경제학석사학위논문

Differences in the Responses to Monetary Policy Shocks before and after the EU Membership: Evidence from the Czech Republic

유럽연합 가입 전후의 통화정책 충격에 대한 거시경제변수들의 반응 차이: 체코 사례를 중심으로

2017년 8월

서울대학교 대학원
경제학부 경제학 전공
박 용 호

Abstract

Differences in the Responses to Monetary Policy Shocks before and after the EU Membership: Evidence from the Czech Republic

Yongho Park
Department of Economics
The Graduate School
Seoul National University

The purpose of this thesis is to investigate differences in the effects before and after joining the European Union(EU) on economy to monetary policy shocks as a small open country. In this paper, the case of the Czech Republic is considered as the representative country. For comparison of the responses of macroeconomic variables for the data before and after the membership of the EU, whole data are divided by two based on the date when the Czech Republic became the member. By employing Structural Vector Autoregression(SVAR) model, this paper is trying to reveal the difference in the responses of major variables to monetary tightening shocks.

As a result, significant exchange rate puzzles are found in the both. While the puzzles are robust in the results for pre-membership sample, those are not robust for the later

sample. According to additional tests, the intervention of the ce ntral bank of the country in the foreign reserves market may cause the differences in the impacts of foreign reserves before and after the membership. Due to the dissimilarity, co-movement of impulse responses of NEER and FORE is only shown in the results for the earlier sample.

Keywords : SVAR, Sign Restrictions, Small Open Economy, Monetary Policy Shocks, Exchange Rate Puzzle, UIP Condition, The European Union.

Student Number : 2014-20211

Contents

List of Tables

List of Figures

Notes : (1) and (2) indicate before and after, respectively.

1. Introduction

After the referendum of the UK for 'Brexit', what effects on economies exist as member states of the EU became one of interesting topics in many countries in the group. Especially in the Czech Republic, this arises as a crucial issue in the election. The Czech Republic is one of the biggest and most advanced countries among transitions in the European Union. Hence, it is valuable to estimate the effects in the country. The effects, of course, are controversial for many different ways and causes. Historically, each country has different roots of their origins. Culturally, it is impossible for their style to be identical because each state has idiosyncratic backgrounds. Therefore, in this paper only economic factor, mainly impulse responses of macroeconomic variables to monetary policy shocks, will be dealt with.

In order to estimate the responses, 'Structural Vector Autoregression'(after SVAR) model is employed in this paper. This method helps reveal pure effects to the specific shocks by identifying the structural shocks from reduced form residual. After Sims(1980), the structural innovations have often been identified by using Choleski decomposition[1]. Due to the limitations that the interactions of each variables are restricted by the ordering of variables. Even though this kind of schemes are still prevalent, those hurdles can be overcome with sign restrictions SVAR introduced by Uhlig(2005).

Using this method, researchers can eliminate illogical puzzles[2]

1) see Sims(1986), Sims(1992), Gali(1996), Peersman and Smet(2001)

2) Puzzles mainly dealt with are price, liquidity, exchange rate, and delayed overshooting.

addressed in previous literature. It helps analysts construct the reasonable system by setting the signs on the impulse responses of certain variables to get rid of puzzles. For instance, Uhlig(2005) restricted the sign of price index to negative while monetary tightening shocks. As a result, the price puzzle, increase in interest rate leads increase in price index, is not found. It holds the validity with other puzzles as well.

Because of the simplicity, SVAR models with sign restrictions have been so far very popular to estimate specific effects without ridiculous side-effects. When using recursive identifications with the data for the Czech Republic, price and output puzzles were so clear that the real effects to the shocks might be blurred. Therefore, sign restrictions are employed to estimate the pure effects to monetary innovations. The identification of this model comes from Uhlig(2005) and Kim and Lim(2016), which imposed negative sings on price and monetary base and positive signs on interest for twelve months.

This paper is also interested in the exchange rate and the delayed overshooting puzzle. These puzzles are common in the empirical studies. By analyzing these puzzles, we can check the effects of the central banks' intervention in the foreign reserves market. This intervention is usual in emerging countries to stabilize their currencies to keep their economies from turbulence by foreign parts.

2. Literature Review

After the introduction of VAR by Sims(1980), this method has been one of most popular ways in the analysis to analyze effects on macroeconomic variables to exogenous shocks, including money demand shocks(Sims(1986)), short-term interest shocks(Sims(1992)), technology shocks(Gali(1996)), and so on. Most of the studies with SVAR have mainly focused on the reponses of macroeconomic variables to monetary policy shocks(with additional shocks). Peersman and Smet(2001) estimated the impacts of monetary policy shocks in the euro area as a whole. The responses to monetary policy shocks in the euro area are quite similar to those in the US. Only for that of exchange rate, the impacts affect less persistently in the monetary union. Unlike the above paper, Mojon and Peersman(2001) investigated those in the individual member state of the area. The innovation of monetary policy is identified by using identification methods[3] for each country depending on degree of currency integration with Germany. As a result, they found consistent and persistent responses to an expected increase in the short-term interest rate of Germany which are not different from those in literature for the US and Peersman and Smet(2001).

---

3) The paper imposes contemporaneous on the interaction between short term interest rate and the real effective exchange rate in Germany, block-recursive in Austria, Belgium, and the Netherlands, and standard and recursive identification in Finland, France, Greece, Ireland, Italy, and Spain.

Uhlig(2005) identified contractionary monetary policy shocks by using relatively new method which is sign restriction by imposing signs on the impulse responses of specific variables. This is very useful to reveal the effects of key macroeconomic variables to specific shocks. The restrictions are usually based on existing empirical results or prominent theories. Scholl and Uhlig(2008) also used the same identification to find out the sources for the delayed overshooting and forward discount puzzle which are found in Uhlig(2005). Kim(2015) adopted the scheme since the author wanted to discover the causes of output puzzle[4]. Furthermore, Kim and Lim(2016) tried to reveal not only the exchange rate puzzle, but also the delayed overshooting puzzle in the emerging countries including Korea, Brazil, and so on. This paper used extraordinary variable, foreign reserves, because the variable is considered as one of major indices for the intervention in the foreign exchange market of emerging countries.

