To my family…

REACTION OF CENTRAL BANKS TO FEDERAL RESERVE AT ZERO LOWER BOUND

Graduate School of Social Sciences
TOBB University of Economics and Technology

ÜMİT GÜNER

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in

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I hereby certify that this thesis meets all the requirements of the Graduate School of Social Sciences for a Master's degree.

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I have read this thesis and found its content and scope adequate for a Master's thesis in Economics in the Graduate School of Social Sciences.

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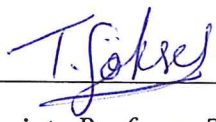

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Ümit GÜNER

ABSTRACT

REACTION OF CENTRAL BANKS TO FEDERAL RESERVE AT ZERO LOWER BOUND

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This study has been carried out on 25 different economies so as to determine how much central banks give place to federal reserve in reaction functions and to what extent this reaction changed with the effect of the financial crisis of 2008. The model to which federal funds rate was added as an independent variable was tested with OLS econometric method separately for 2000-2007 and 2008-2014 periods. According to the empirical evidence, the reaction of most of the countries to the US economy, which is the leading country of the world's biggest economies, turned out to be statistically 5% significant at the level of significance. However, together with this reaction's continuation for many countries after the crisis, it changed dramatically for each country when

examined country-by-country. In addition, time varying regression method was used in this study so as to both differentiate it from literature and also to confirm the results with a different method. First findings were accordingly strengthened with the obtained results.

Keywords: Monetary Policy, Taylor Rule, Time Varying Regression, Zero Lower Bound

ÖZET

MERKEZ BANKALARININ SIFIR ALT
ÇİZGİSİNDE FEDERAL RESERVE'E TEPKİLERİ

GÜNER, Ümit
Yüksek Lisans, Ekonomi Bölümü
Tez Yöneticisi: Doç. Dr. Bedri K. Onur TAŞ

Temmuz 2016

Bu çalışma; merkez bankalarının tepki fonksiyonlarında federal reserve e ne ağırlıkta yer verdiklerinin ve bu tepkinin 2008 finansal kriziyle ne ölçüde değiştiğini tespit etmeyi amaıyla 25 farklı ekonomi üzerinde yürütülmüştür.Federal funds rate in bağımsız değişken olarak eklendiği model 2000-2007 ve 2008-2014 dönemleri için ayrı ayrı sıradan en küçük karaler ekonometrik metoduyla test edilmiştir. Ampirik bulgulara göre ülkerin çoğu , dünyanın en büyük ekonomilerinin başında gelen ABD ekonomisine verilen

tepki %5 anlamlılık düzeyinde istatistiki olarak anlamlı çıkmıştır. Ancak bu tepki kriz sonrası dönemde birçok ülke için devam etmekle beraber; ülke ülke incelediğinde her biri için önemli ölçüde değişikliğe uğramıştır. Ayrıca çalışmada; hem literatürden farklılaştırmak hem de sonuçları farklı bi yöntemle teyit etmek için zamanla değişen regression yöntemi de kullanılmıştır.Elde edilen sonuçlarla ilk bulgularla sağlamlaştırılmıştır.

Anahtar Kelimeler: Para Politikası,Taylor Kuralı, Zamanla Değişen Regresyen, Sıfır Alt Çizgisi

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Even though just my name comes out on the cover of this thesis, lots of people have contributed to its production. I owe my appreciation to all those people who have made this thesis possible and by dint of whom my graduate experience has been one that I will eternize forever.

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ABBREVATIONS

CPI: The consumer price index

GDP: Gross Domestic Product

LGDP: Lag of Gross Domestic Product

LCPI: Lag of Consumer Price Index

MMR: Money Market Rate

CBPR: Central Bank Policy Rate

IFS: International Financial Statistics

IMF: International Monetary Fund

OECD: Organization for Economic Co-operation and Development

ZLB: Zero Lower Bound

U.K.: United Kingdom

U.S.: United States of America

CHAPTER ONE

INTRODUCTION

There is no consensus among the economists about how to implement monetary policy. Some economists suggest that central banks should pursue a policy that fits their purpose by keeping track of the improvements constantly. This notion, especially accepted by Keynesian economists, is also known as Discretion Approach.

Economists who are against the Discretion Approach support that central banks should carry out monetary policy according to the rules that were set beforehand. This notion, which means that monetary policy will be implemented automatically, is called Policy Rules Approach in literature.

The petrol crisis that took place in the 1970s led to an increase in most of the macroeconomic indicators such as inflation and unemployment of many national economies. This situation forced the governments into intervention and along with this situation, differentiation in policy rules and discretion has begun to have its place in literature.

Those who support that different policies should be followed based on each circumstance due to the fact that the economic structures are in a state of flux find the implementation of discretion more reliable. In spite of that, those who put forward the idea that the financial environment will deteriorate even more with the intervention of politicians in monetary policy in the event that these policies are carried out support that specific rules should be followed.

The first studies performed in favor of policy rules belong to Kydland & Prescott and Barro & Gordon. In these studies, it was put forward that politicians would want to keep unemployment rate under its natural level. What is more, unexpected economical shocks will be used for that. However, this practice has no chance of success under the rational expectations theory. A policy of this kind will cause the inflation to increase and the unemployment rate to remain the same in the long term. Therefore, to develop policy rules in order to avoid such a situation will be the best option that is available.

Another point that is important is that economical shocks occur much less owing to the policy rules that are developed. By this way, economic units will be able to protect both themselves and the society from the cost that is likely to result from shocks.

In the year 1993, John Taylor put forward a simple form of reaction function of central bank. This function, also known as the Taylor Rule, states that the short-term rate of interest will adapt to the income and inflation rate of economy in the simplest term (Mishkin, 2002).

US Central Bank Federal Reserve, which is one of the most powerful economies in the world, has been using the federal funds rate as the primary

intervention tool since the beginning. In 1980s and 1990s, federal funds rate was in a co-movement with the policy rule put forward by Taylor in 1993. However, from the beginning of 2008, federal funds rate started to deviate from that policy rule (Gray, 2000). When it came to the year 2008, monetary policies conducted by major central banks lost their efficiency against the global crisis that broke out. US being in the first place, the most powerful economies resorted to monetary expansion by using quantitative easing method. As a result of this monetary expansion, federal funds rate came to zero lower bound.

The most important issue that arouses curiosity in the light of these facts is how World Economic Outlook will be shaped after the normalization of the US economy. Whether or not the economies of other countries will be influenced as a result of FED's interest rate increase, and to what extent this influence will be in case it happens are matters of debate.

This work consists of the following chapters: chapter two investigates and summarizes the findings of previous literature; chapter three provides information about the data and methodology applied and chapter four displays results and findings, and finally chapter five concludes the whole study.

