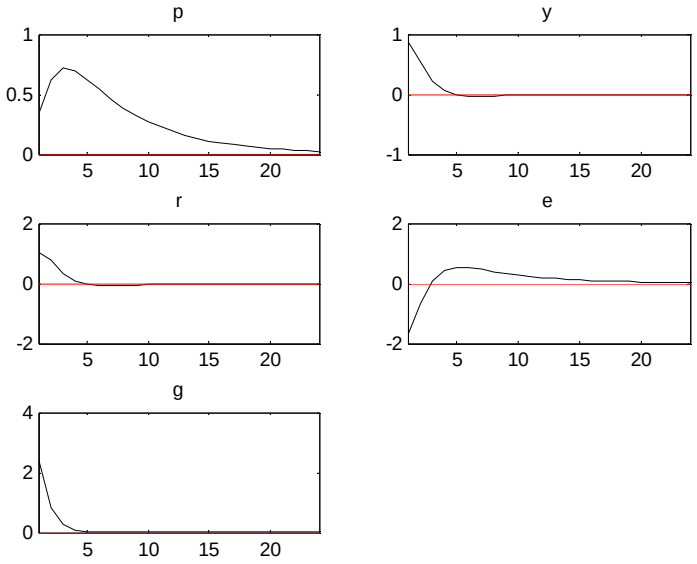
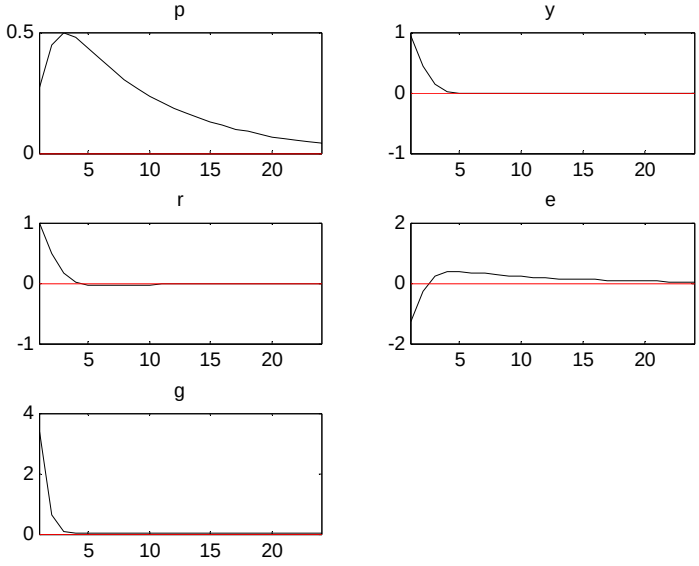


Figure E.4.

Estimation for Hungary



Annex F. *The Impact of Foreign Interest Rate Shocks*

Figure F.1.

Case of Romania

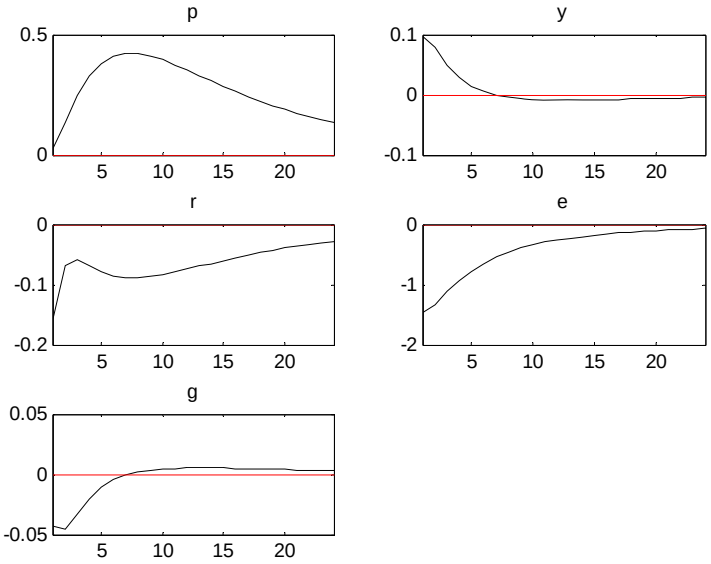


Figure F.2.