This paper only focuses on the Czech Republic which newly joined in the EU in May. 2004. Some researchers have tried to investigate the effects of regime change to monetary policy shocks in Czech Republic with time varying parameter VAR. Franta et al.(2009) employed two exogenous shocks, which are monetary policy shocks and exchange rate shocks with sign restrictions to investigate the changes of macroeconomic

4) Kim(2015) refered to the positive impulse responses of output to monetary policy shocks found in Uhlig(2005) as output puzzle.

variables. The responses of price to monetary policy shocks are more responsive over time according to the paper. Darvas(2013) compared euro area to the three new countries which are the Czech Republic, Hungary, and Poland. This adopts time-varying parameter SVAR in order to reveal the transmission mechanism of monetary policy to key economic variables. In the paper, the effectiveness of monetary policy in each country is different for the data for the second quarter of 2008. Anzuini and Levy(2011) analyzed the differences in the responses of three new members of the EU, the Czech Republic, Hungary, and Poland. According to the paper, their impulse responses to monetary tightening shocks are very similar to those of each country. In addition, the results estimated in the paper showed that the impacts of the included variables to monetary policy shocks are not different from that for leading countries in the EU despite of the differences of economic conditions. The authors argued that the differences may be caused by the degree of credibility of monetary policy, the degree of openness, and the part of loans for foreign currency.

Furthermore, foreign exchange market intervention in the Czech Republic obviously matters because fluctuations of exchange rate are relatively higher than those in advanced countries. In order to stabilize the rate, central banks officially or non-officially intervene the market. Disyatat et at.(2007) revealed that the interventions in the Czech Republic have been small but statistically significant effects on the spot exchange

rate. On the other hand, they did not find obvious evidence that impacts on short-term volatility of exchange rate.

However, there is few paper that investigates how different responses to monetary policy shocks are in the new member state of the EU. With this thesis, we can expect and calculate how the effects of major variables to monetary policy shocks would change after becoming the member state of the EU. In addition, it enables to reveal the intervention with real data by employing the SVAR with sign restrictions comparing two different circumstances.

3. Methodology

3.1 Empirical model

In this paper, I employ the model used by Uhlig(2005), named Structural Vector Autoregression(SVAR) model with sign restrictions. This SVAR is given by

$$Y_t = A_{(0)} + A_{(1)} Y_{t-1} + \cdots + A_{(p)} Y_{t-p} + BX_t + u_t,\ t = 1, \cdots, T\ ,$$

where, Y_t and X_t are $n \times 1$ data vectors at $t = 1, \cdots, T$ including endogenous and exogenous variables, respectively. $A_{(i)}$($A_{(0)}$ is a constant matrix) are $n \times n$ coefficient matrices for the endogenous variables. B is an $n \times n$ coefficient matrix for the exogenous variables. Lastly, u_t is the reduced form residual. To identify the structural shocks from the residual, I follow the same steps with Uhlig(2005). Like the paper, monetary policy shocks are the main source for the responses of macroeconomic variables used in this paper.

The difference of this from Uhlig(2005)'s is that some variables for a small open economy are replaced. Kim and Lim(2016) introduced unorthodox variables for the set of variables to estimate the effects on impulse responses of exchange rate to monetary policy shocks. Details for the variables are presented in the next.

3.2 Data

Six macroeconomic variables are used in this paper. First of all, Repurchase Agreement rate[5] is included in endogenous variables to capture the effects of interest rate to monetary policy shocks. Interest rate as an instrument for monetary policy for the Czech Republic is in the level of percentage. Consumer Price index(CPI) and Industrial Production index(IP) are considered as main sources to reflect the monetary tightening shocks into the real economic activities. Nominal Effective Exchange Rate(NEER), and Total Reserves minus gold(FORE) are in this base model as the measure of the impact of the monetary shocks to foreign markets. In addition, monetary base(MB) is one of endogenous variables to rule out the effects of money supply due to the change of the monetary instrument.

Interest rate as an instrument for monetary policy for the Czech Republic is in the level of percentage. On the contrary, CPI, IP, NEER, MB, and FORE are used in logarithm. The reason for using MB and FORE is that this paper follows the empirical model proposed Kim and Lim(2016), which investigates the effects of monetary tightening shocks on exchange rate for small open countries. Also, interest rate, CPI, and IP for the euro area are included for considering external effects as exogenous variables since the area is the major partner of trade for the country. An dummy variable is employed to eliminate the effects of two crises. One is the sub-prime mortgage crisis from Aug. 2008 to Dec. 2008. The

5) The Czech National Bank controls the 2-week Repurchase Agreement rate as the instrument for the open market operations.

other is the European debt crisis from Jan. 2010 to Dec. 2010. The data span is from Jan. 1998 to Nov. 2012. At Nov. 1 2012, the CNB Board decisions announced that policy rate would be lowered to 0.05 percentage. Thereafter, the Board has not made any change of the rate for their monetary policy. In addition, in order to investigate the effects on joining the European Union for the Czech Republic(May. 1 2004), the model is estimated by two sample periods. One is from Jan. 1998 to Apr. 2004, the other is from May. 2004 to Nov. 2012. All data in this paper are from IMF (IFS).

3.3 Lag selection

Since monthly data are used in this paper, it is general to set 6 or 12 lags for this empirical models. Instead of 12 lags or 6 lags, only one lag is employed for each endogenous variables due to the results of the selection tests for lags. According to Liew(2004), Akaike Information Criterion(AIC) test may yield better results for small sample size(under 120). To check the robustness for the tests, Hannan-Quinn test(HQ) and Bayesina Information Criterion(BIC) tests are conducted with AIC method. Three equations are following:

$$AIC_p = -2T[\ln(\hat{\sigma}_p^2)] + 2p$$

$$BIC_p = (T-p)\ln[\frac{T\hat{\sigma}_p^{\,2}}{T-p}] + T[1+\ln(\sqrt{2\pi})] + p\ln[\frac{\sum_{t=1}^{T} y_t^{\,2} - T\hat{\sigma}_p^{\,2}}{p}]$$

$$HQ_p = \ln(\hat{\sigma}_p^{\,2}) + 2\frac{p\ln[\ln(T)]}{T}$$

where $\hat{\sigma_p}^2 = \frac{\sum_{t=p}^{T} \hat{\epsilon_t}^2}{T-p-1}$, ϵ_t is the residual of the model and T is the size of the sample.

Each value in the tables shows that the less lags are applied to this model, the more suitable they are. Through these results, the most appropriate length of the lag is one for endogenous variables in the baseline model. Although it seems insufficient to consider the all interactions between each variables with only one lag, the below robustness test[6] will complement the baseline model.