CHAPTER TWO

LITERATURE REVIEW

In the past, fixed exchange rate and constant monetary expansion used to be used as the main monetary policy. However, capital flow which is dependent on the volume of increasing interstate foreign trade caused malfunction in financial markets. As a result of this situation, old policy instruments have been replaced by the policies that show how central bank instruments can be adapted to the thriving economy (Ongan, 2004). For this reason, many researches which help estimate the changes in policy instruments have been made on central bank reaction function.

Taylor constituted central bank reaction function in a very simple way in his study in 1993. In that study of his, Taylor examined the federal funds rate between the years 1987 - 1992 by approaching the US economy as a closed economy, and put forward that GDP gap and deviation of inflation from its expected value played a role in determining this interest rate. Taylor also claimed that this function in which policy interest is accepted based on deviation of inflation and GDP gap is a good policy proposal (Österholm, 2003).

It is expected that Central Bank Reaction Functions are important tools which are used in order to evaluate the effects of exogenous economics shocks and other policy implements. After being published, Taylor Rule has been used so as to investigate the policy behaviors of central banks of many developed and developing countries. In these studies, Taylor Rules which have been expanded differently by addition of other independent variables were used instead of the original Taylor Rules. For instance, it was found useful to also add the exchange rate as a variable especially to the models created for open small economies. Ball (1999), Svensson (2001) and Taylor (2001) have obtained significant results in their studies by implementing this.

In other studies, in which whether the exchange rate was meaningful as an independent variable was tested, Moura and Carvalho (2010) examined the most powerful seven economies of Latin America while Frömmel et al. (2011) examined six central and eastern European countries. In these studies, Moura and Carvalho showed the exchange rate-relevant variable for interest rate decisions only for Mexico while Frömmel et al. showed that the coefficient of the exchange rate is significant for Slovakia.

According to some studies that have been carried out, the monetary policy which was suggested by Taylor in 1999 is not valid in the European countries. The study of Drumetz and Vendelhan can be given as an example to these studies. According to that study, Taylor Rule is not valid in France Economy either.

Another dependent variable whose effect has been tested in some studies is political news and announcements from international institutions. In

highly indebted economies; some political news and announcements from international institutions may increase or reduce concerns about debt sustainability as well as having the possibility to influence asset prices. For instance, the fact that political news, IMF announcements and EU related news has an effect on secondary market government securities yields has been confirmed on the economy of Turkey (O.Y. Emir et al., 2007).

In this context, another subject that is examined in literature is spillover effects and transmission mechanism. It has been suggested by several studies that the policies which countries carry out could have an influence on the macroeconomics indicators of other countries through various channels. For instance, Kim (2001) showed in his study that US monetary expansion has a positive spillover effect on non-US and G-6 output.

Short-term interest rate, long term interest rate and exchange rate play an important role as transmission channels in literature. Takats and Vela put forward in their studies that US long term interest rate affects EMEs' long term interest rates significantly while Francia and Verdu show that the long-term rate channel might have obtained a bigger role in the era following the crisis. On the other hand, Takats and Vela found evidence that policy rate responses became less important after 2008.

The fact that monetary policies carried out by the countries have an influence on these relationships appear in literature. For instance, Takats and Vela showed again in the same study that the correlation between US and EME policy rates is more powerful for inflation targeting regimes than all EMEs taken together. In again the same study, the fact that in stable exchange rate

regimes with independent capital flow such as Hong Kong SAR, Saudi Arabia and the United Arab Emirates, the connection between advanced and EME policy rates is widely straight and self-regulating, and that in China, regardless of capital control and advancing liberalization of the exchange rate regime over the previous decade, the renminbi short-run interest rate has not deviated much from the US policy rate were shown as empirical results.

The global crisis of 2008 caused the rule-like monetary policies, which was successfully implemented in 1980s and 1990s, to be questioned. The fact that the crisis broke out in the US and that it may have affected the other countries easily with its strong economy has intensified the researches on the US.

It was inevitable that the low interest policy of the US would have an effect on other countries as well. As Bruno and Shin (2012) indicate in their study; the fact that a major central bank lowers its interest policy can increase risk-taking in other countries. So as to cope with this situation and to be able to compete with dollar which depreciated in the world market, other countries had to resort to interest rate cut as well.

According to Hofmann and Bogdanova (2012); between 2002 and 2006, the Federal Reserve set interest rates significantly below the rates suggested by well-known monetary policy rules that contributed to global liquidity boom. But empirical research of Ahrend (2010) and Hofmann and Bogdanova (2012) also shows that there were similar deviations at many other central banks as well.

The relationship between these deviations and how they changed before and after the crisis have started to be examined. For example, Taylor (2013) put forward a spillover amplification mechanism which can create even larger deviations from policy rules in his study. In the same study of his, he defends that struggles to prevent this interest rate outcome through currency intervention or capital controls produce extra adverse effects.

Federal funds rate, which regressed to zero lower bound level towards the end of 2008 is expected to be increased again as a result of UE's economy's normalization. Recent studies are about the possible effect of this change on other countries. The impact of increased US interest rates on global interest rates is a matter of curiosity, because it is often argued that the degree of co-movement in asset prices is increasing over time, driven by deeper integration of financial markets (Obstfeld et. al., 2010; Rey, 2015).

The answer of this question is actually about to what extent other countries follow the US economy. So, this research attempts to address two main questions:

1-) Do central banks react to the changes in monetary policy conducted by the FED?

2-) Do the reaction of the central banks to the FED measured by the Taylor rule regression coefficient change with respect to time (before and after financial crisis)?

CHAPTER THREE

DATA

The main methodology of this study has been Ordinary Least Squares (OLS) and Time Varying OLS Model analysis for the following economies separately: Armenia, Bulgaria, Canada, Chile, Croatia, Czech Republic, Denmark, Euro Area, Iceland, India, Israel, Japan, Jordan, Korea, Malaysia, Mexico, Norway, Poland, Romania, Russia, Sweden, Tunisia, Turkey, Ukraine and the United Kingdom. In order to see the effects of 2008 financial crises on reaction of central banks to Federal Reserve at zero lower bound, four variables have been taken into consideration: inflation rate, interest rate, federal funds rate and output gap. Monthly CPI based percentage change series is evaluated for the calculation of inflation rates. Money market rates' monthly series have been used for the interest rate variable for the following countries: Croatia, Czech Republic, Iceland, Japan, Jordan, Korea, Malaysia, Mexico, Poland, Romania, Russia, Sweden, Tunisia and Ukraine. On the other hand; in the case of Armenia, Bulgaria, Canada, Chile, Denmark, India, Israel, Norway and Turkey, Central Bank policy rate is used as interest rate variable. Shadow rates of Euro Area and the United Kingdom, which were calculated separately by

Cynthia Wu, were used as policy rate also. Data about the output gap has been calculated by using the monthly industrial production data through the application of Hodrick-Prescott filter.

The last variable used in the model is federal funds rate. As known, it almost reached the zero lower bound in the middle of 2008. So as to preserve continuity and consistency, the shadow federal funds rate which is again calculated by Cynthia Wu is used for this variable.