Case of Czech Republic

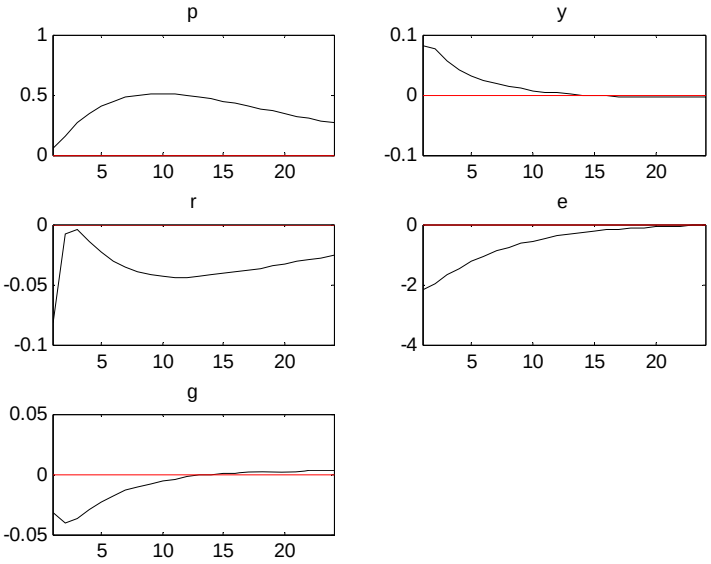


Figure F.3.

Estimation for Poland

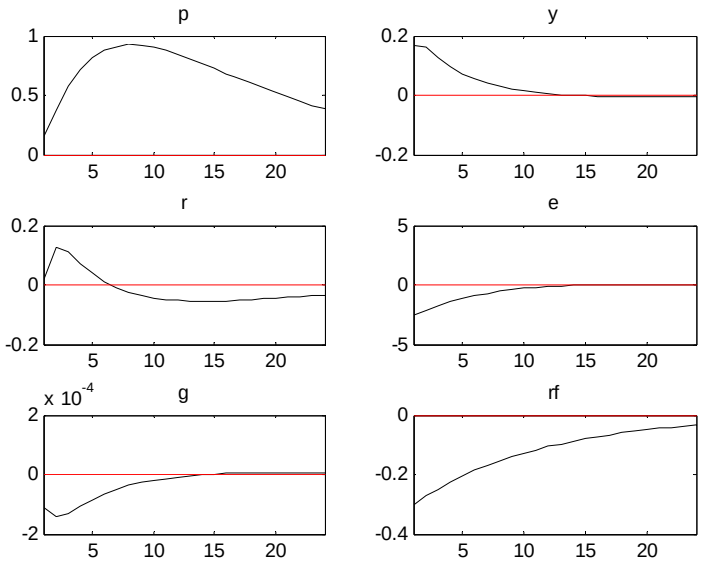
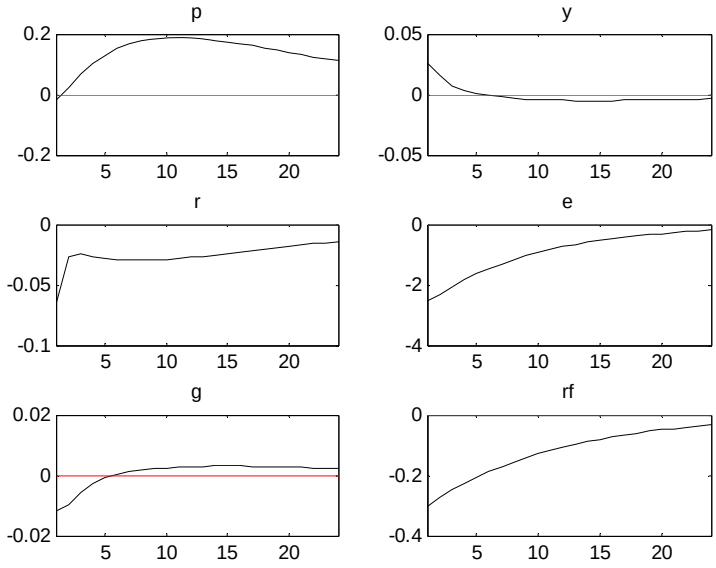


Figure F.4.