	1	2	3	4	5	6
AIC	1.475	2.060	3.107	3.986	4.358	4.222
BIC	2.763	4.452	6.603	8.587	10.062	11.030
HQ	1.990	3.016	4.504	5.825	6.637	6.943

Table 1 Information criteria for the data before the EU membership

	1	2	3	4	5	6
AIC	-1.89	-1.077	-0.501	0.003	0.331	1.160
BIC	-0.816	0.918	2.415	3.840	5.089	6.839
HQ	-1.455	-0.269	0.680	1.557	2.258	3.460

Table 2 Information criteria for the data after the EU membership

Notes: These tables show that the three tests imply that the minimum values for the both models are one.

6) Robustness tests are conducted below to check whether the results with the baseline model are robust.

4. Identification

In the baseline model, sign restrictions are imposed on the impulse responses of interest rate, CPI, and MB for 12 months, positively for those of interest rate and negatively for those of CPI and MB to the monetary tightening shocks. These restrictions are from Kim and Lim(2016), which gives the direct implications for this paper. Many researchers have adopted the restrictions in order to reveal the effects of tightening monetary policy without commonplace puzzles such as price and liquidity puzzles(Uhlig(2005), Scholl and Uhlig(2008), Arias et al.(2016), Kim and Lim(2015)). Also, the Czech National Bank officially revealed the transmission mechanism of the monetary policy with these variables. According to the statement, the restrictions of this paper are reasonable.

	Interest	CPI	IP	NEER	MB	FORE
Sign Restrictions	+	−	0	0	−	0

Table 3 Sign restrictions for each variable.

Notes: Positive sign restrictions for 12 months are imposed on interest rate. Opposite restrictions for the same period are imposed on CPI and MB. IP, NEER, and FORE are unrestricted.

5. Empirical Result

5.1 Exchange rate

Figure 1 and Figure 2 report results of the baseline model for the two subsample data. Each Figure shows the impulse responses to monetary policy shocks with 84% error bands for each variable for the data sample. By the construction, these results avoid the price and the liquidity puzzles. The output puzzle proposed in Kim(2015) are not found under the circumstances of monetary tightening. However, the responses of exchange rate and foreign reserves are quite puzzling.

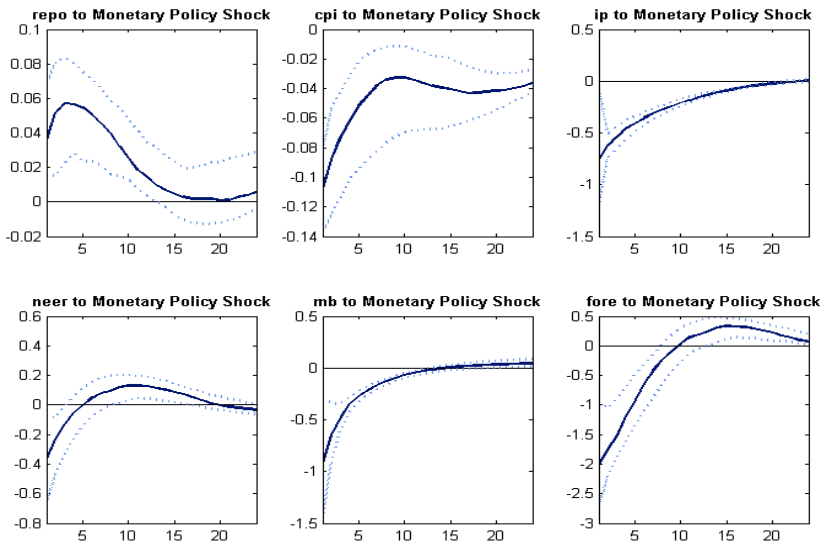

Figure 1 Impulse responses of the baseline model to monetary policy shocks before the membership of the EU

At first, a positive innovation in interest rate leads to appreciation of exchange rate in the US by Eichenbaum and

Evans(1995). On the other hand, other G-7 countries show the opposite impact that the US has to monetary policy shocks by Sims(1992), and Grilli and Roubini(1995). In addition, Kim and Lim(2016) shows the significant exchange rate puzzle in emerging countries such as Brazil. This puzzle is found in both Figure 1 and Figure 2. While the impulse responses of NEER in Figure 1 are negative for just 3 months after the shocks, those in Figure 2 are under the zero for entire twenty months after the innovations.

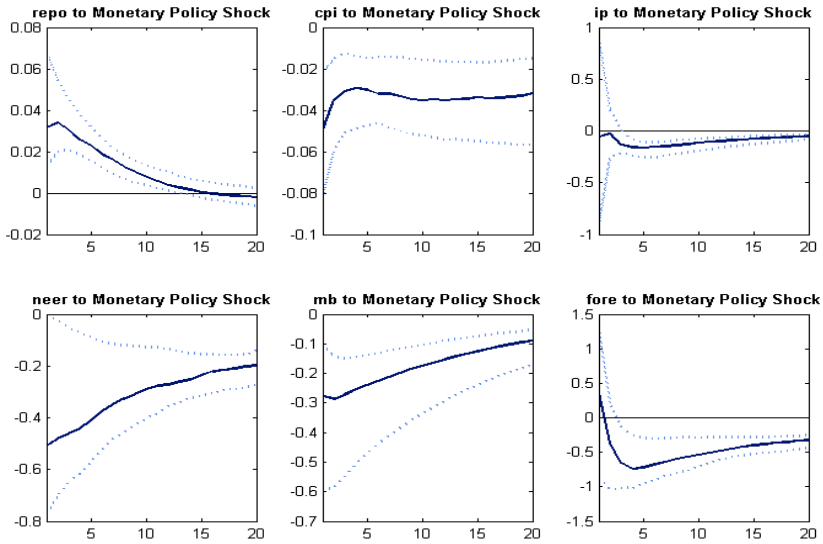

Figure 2 Impulse responses of the baseline model to monetary policy shocks after the membership of the EU

Also, delayed overshooting puzzle for exchange rate is apparent in Figure 1. Like Eichenbaum and Evans(1995), and Scholl and Uhlig(2008), Figure 1 reports that the responses of exchange rate to monetary tightening shocks have the

maximum at the eleventh month. This result is far from the overshooting theory.(see Dornbush(1976)) This is very similar impulse responses of exchange rate to monetary policy shocks to those in Eichenbaum and Evans(1995), and Scholl and Uhlig(2008). Hence, the delayed overshooting puzzle is identified in this baseline model.