The data for inflation rates, interest rates and output gap for every economy, except India and Turkey, included in the analysis have been retrieved from the IFS database of IMF. On the other hand, interest rates of Turkey and India were retrieved from OECD Database.

There are merely 25 economies which have been included in the analysis content because there is only high frequency data for only those 25 countries in IFS database. Moreover, there is not enough data for some other countries in the IMF database and therefore those countries are not included in the analysis.

While the data used in this study were generally ranging from January 2000 to December 2013, there are some differences only for 5 countries. Whereas the data of Armenia starts from 2001 April and Ukraine from 2002 January; those of Croatia ends in March 2013, Iceland in December 2012, and Sweden in 2014.

3.1. Shadow Funds Rate

After the economy spiraled down in last global financial crisis, to stimulate economic growth, the Fed taper the federal funds rate to near zero, known as the zero lower bound. Unable to move the short end of the yield curve, the Fed has started to conduct unconventional policies, such as its famed quantitative-easing bond-buying programs, to increase the money supply.But at this point federal funds rate does not have any meaning to understand these policies are effective or not.

To capture the effectiveness of these uncontional monetary policies, Wu and Xia suggest using a hybrid of the federal funds rate and this shadow rate. Shadow federal funds rate measure US monetary policy ceaselessly and consistently over time, from 1960 to the Great Recession, and into the future while the federal funds rate is not market sensitive at zero.

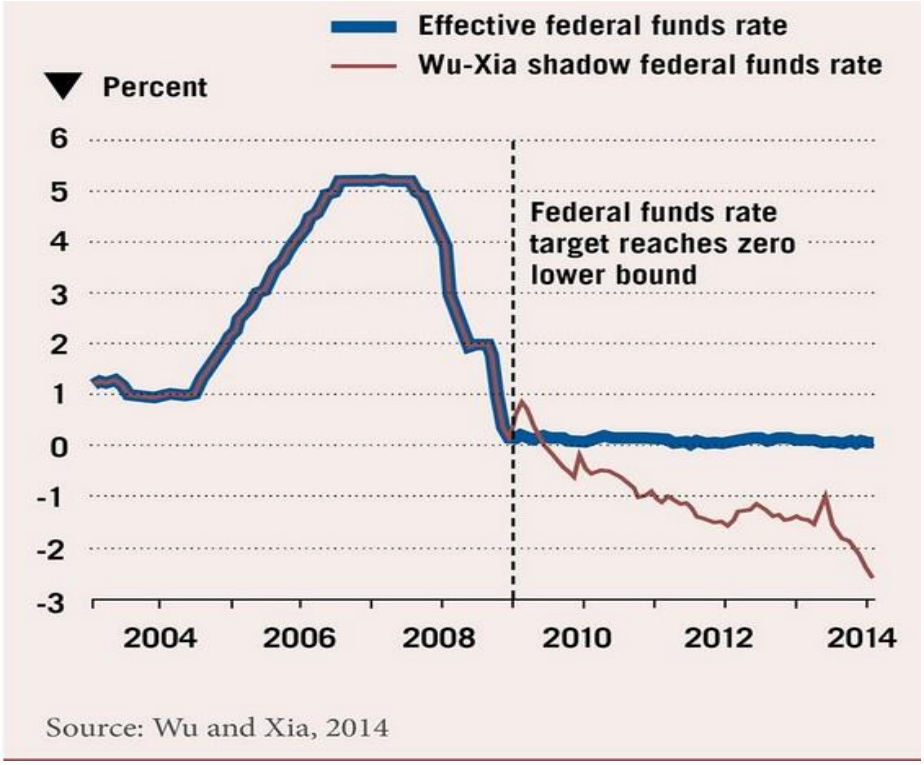

Figure 1: The Movement of Shadow and Real Federal Funds Rate

CHAPTER FOUR

METHODOLOGY

This study is mainly concerned with whether central banks follow federal funds rate or not and to what extent this affects the financial crisis of 2008. So as to investigate the answer to this question, reaction functions of central banks have been added to these functions as a variable and they have been formed in this way:

$$i_t = \beta_0 + \beta_1 y_{t-1} + \beta_2 \pi_{t-1} + \beta_3 i_t^{funds}$$

In our model which we formed as Backward-Looking Taylor Rule, i_t represents interest rate, y_{t-1} lag of gdp gap, π_{t-1} inflation rate, and i_t^{funds} shadow federal funds rate. By using gdp gap and inflation rate variable's lag, we tried to avoid endogeneity problem. The model was first analyzed with OLS and then with Time Varying OLS.

In order to be able to test the effect of financial crisis of 2008 with OLS method, the data were first split into two groups as the starting dates until 2007 December and the ending dates until 2008 January. In this way, the

significance level of the variable i_t^{funds} and the weight of the coefficient β_3 and federal funds rate in reaction functions could be observed.

So as to be able to compare the acquired results, data were once again analyzed with the help of OLS method without being split into two groups, and structural Break-Point Test (Chow Test) was applied on the final results. For the implementation of Chow Test, January 2008 was chosen as base point.

Forming a model by accepting the variables as time-dependent also enables more realistic analyses to take place. In our model, Time Varying Regression Method was used in order to analyze how the relationship that is intended to be examined changes in time. This method and the time-varying coefficients of the Backward-Looking Taylor Rule are estimated by using unobserved components modelling and Kalman filter. The time varying coefficients are calculated by using maximum likelihood. The results obtained by this method will enable the crisis of 2008 to be observed more realistically, and be robustness for the results obtained by OLS.

CHAPTER FIVE

RESULTS AND FINDINGS

5.1. Results of OLS

In order to investigate the effect that the financial crisis of 2008 had on the reaction functions of central banks, we had added the federal funds rate as an independent variable to the classical Backward-Looking Taylor Rule. The result of this model which has been formed by this way was analyzed by OLS, and the summary of these results are displayed in Table 1.

Table 1: Summary Results of OLS Regression and Chow Test

Country	2000-2007	2008-2014	Chow Test (2008M01)
Armenia	-1.254 (4.31)**	-0.310 (4.08)**	F-statistic 3,8367 Prob.F(1,159) 0.052
Bulgaria	0.016 (0.28)	0.777 (4.41)**	F-statistic 47.3379 Prob.F(1,174) 0.000
Canada	0.540 (20.89)**	0.276 (5.74)**	F-statistic 21.5136 Prob.F(1,174) 0.000
Chile	0.374 (5.94)**	-0.177 (1.59)	F-statistic 13,8209 Prob.F(1,174) 0.000
Croatia	0.249 (1.49)	1.599 (4.04)**	F-statistic 17.1729 Prob.F(1,165) 0.000
Czech Republic	0.088 (1.66)	0.678 (12.38)**	F-statistic 5.0413 Prob.F(1,174) 0.026
Denmark	0.277 (7.26)**	0.755 (12.54)**	F-statistic 36.4430 Prob.F(1,174) 0.000