Estimation for Hungary



Annex G. *The Impact of Foreign Demand Shocks*

Figure G.1.

Case of Romania

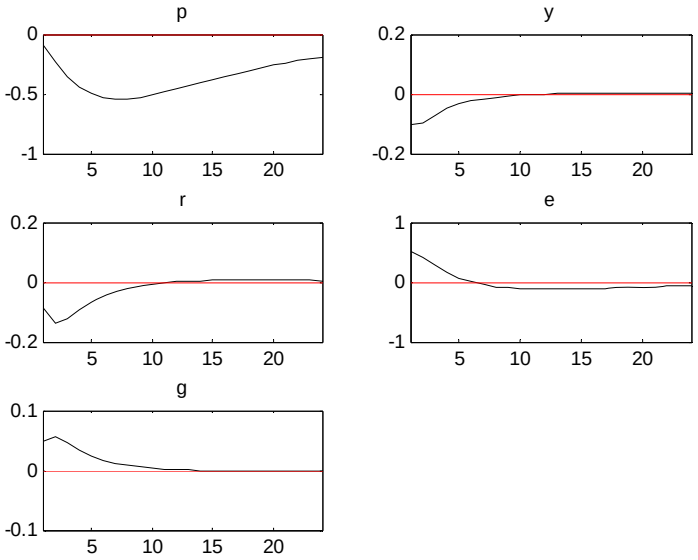


Figure G.2.

Case of Czech Republic

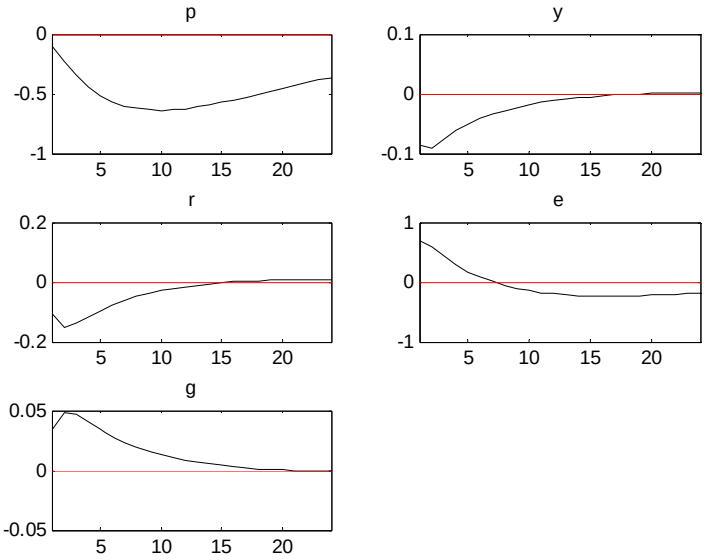


Figure G.3.