5.2 Foreign reserves

Unlike Kim and Lim(2016), Figure 1 reports the co-movement of the impulse responses of NEER and FORE for the data before the Czech Republic joined in the EU. On the contrast, the action is not found in Figure 2. The co-movement of them may arise due to the direct intervention in foreign reserves market by government or the central bank according to Kim and Lim(2016), especially in the emerging markets such as the Czech Republic. Although Kim and Lim(2016) does not find the direct evidence that the intervention causes the currency depreciation, the results in Figure 1 support the claim.

This result also can be supported by the empirical analysis with the Uncovered Interest Parity(UIP) condition. This condition has been often used to measure the risk premium since it holds when interest differential between domestic and foreign equals the rate of change in exchange rate.

$$i_t - i_t^* = E_t - E_{t+1}$$

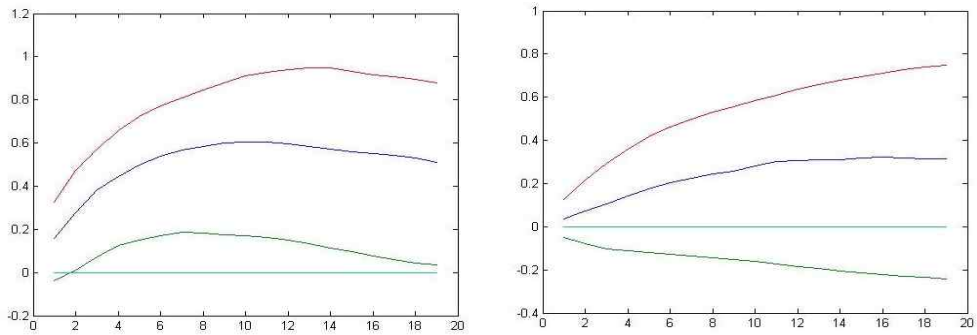

Figure 3 Accumulated deviation from UIP condition before and after joining the EU, respectively with 84% error bands.

This equation is the basic model of UIP condition. Hence, the difference in the left hand side and the other side can be considered as the risk premium. Following Eichenbaum and Evans(1995) and Kim and Lim(2016), accumulated deviation from UIP condition is calculated in terms of the impulse responses conditional on monetary policy shocks.

Figure 3 reports that the accumulated risk premiums for the both sample periods. Before the Czech Republic got the membership of the EU, the risk premium significantly differs from the zero line. That is, the rate of change in exchange rate to monetary policy shocks in the Czech Republic does not offset the change in interest rate to the innovations. On the contrary, the error bands for the second period contain the zero. Hence, it is insignificant. This difference might be caused by the CNB's intervention in the foreign exchange market. Without the intervention, the error bands for the risk premium should include zero.

Another possible explanation for the co-movement is privatization. Before joining the EU, the CNB(the Czech National Bank) and the government agreed to intervene in the foreign reserves market to reduce the volatility of exchange rate when privatizing their public enterprises. The privatization in the Czech Republic increased the level of foreign reserves as the central bank lowered policy rate, even though the government tried to keep the privatization revenues in euro from affecting the foreign market by not converting into korun a[7]. While the government privatized their properties, the interest rate steadily decreased. This trend might be captured due to the weakness of the identification of monetary policy shocks.

In contrast, after May. 2004 FORE in Figure 2 reacts insignificantly in the short-run and differently from Figure 1. This may be related to what the EU requires to its member states. According to the conditions for membership, the EU encourages the authorities of member states to keep their central banks independent.

7) The CNB Board decisions from CNB's website

6. Robustness Tests

In order to check whether the results of the baseline model are robust, the model is modified to diverse ways and additional variables are included in the model. First, the longer lags are employed in the baseline model. Although the lag adopted in the model is based on the theoretical results, it may not be enough to consider the interactions between each variable and their lagged values. I apply three, four, and six lags for the model for analysis for the interactions. Next, one lag of exogenous variables are included for the effects of the eurozone. This adoption may better capture the effects of external circumstances. Thirdly, real effective exchange rate(REER) is included in the baseline model instead of NEER. There does not exist any difference with the two results. Lastly, a longer and a shorter imposition length are considered in the sign restrictions. Instead of 12 months restrictions, 9 and 15 months are imposed on each variable.

For all extended analyses, only the responses of NEER for later sample for the specification of longer lags differ from the baseline results. For longer lags of endogenous variables, there exist no exchange rate puzzle for data after joining the EU.

7. Conclusion

This research mainly estimates the effects of exchange rate and central bank's intervention in foreign reserves market under the condition of monetary tightening. Using SVAR with sign restrictions, it could be possible to estimate the effects without commonplace puzzles such as price and liquidity puzzles. In order to compare the impulse responses of variables in the Czech Republic before and after joining the EU the whole sample period is divided by two subsamples. Although this paper fundamentally follows Uhlig(2005), there is a stark difference in some variables between the paper and this. Since estimating effects in a small open economy is a target, variables that can reflect such country's features should be included. Kim and Lim(2016) employed the method used in Uhlig(2005) and different variables, exchange rate and foreign reserves, putting them into the model.

Apparently, exchange rate puzzle is found in the both sample periods. While the puzzle is robust for the results of data before the membership of the EU, the anomaly is not robust for other results. The responses of FORE to monetary policy shocks are significantly downward and have co-movement with those of exchange rate for the data of 'before' in the baseline model. In contrast, the co-movement is not found for the data of 'after'. Based on the test of the UIP conditions, the co-movement may be induced by the direct intervention of the central bank in the foreign reserves market.

Although this paper is trying to recover the effects of the EU

membership, there are practical limitations such as shortness of time span, difficultness of access to specific decision making made by the central bank, and weakness in identification of monetary policy shocks. To resolve these, various ways could be employed. First of all, considering other countries which joined the union eariler than the Czech Republic can help one of the problems. Also, analysis for more countries can be one solution. By eliminating idiosyncratic factors for each country, researchers can only focus on the unadulterated effects of the EU membership. In the next researches, these problems should be considered so that the results would be more reliable.

Reference

Anzuini, A., & Levy, A. (2007). Monetary policy shocks in the new EU members: A VAR approach. *Applied Economics*, 39(9), 1147-1161.

Anzuini, L. (2011). Pagano. The impact of monetary policy shocks on commodity prices. working paper.

Arias, J., Caldara, D., & Rubio Ramírez, J. (2016). The systematic component of monetary policy in SVARs: an agnostic identification procedure. Working paper.