Tablo 1 (Continued)

Euro Area	0.253 (6.87)**	0.912 (12.95)**	F-statistic 24.8549 Prob.F(1,174) 0.000
Iceland	0.838 (3.45)**	2.318 (12.89)**	F-statistic 3.9243 Prob.F(1,151) 0.049
India	0.236 (9.37)**	-0.707 (7.73)**	F-statistic 77.2340 Prob.F(1,174) 0.000
Israel	0.180 (1.69)	0.134 (1.22)	F-statistic 2.0748 Prob.F(1,174) 0.152
Japan	0.046 (6.14)**	0.088 (26.36)**	F-statistic 33.7243 Prob.F(1,174) 0.000
Jordan	0.678 (24.82)**	0.109 (1.61)	F-statistic 42.5987 Prob.F(1,174) 0.000
Korea	0.242 (8.82)**	0.241 (3.28)**	F-statistic 0.0010 Prob.F(1,174) 0.974
Malaysia	0.072 (4.12)**	-0.057 (2.11)*	F-statistic 5.9136 Prob.F(1,174) 0.016
Mexico	0.614 (7.05)**	0.887 (16.52)**	F-statistic 0.2727 Prob.F(1,174) 0.602
Norway	0.021 (0.20)	0.801 (10.28)**	F-statistic 6.9030 Prob.F(1,174) 0.009
Poland	-0.308 (1.72)	0.273 (3.29)**	F-statistic 9.5597 Prob.F(1,174) 0.002
Romania	-1.053 (5.04)**	2.277 (9.06)**	F-statistic 19.4995 Prob.F(1,174) 0.000
Russia	-0.138 (0.78)	-1.383 (5.57)**	F-statistic 8.7405 Prob.F(1,174) 0.004
Sweden	0.086 (2.59)*	0.347 (6.45)**	F-statistic 3.5377 Prob.F(1,172) 0.062
Tunisia	0.057 (2.59)*	0.115 (2.77)**	F-statistic 0.0047 Prob.F(1,174) 0.945
Turkey	2.602 (1.13)	1.486 (8.35)**	F-statistic 0.2363 Prob.F(1,174)0.628
Ukranie	-1.028 (4.10)**	-0.884 (1.05)	F-statistic 0.7656 Prob.F(1,150) 0.383
United Kingdom	0.372 (12.98)**	0.821 (8.03)**	F-statistic 16.7493 Prob.F(1,174) 0.000

* $p<0.05$; ** $p<0.01$

The data have been split into two groups since January 2008. OLS was applied on these data groups separately. Whereas the 1. column of the table displays the results of federal funds rate in pre 2008, the 2. column contains the results which belong to post-2008 period.

For the pre-2008 period, the shadow policy rate coefficient is significant at the 5% level for 17 economies. This coefficient is not statistically significant for 3 economies (Chile, Jordan, Ukraine) at the post-2008 period.

Only 1 (Israel) of the 8 economies that are not statistically significant in pre-2008 period remains not being significant in post-2008 period as well.

For 3 economies, whereas significance does not change between the periods pre-2008 and post-2008, the sign of coefficient changes. While India and Malaysia are significantly positive in pre-2008 period, they are significantly negative in post-2008 period. On the other hand, it is significantly negative for Romania during pre-2008 period, then it becomes significantly positive during post-2008 period. Both the change in significance and the change in the sign of coefficient demonstrate the change in the reaction of central banks to federal funds rate along with the crisis.

The 3. column of Table 1 displays the results of all the data that belong to the Chow Test results. By also looking at these data, the breaking in the reserved reaction of central banks can be observed. For instance, while federal funds rate for Bulgaria in pre-2008 period is not significant; the reaction to this variable in post-2008 period is statistically significant. The Chow-test results which belong to this economy also confirm and support the results that there is a breakpoint in the federal funds rate of this model.

TABLE 2: Interpretation of OLS Results for Each Economies

Armenia	It is negatively significant at 95% level both in pre and post crisis period. The effects of funds rate is higher in pre-crisis period.
Bulgaria	While it is insignificant at pre-crisis period, positively significant at 95% level in post-crisis period.
Canada	It is positively significant at 95% level in both pre and post crisis period. The effects of funds rate is higher in pre-crisis period.
Chile	While it is positively significant at 95% level in pre-crisis period, insignificant in post-crisis period.
Croatia	While it is insignificant at pre-crisis period, positively significant at 95% level in post-crisis period.
Czech Republic	While it is insignificant at pre-crisis period, positively significant at 95% level in post-crisis period.
Denmark	It is positively significant at 95% level in both pre and post crisis period. The effects of funds rate is higher in post-crisis period.
Euro Area	It is positively significant at 95% level both in pre and post crisis period. The effects of funds rate is higher in post-crisis period.
Iceland	It is positively significant at 95% level both in pre and post crisis period. The effects of funds rate is higher in post-crisis period.
India	While it is positively significant at 95% level in pre-crisis period, negatively significant at 95% level in post-crisis period.
Israel	It is insignificant in both pre and post crisis period.
Japan	It is positively significant at 95% level in both pre and post crisis period. The effects of funds rate is higher in post-crisis period.
Jordan	While it is positively significant at 95% level in pre-crisis period, insignificant in post-crisis period.
Korea	It is positively significant at 95% level in both pre and post crisis period. The effects of funds rate is almost same in pre and post-crisis period.
Malaysia	While it is positively significant at 95% level in pre-crisis period, negatively significant at 95% level in post-crisis period.
Mexico	It is positively significant at 95% level both in pre and post crisis period. The effects of funds rate is higher in post-crisis period.
Norway	While it is insignificant at pre-crisis period, positively significant at 95% level in post-crisis period.
Poland	While it is insignificant at pre-crisis period, positively significant at 95% level in post-crisis period.
Romania	While it is negatively significant at 95% level in pre-crisis period, positively significant at 95% level in post-crisis period.
Russia	While it is insignificant at pre-crisis period, negatively significant at 95% level in post-crisis period.
Sweden	It is positively significant at 95% level in both pre and post crisis period. The effects of funds rate is higher in post-crisis period.
Tunisia	It is positively significant at 95% level in both pre and post crisis period. The effects of funds rate is higher in post-crisis period.
Turkey	While it is insignificant at pre-crisis period, positively significant at 95% level in post-crisis period.
Ukraine	While it is negatively significant at 95% level in pre-crisis period, insignificant in post-crisis period. The effects of funds rate is higher in post-crisis period.
United Kingdom	It is positively significant at 95% level in pre and post period.

5.2. Results of Time Varying Regression

The reaction of each economy to federal funds rate is displayed at Figure 2. While upper curve demonstrates the 68% significance level, lower curve demonstrates the 32% significance level and the curve at the middle demonstrates the mean of them at the same time in each figures.