Estimation for Poland

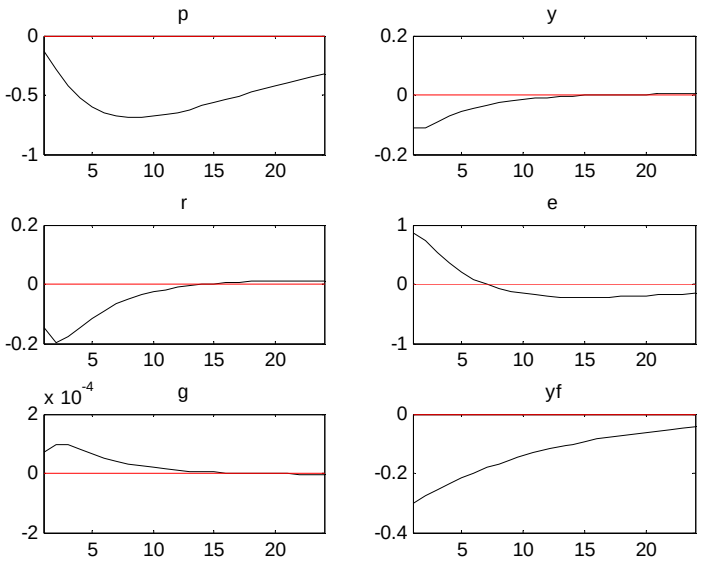
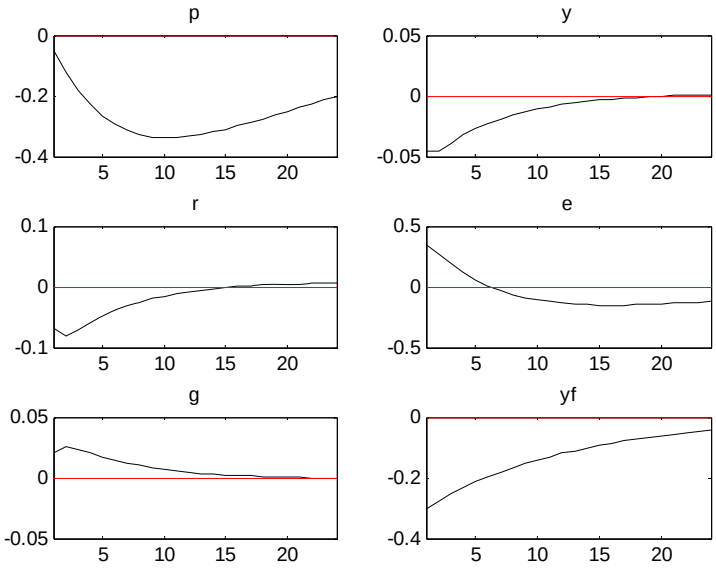


Figure G.4.

Estimation for Hungary



ANNEX H. Bayesian Comparison of the Models with and without Fiscal Rule

Table H.1.

Bayesian comparison of the models

	Log-likelihood		
	M1: DSGE with Fiscal rule	*M2: DSGE without Fiscal rule*	*Log-Bayes Factor of M1 against M2*
Romania	224.02	219.27	**4.75**
Czech Republic	560.10	552.52	**7.58**
Poland	424.89	420.05	**4.84**
Hungary	544.86	539.68	**5.18**

ANNEX I. Explaining the Variation of the Main Economic Variables

Table I.1.

The Decomposition of variance for the case of Romania

Domestic Variables	**Source of Shocks**							
	Domestic Demand	**Domestic Supply**	**Fiscal Deficit**	**Domestic Interest rate**	**Exchange Rate**	**Foreign Demand**	**Foreign Interest Rate**	**Foreign Supply**
Inflation	11.37	57.14	16.70	5.28	1.03	5.42	3.05	0.00
Output	35.49	10.37	27.10	26.40	0.47	0.11	0.07	0.00
Interest Rate	21.13	9.68	17.83	48.26	2.69	0.13	0.28	0.00

Table I.2.

The Decomposition of variance for the case of Czech Republic

Domestic Variables	**Source of Shocks**							
	Domestic Demand	**Domestic Supply**	**Fiscal Deficit**	**Domestic Interest rate**	**Exchange Rate**	**Foreign Demand**	**Foreign Interest Rate**	**Foreign Supply**
Inflation	3.74	50.03	7.76	2.48	0.44	22.38	13.17	0.00
Output	29.98	21.59	22.27	24.24	0.65	0.80	0.48	0.01
Interest Rate	15.10	27.27	14.06	38.98	2.57	1.43	0.59	0.00

Table I.3.