Borys, M. M., Horváth, R., & Franta, M. (2009). The effects of monetary policy in the Czech Republic: an empirical study. *Empirica*, 36(4), 419-443.

Coco, A., & Silvestrini, A. (2017). The nature and propagation of shocks in the euro area: a comparative SVAR analysis. *International Journal of Computational Economics and Econometrics*, 7(1-2), 95-114.

Darvas, Z. (2013). Monetary transmission in three central European economies: evidence from time-varying coefficient vector autoregressions. *Empirica*, **40**(2): 363-390.

Disyatat, P., & Galati, G. (2007). The effectiveness of foreign exchange intervention in emerging market countries: Evidence from the Czech koruna. *Journal of International Money and Finance*, 26(3), 383-402.

Dornbusch, R. (1976). Expectations and exchange rate dynamics. *Journal of political Economy*, 84(6), 1161-1176.

Eichenbaum, M., & Evans, C. L. (1995). Some empirical evidence on the effects of shocks to monetary policy on exchange rates. *The Quarterly Journal of Economics*, 110(4), 975-1009.

Gali, J. (1996). Technology, employment, and the business cycle: Do technology shocks explain aggregate fluctuations. National bureau of economic research.

Grilli, V., & Roubini, N. (1995). Liquidity and exchange rates: puzzling evidence from the G-7 countries. Working paper.

Hnatkovska, V., Lahiri, A., & Vegh, C. A. (2016). The Exchange Rate Response to Monetary Policy Innovations. *American Economic Journal: Macroeconomics*, 8(2), 137-181.

Kim, S. & Lim, K. (2016). Effects of Monetary Policy Shocks on Exchange Rate in Emerging Countries. Working paper.

Kim, S. (2015). What are the Effects of Monetary Policy Shocks? Sign Restrictions and Endogeneity of Monetary Policy Actions. Working paper.

Kucharcukova, O. B., Franta, M., Hajkova, D., Kral, P., Kubicova, I., Podpiera, A., & Saxa, B. (2013). What we know about monetary policy transmission in the Czech Republic: Collection of empirical results. Czech National Bank, Research Department, No. 2013/01.

Liew, Venus Khim-Sen. (2004) Which Lag Lengh Selection Criteria Should We Employ? *Economics Bulletin,* Vol. 3, No. 33 pp 1-9.

Mojon, B., & Peersman, G. (2001). A VAR description of the effects of monetary policy in the individual countries of the euro area. Working paper.

Peersman, G. and F. Smets (2001). The monetary transmission mechanism in the euro area: more evidence from VAR analysis. MTN conference paper.

Scholl, A., & Uhlig, H. (2008). New evidence on the puzzles: Results from agnostic identification on monetary policy and exchange rates. *Journal of International Economics*, 76(1), 1-13.

Sims, C. A. (1980). Macroeconomics and reality. *Econometrica: Journal of the Econometric Society*: 1-48.

Sims, C. A. (1986). Are forecasting models usable for policy analysis? Federal Reserve Bank of Minneapolis Quarterly Review **10**(1): 2-16.

Sims, C. A. (1992). Interpreting the macroeconomic time series facts: The effects of monetary policy. *European Economic Review*, **36**(5): 975-1000.

Uhlig, H. (2005). What are the effects of monetary policy on output? Results from an agnostic identification procedure. *Journal of Monetary Economics*, **52**(2): 381-419.

Appendix A Data Description

Name	Abbreviation	Period	Source
Repurchase Agreement Rate for the Czech Republic	REPO	From Jan. 1998 to Nov. 2012	IFS[8)]
Consumer Prices Index for the Czech Republic	CPI	From Jan. 1998 to Nov. 2012	IFS
Industrial Production for the Czech Republic	IP	From Jan. 1998 to Nov. 2012	IFS
Nominal Effective Exchange Rate for the Czech Republic	NEER	From Jan. 1998 to Nov. 2012	IFS
Monetary Base for the Czech Republic	MB	From Jan. 1998 to Nov. 2012	IFS
Foreign Exchange Reserves for the Czech Republic	FORE	From Jan. 1998 to Nov. 2012	IFS
Repurchase Agreement Rate for the Eurozone	EREPO	From Jan. 1998 to Nov. 2012	IFS
Consumer Prices Index for the Eurozone	ECPI	From Jan. 1998 to Nov. 2012	IFS
Industrial Production for the Eurozone	EIP	From Jan. 1998 to Nov. 2012	IFS

Table 4 Data description used in this paper.

8) IFS is a name for IMF data resource.

Appendix B Robustness Test Results

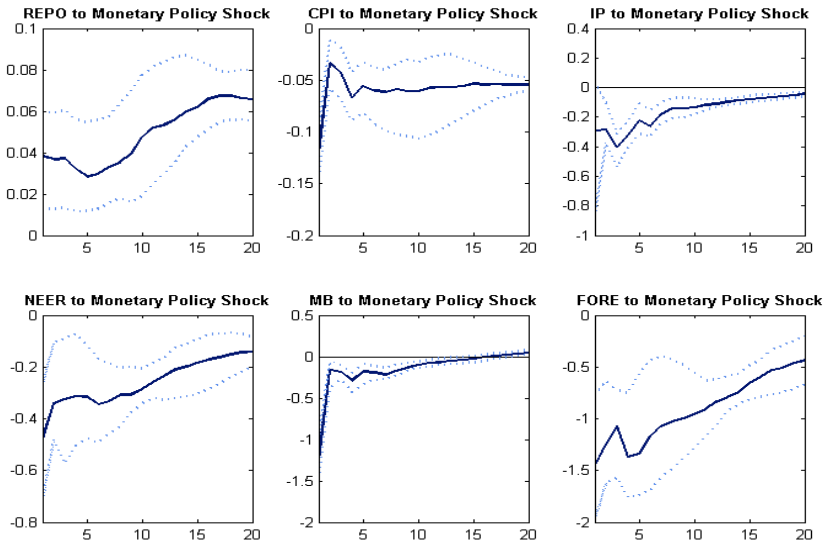

Figure 4 Impulse responses to monetary policy shocks before the membership of the EU with three lags for endogenous variables.