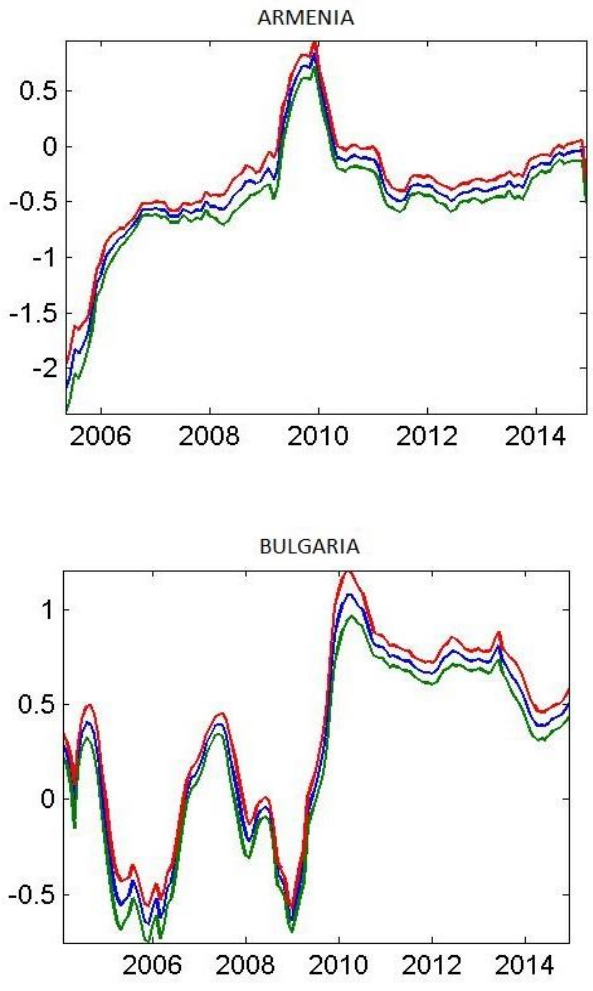

Figure 2: The Graph of Federal Funds Rate After Time Varying Regression for Each Economy

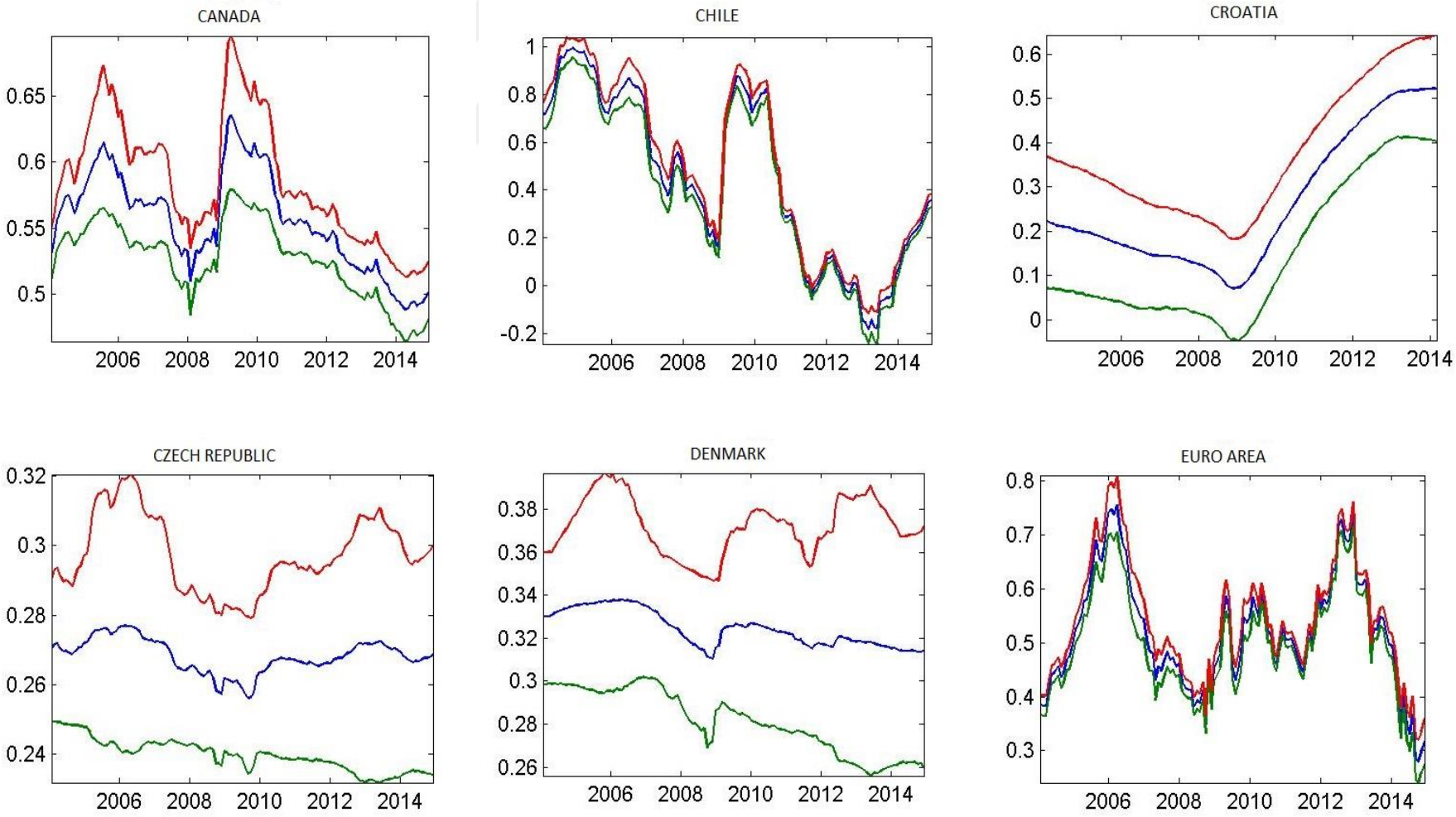

Figure 2 (Continued)