The Decomposition of variance for the case of Poland

Domestic Variables	**Source of Shocks**							
	Domestic Demand	**Domestic Supply**	**Fiscal Deficit**	**Domestic Interest rate**	**Exchange Rate**	**Foreign Demand**	**Foreign Interest Rate**	**Foreign Supply**
Inflation	2.75	8.35	12.07	2.10	0.64	60.68	0.05	13.36
Output	20.51	25.28	26.64	15.81	3.46	2.43	0.09	5.79
Interest Rate	0.74	0.32	1.29	0.36	86.78	0.22	9.87	0.42

Table I.4.

The Decomposition of variance for the case of Hungary

Domestic Variables	**Source of Shocks**							
	Domestic Demand	**Domestic Supply**	**Fiscal Deficit**	**Domestic Interest rate**	**Exchange Rate**	**Foreign Demand**	**Foreign Interest Rate**	**Foreign Supply**
Inflation	2.45	82.00	4.87	2.23	0.36	6.26	1.82	0.00
Output	27.61	13.37	26.08	32.58	0.10	0.22	0.03	0.00
Interest Rate	19.50	17.64	20.17	41.44	0.50	0.44	0.31	0.00

ANNEX J. Historical Decomposition of Output

Figure J.1.

Historical decomposition of output for Romania

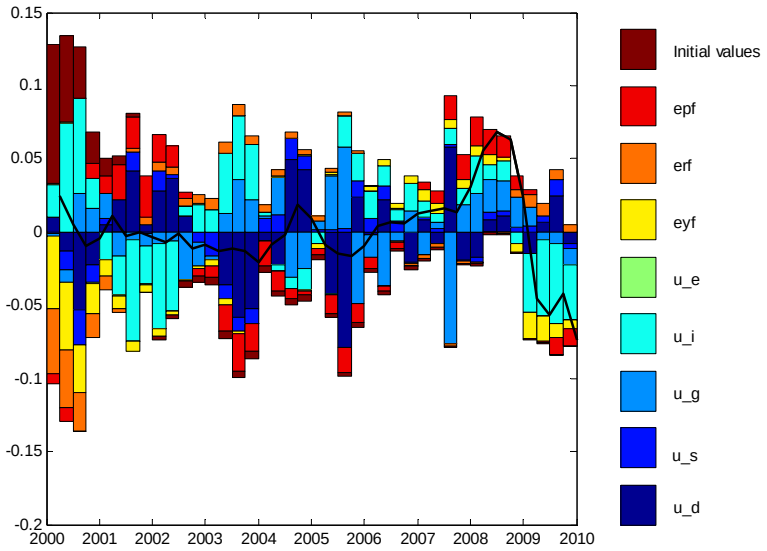


Figure J.2.

Historical decomposition of output for Czech Republic

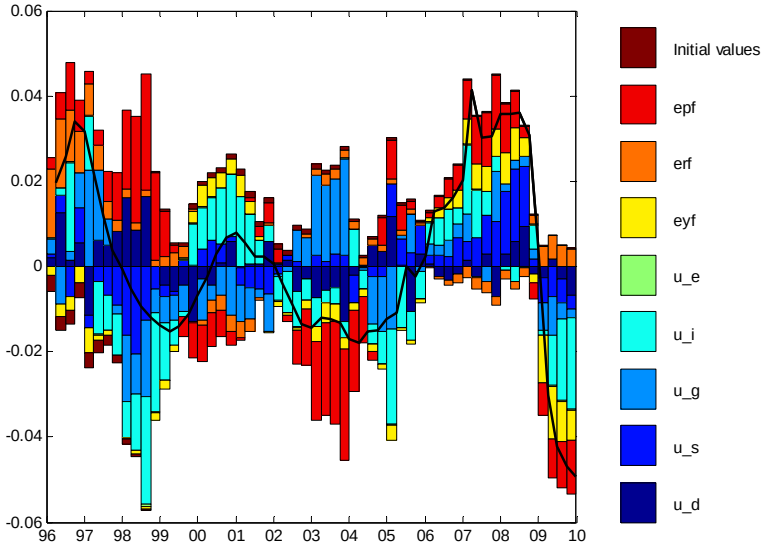


Figure J.3.