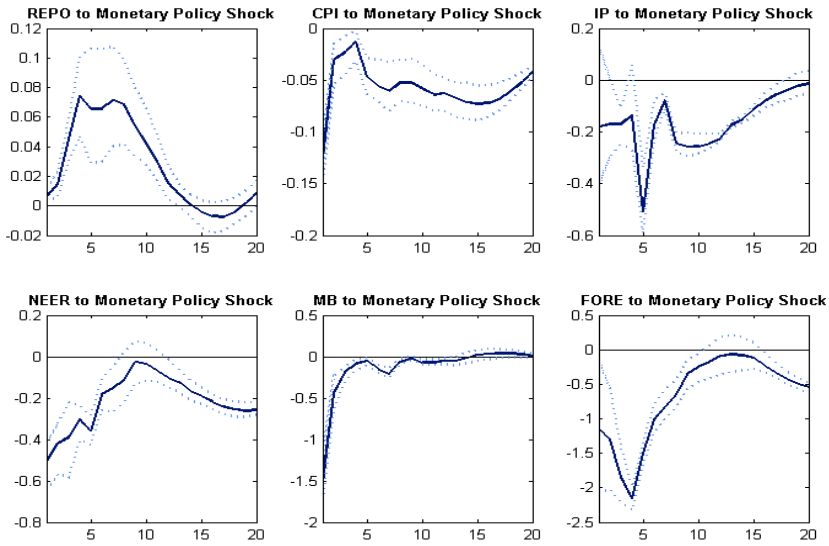

Figure 5 Impulse responses to monetary policy shocks before the membership of the EU with four lags for endogenous variables.

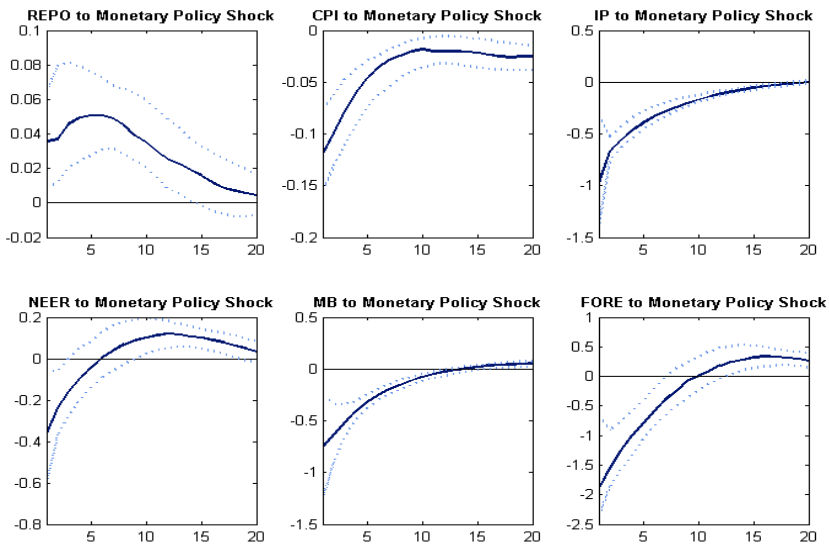

Figure 6 Impulse responses to monetary policy shocks before the membership of the EU with one lag for exogenous variables.

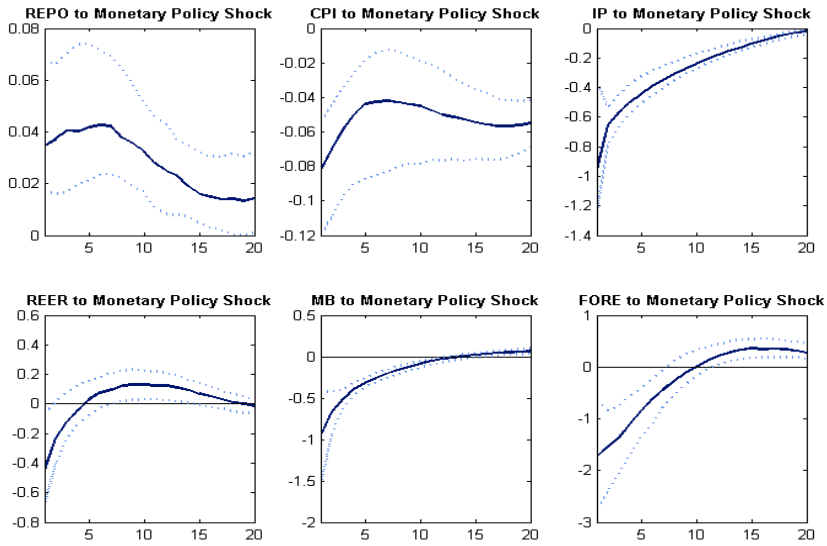

Figure 7 Impulse responses to monetary policy shocks before the membership of the EU with Real Effective Exchange Rate(REER).

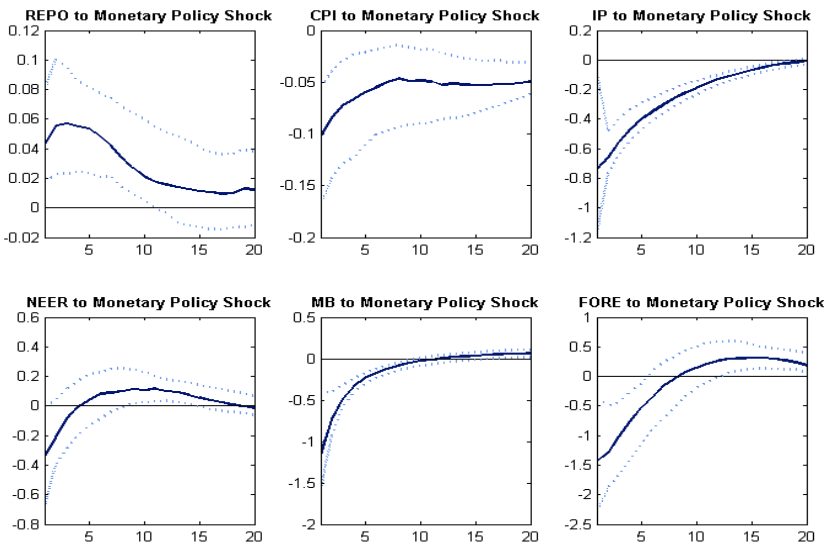

Figure 8 Impulse responses to monetary policy shocks before the membership of the EU with sign restrictions for nine months.