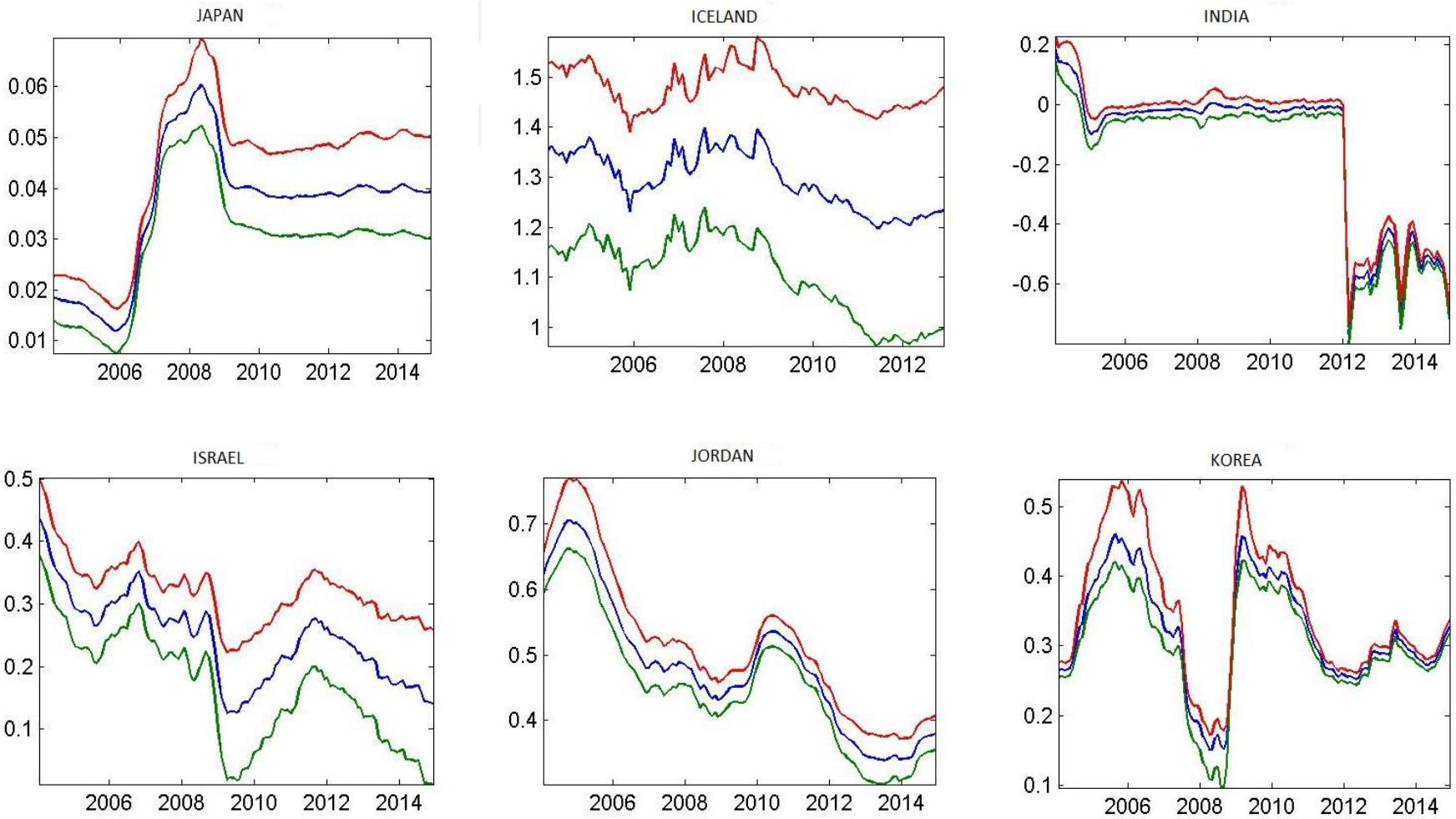

Figure 2 (Continued)

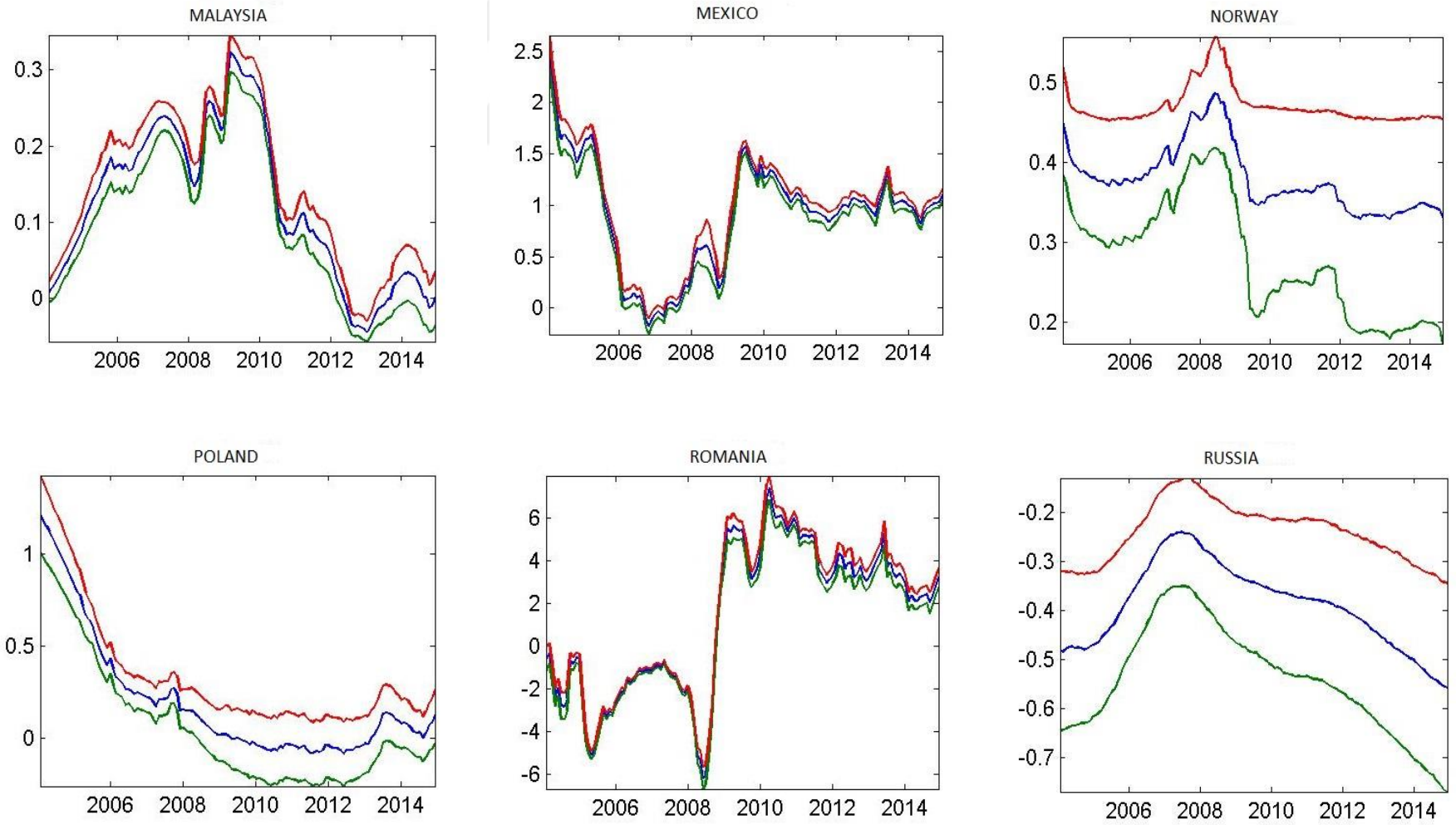

Figure 2 (Continued)