Historical decomposition of output for Poland

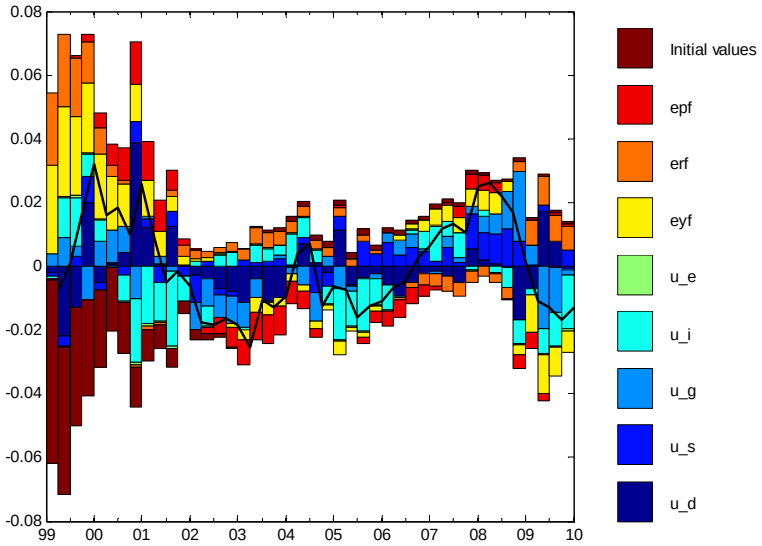
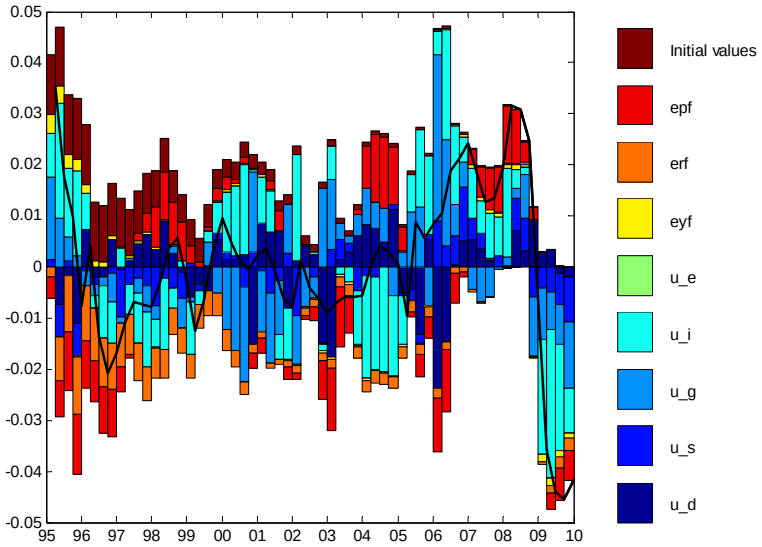


Figure J.4.

Historical decomposition of output for Hungary



K. Counterfactuals scenarios

Figure K.1.

Case of Romania

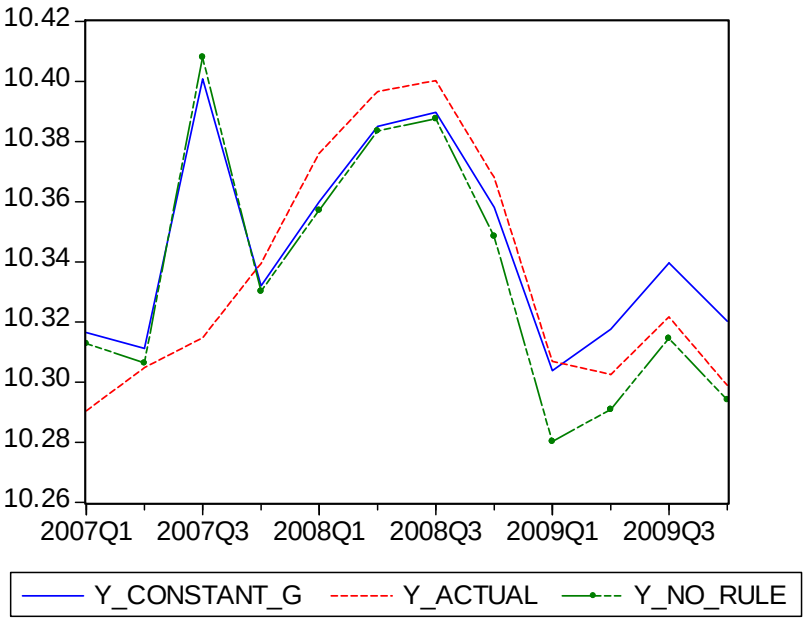


Figure K.2.