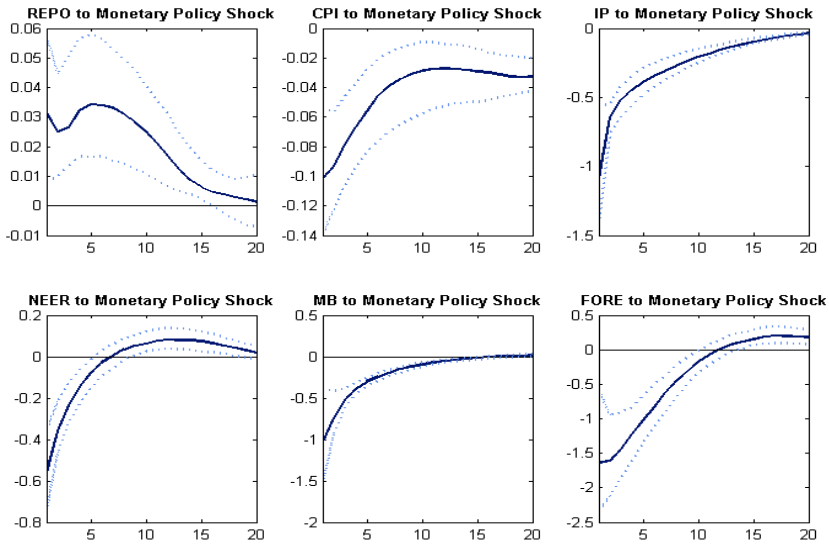

Figure 9 Impulse responses to monetary policy shocks before the membership of the EU with sign restrictions for fifteen months.

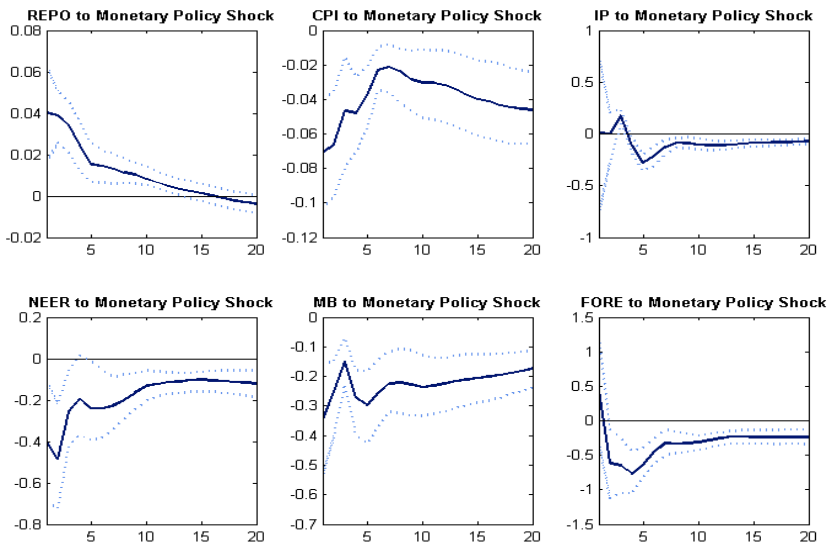

Figure 10 Impulse responses to monetary policy shocks after the membership of the EU with three lags for endogenous variables.

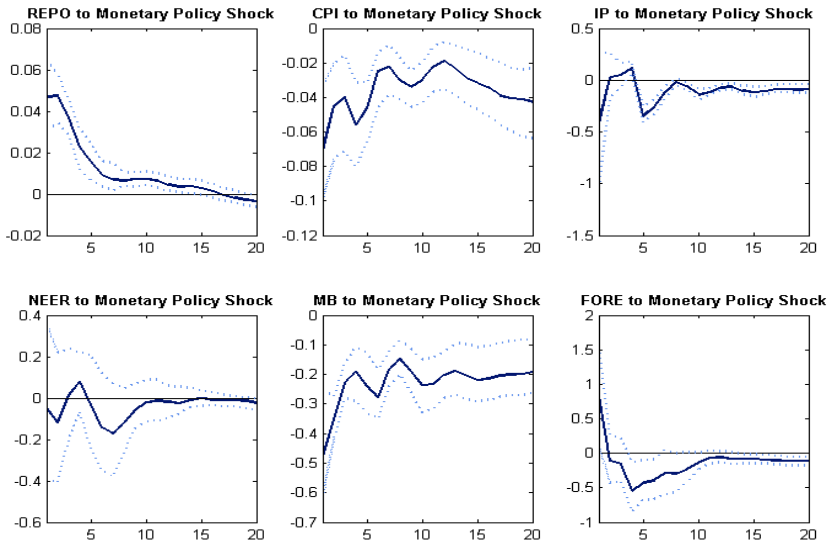

Figure 11 Impulse responses to monetary policy shocks after the membership of the EU with four lags for endogenous variables.

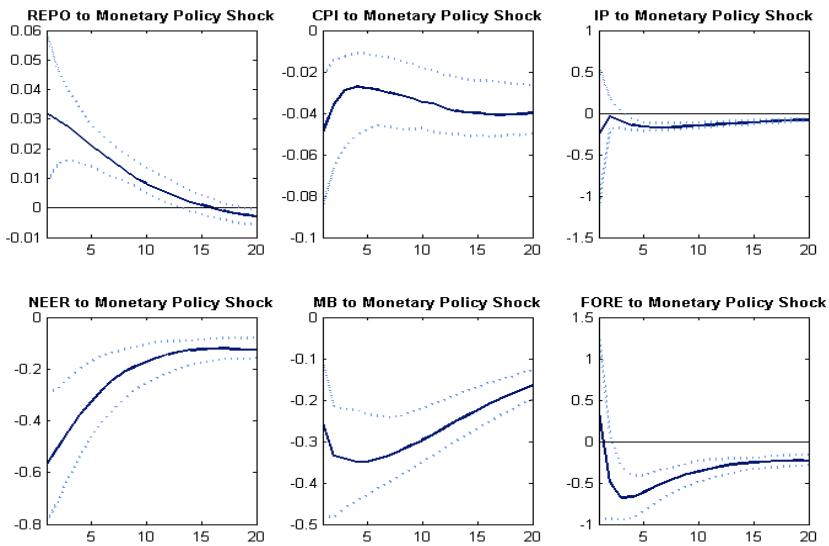

Figure 12 Impulse responses to monetary policy shocks after the membership of the EU with one lag for exogenous variables.