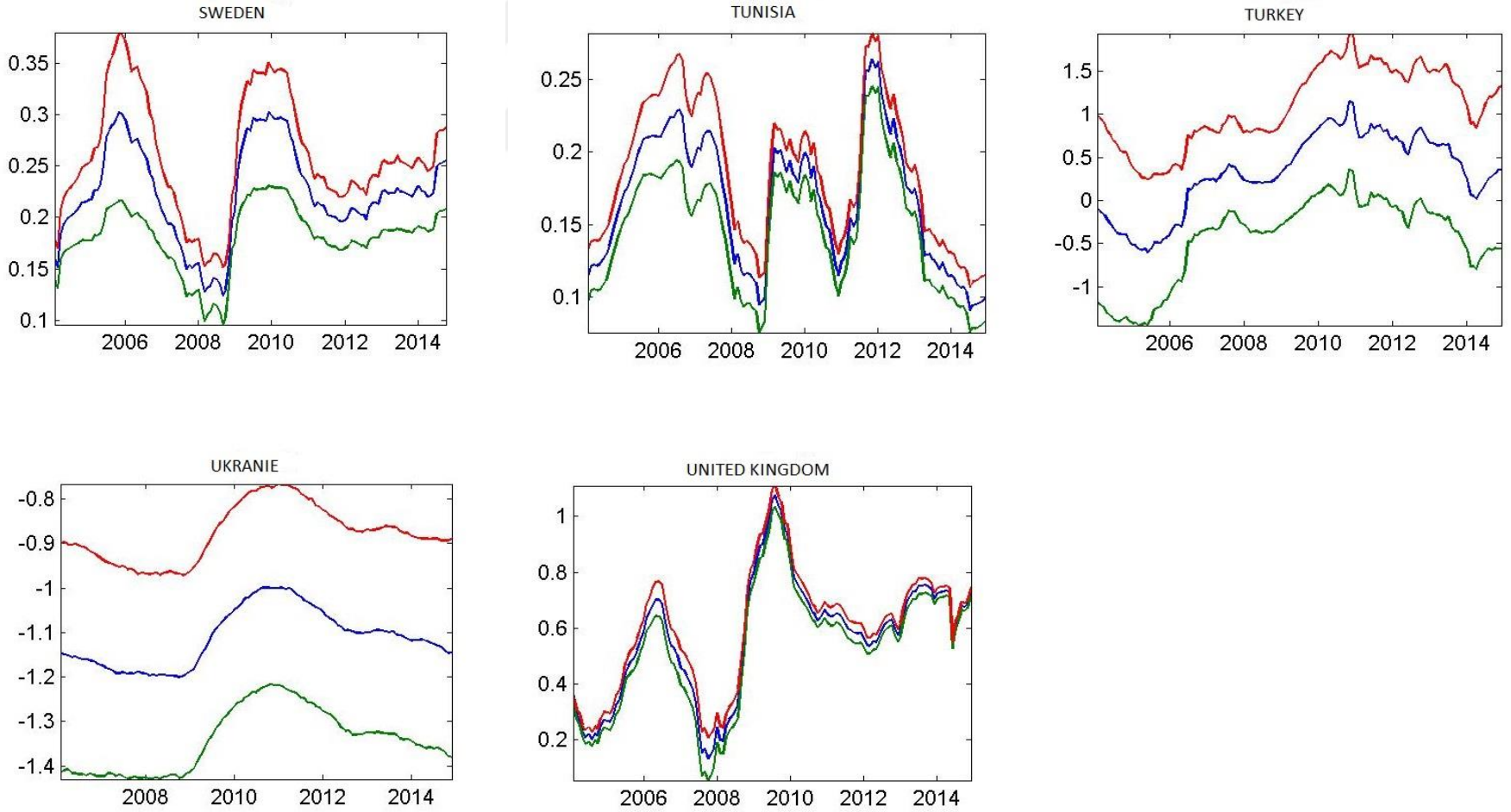

Figure 2 (Continued)

In case of Armenia, there has been an upward trend in impact of federal funds rate in pre-2008 period. After the financial crisis, this impact started being constant. However, due to this shock, the jump which took place under the influence of federal funds rate can be clearly observed. Owing to this jump, reaction to federal funds rate has started to have bigger value.

In case of Bulgaria, the effect of federal funds rate which had a downward trend started to have bigger value by creating a big increment along with the economical shock. Besides, there was a local minimum in 2008, and the effect of federal funds rate started to increase after 2009.

In case of Canada and Chile; although the reaction to federal funds rate had downward trend in both pre-crisis and post-crisis period, the big increase in 2008 was also clearly observable in the figure. Whilst there was a local minimum for Canada in 2008, local minimum for Chile was observable in 2009.

In case of Croatia and Euro Area; while the reaction to federal funds rate had downward trend, this trend has started to become upward in post-2008 period. Reaction to federal funds rate was at its lowest level in 2009 for Croatia. Although effects of funds rate became the weakest in post-crisis period, it had a local minimum in 2009 for Euro Area

In case of India; the reaction to federal funds rate was stable in both pre-2008 and post-2008 period. Although the value of coefficient of funds rate was almost zero in pre-crisis period, it decreased rapidly along with the economical shock of 2008. So, its negative effects could be observed well.

In case of Israel; the reaction to downward federal funds rate became upward in post-2008 period. In other words, the effects of federal funds rate had its lowest value in 2009.

In case of Japan; while the reaction to federal funds rate was upward in pre-2008 period, this value started to become stable by decreasing during post-2008 period. The effects of federal funds rate had its highest value in 2008.

In case of Korea and the United Kingdom; whereas the reaction to federal funds rate was almost 0 in pre-2008 period, it increased to a large extent along with the financial crisis of 2008 and has maintained its positive effect during post-2008 period. Although there was almost no change in average of the value of the federal funds rate's coefficient between the pre and post-crisis period for Korea; the average of this coefficient became higher in post-crisis period for United Kingdom.

In case of Malaysia; the reaction to federal funds rate which was upward became downward along with the financial crisis of 2008. This reaction was the strongest in 2009.

In case of Sweden; the reaction to federal funds rate which was downward became upward along with the financial crisis of 2008. This reaction was the weakest in 2009.

In case of Mexico; the effect of federal funds rate which was downward started to have bigger value after the crisis increasingly. The reaction of federal funds rate was the weakest in 2007 and after this point it started to have upward trend.

In case of Norway; the effect of upward federal funds rate started to have less value decreasingly. In 2008; the value of coefficient of federal funds rate got its place at the pick point. Although it is decreasing after post-crisis period, it is never 0 and always takes positive value.

In case of Romania; federal funds rate which had negative effect during pre-2008 period has started to have positive effect in post 2008 period. In 2008; the value of coefficient of federal funds rate got its lowest value.

In case of Russia; the reaction to upward federal funds rate became downward along with the crisis of 2008. Although the sign of the coefficient of the federal funds rate did not change, it took its place at the highest level in near 2008.