Case of Czech Republic

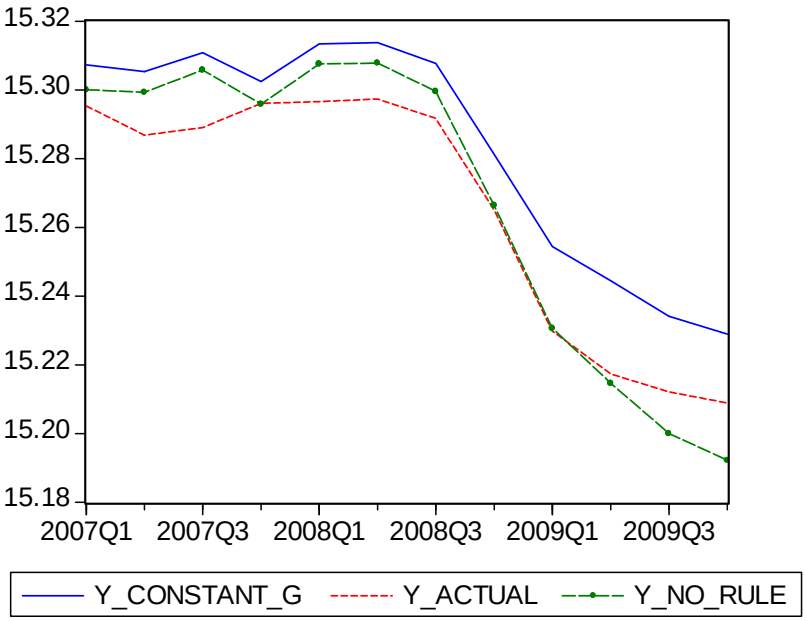


Figure K.3.

Case of Poland

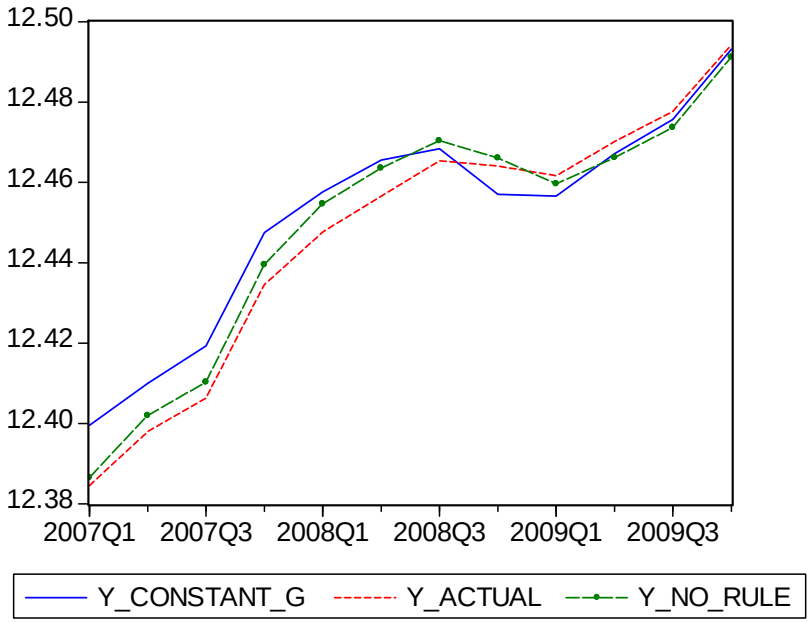


Figure K.4.

Case of Hungary