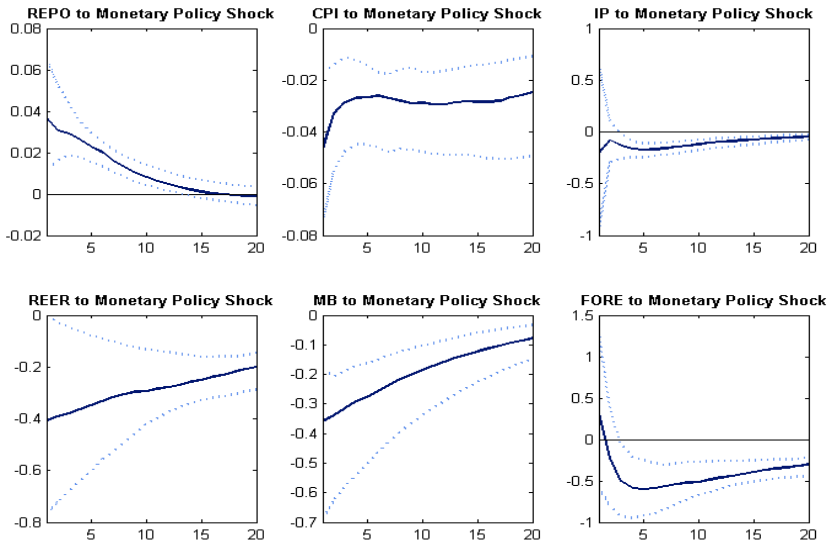

Figure 13 Impulse responses to monetary policy shocks after the membership of the EU with Real Effective Exchange Rate(REER).

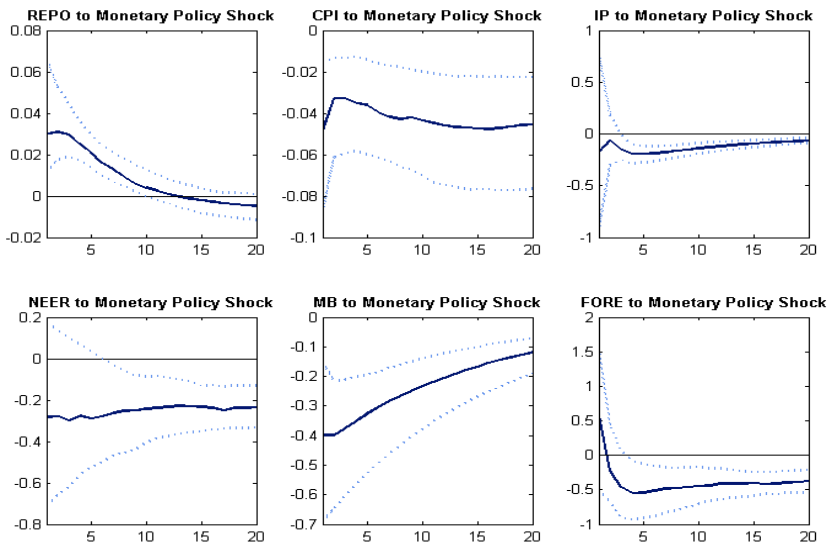

Figure 14 Impulse responses to monetary policy shocks after the membership of the EU with sign restrictions for nine months.

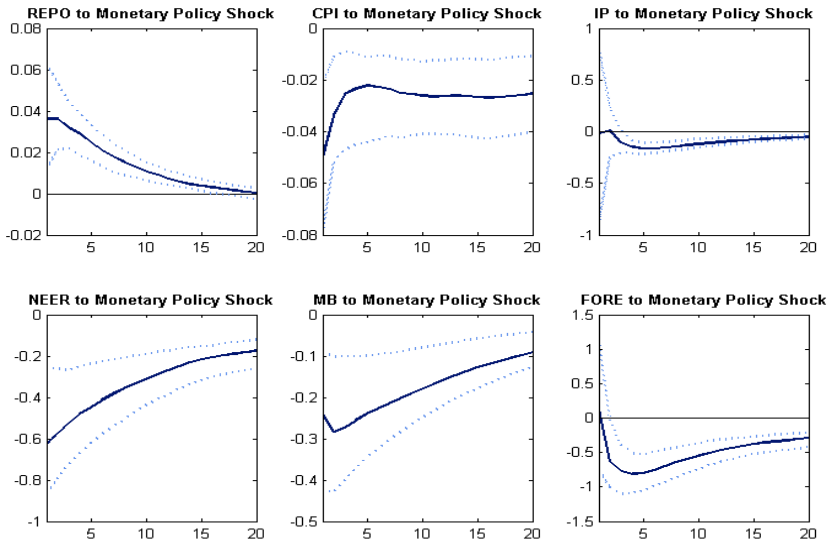

Figure 15 Impulse responses to monetary policy shocks after the membership of the EU with sign restrictions for fifteen months.

국문초록

유럽연합 가입 전후의 통화정책 충격에 대한 거시경제변수들의 반응 차이: 체코를 중심으로

박 용 호
경제학부 경제학 전공
서울대학교 대학원

이 논문의 목적은 개방소국으로서 유럽연합의 가입 전후로 통화정책의 충격이 경제에 주는 효과가 어떻게 다른가를 연구하기 위함이다. 이 논문에서는 대표적인 국가로 체코를 선정해서 분석을 진행하였다. 거시변수들의 반응에 대한 가입 전후의 변화를 비교하기 위하여, 체코가 유럽연합에 가입한 날을 기준으로 자료를 나누었다. 위와 같은 분석을 위하여 구조적 벡터 자기 회귀(SVAR) 모형을 도입하였다. 또한 신호제약을 이용해 경험적 연구에서 흔히 발생하는 가격과 통화량 수수께끼를 배제하고 분석할 수 있었다. 그 결과 유의미한 환율 퍼즐이 두 시점 모두에서 발견되었다. 가입 전의 결과가 강인성 시험에서도 유의미함을 보여주었던 반면, 가입 이후의 퍼즐은 강인성을 시험하기 위한 다른 모형에서는

유의미하지 않았다. 추가적인 실험에 따르면, 유럽연합 가입 전후의 통화정책에 대한 외환보유액의 반응의 차이는 중앙은행의 외환시장 개입에 의한 결과일 수 있다. 그 결과로 유럽연합 가입 전의 데이터에서는 발생하는 환율과 외환보유액의 통화정책에 대한 충격의 동행성이 가입 이후의 분석에서는 발견되지 않았다.

주 요 어 : 구조적 벡터 자기 회귀, 신호 제약, 개방소국, 통화정책, 환율 퍼즐, 유(有)위험 이자율평가, 유럽연합

학 번 : 2014-20211