CHAPTER SIX

CONCLUSION

The Federal Reserve will keep on normalizing its monetary stance as long as the US economic outlook reinforces. A number of market analysts and policymakers are concerned about the global inferences of the normalization of US monetary policy after several years of policy rates at the zero lower bound, improper operations, long-term rates and term premiums at historically low levels. The point that arouses curiosity is whether changes are international risk appetite to translate into macroeconomic unpredictability particularly after 2008 or not.

The influence of US monetary policy seems to have declined after 2008 according to the results of this study which is carried out with the purpose of measuring federal reserve reactions of central banks and determining whether there has been a change in the reaction along with the 2008 financial crisis or not.

These important regression results do not necessarily indicate a loss of monetary policy independence in EMEs. As a matter of principle, EME central banks can select their short-term policy raters. The question is why they appear to pursue US monetary policy, a matter which is argued in the accompanying paper by Gadanecz, Miyajima and Urban (2014). Whereas this might be the case owing to the monetary spillovers, there are other explanations as well. For example, US monetary policy might take joint action with some common factors such as the prospects for the global business cycle and risk sensibility, which influence EMEs and advanced economies in the same way.

In conclusion, we discover that a big part of the response of short-term interest rates to movements in US rates can be related to the synchronicity of business cycles across nations. On the other hand, we also discover that movements in US rates produce important spillovers to domestic short-term rates in various countries, both advanced and rising markets, above and beyond what can be clarified by standard business-cycle co-movement. Depending upon historical proof, those nations seem to have restricted monetary autonomy so as to cope with a situation or emerging policy rates in the United States.

In brief, our results point out that EME policy rates act in unison with the US rate. What is more, these results are in agreement with central bank questionnaire responses as well. (Takats and Vela). The spillover impacts are likely to be dependent on country-specific factors which have not been sufficiently studied.

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Appendix A: Results of OLS Regression for Each Economy

A.1. For Pre-Crisis Period

	cbpr_arm
lgdp_arm	-0.036
	(0.43)
lcpi_arm	-0.290
	(1.87)
shad	-1.254
	(4.31)**
_cons	12.423
	(10.62)**
R^2	0.21
N	80

* $p<0.05$; ** $p<0.01$

Table 3: Armenia

	cbpr_bul
lgdp_bul	0.013
	(0.89)
lcpi_bul	0.133
	(3.76)**
Shad	0.016
	(0.28)
_cons	2.346
	(11.41)**
R^2	0.23
N	95

* $p<0.05$; ** $p<0.01$

Table 4: Bulgaria

	cbpr_can
lgdp_can	0.008
	(0.71)
lcpi_can	0.285
	(4.91)**
shad	0.540
	(20.89)**
_cons	1.022
	(6.34)**
R^2	0.86
N	95

* $p<0.05$; ** $p<0.01$

Table 5: Canada

	mmr_cze
lgdp_cze	-0.002
	(0.13)
lcpi_cze	0.586
	(8.69)**
shad	0.088
	(1.66)
_cons	1.461
	(7.29)**
R^2	0.57
N	95

* $p<0.05$; ** $p<0.01$

Table 6: Czech Republic

	cbpr_chi
lgdp_chi	-0.009
	(0.37)
lcpi_chi	0.371
	(4.00)**
shad	0.374
	(5.94)**
_cons	1.689
	(6.48)**
R^2	0.55
N	95

* $p<0.05$; ** $p<0.01$

Table 7: Chile

	mmr_cro
lgdp_cro	-0.014
	(0.32)
lcpi_cro	0.142
	(0.55)
shad	0.249
	(1.49)
_cons	2.549
	(4.35)**
R^2	0.07
N	95

* $p<0.05$; ** $p<0.01$

Table 10: Croatia

	cbpr_den
lgdp_den	0.004
	(0.56)
lcpi_den	0.488
	(4.09)**
shad	0.277
	(7.26)**
_cons	1.108
	(4.56)**
R^2	0.53
N	95

* $p<0.05$; ** $p<0.01$

Table 8: Denmark

	mmr_ice
lgdp_ice	-0.133
	(1.32)
lcpi_ice	1.152
	(4.82)**
shad	0.838
	(3.45)**
_cons	2.181
	(1.93)
R^2	0.41
N	95

* $p<0.05$; ** $p<0.01$

Table 11: Iceland

	cbpr_isr
lgdp_isr	0.053
	(1.27)
lcpi_isr	0.399
	(4.72)**
shad	0.180
	(1.69)
_cons	4.646
	(10.50)**
R^2	0.22
N	95

* $p<0.05$; ** $p<0.01$

Table 9: Israel

	mmr_jap
lgdp_jap	0.003
	(1.23)
lcpi_jap	0.084
	(3.03)**
shad	0.046
	(6.14)**
_cons	-0.031
	(1.02)
R^2	0.40
N	95

* $p<0.05$; ** $p<0.01$

Table 12: Japan

	mmr_jor
lgdp_jor	0.007
	(0.95)
lcpi_jor	0.074
	(3.24)**
shad	0.678
	(24.82)**
_cons	1.626
	(13.86)**
R^2	0.88
N	95

* *p*<0.05; ** *p*<0.01

Table 13: Jordan

	mmr_msia
lgdp_msia	-0.017
	(2.04)*
lcpi_msia	0.111
	(3.44)**
shad	0.072
	(4.12)**
_cons	2.449
	(34.73)**
R^2	0.36
N	95

* *p*<0.05; ** *p*<0.01

Table 14: Malaysia

	cbpr_nor
lgdp_nor	0.016
	(0.58)
lcpi_nor	0.825
	(5.11)**
shad	0.021
	(0.20)
_cons	4.648
	(10.82)**
R^2	0.25
N	95

* *p*<0.05; ** *p*<0.01

Table 15: Norway

	mmr_kor
lgdp_kor	0.020
	(1.42)
lcpi_kor	0.157
	(2.66)**
shad	0.242
	(8.82)**
_cons	2.947
	(12.57)**
R^2	0.50
N	95

* *p*<0.05; ** *p*<0.01

Table 16: Korea

	mmr_mex
lgdp_mex	-0.095
	(1.65)
lcpi_mex	1.425
	(17.25)**
shad	0.614
	(7.05)**
_cons	-0.037
	(0.09)
R^2	0.86
N	95

* *p*<0.05; ** *p*<0.01

Table 17: Mexico

	mmr_pol
lgdp_pol	-0.093
	(1.19)
lcpi_pol	1.604
	(14.50)**
shad	-0.308
	(1.72)
_cons	4.145
	(6.92)**
R^2	0.74
N	95

* *p*<0.05; ** *p*<0.01

Table 18: Poland

	mmr_rom
lgdp_rom	0.107
	(1.23)
lcpi_rom	0.977
	(35.08)**
shad	-1.053
	(5.04)**
_cons	6.827
	(8.02)**
R^2	0.93
N	95

* $p<0.05$; ** $p<0.01$

Table 19: Romania

	mmr_swe
lgdp_swe	0.001
	(0.23)
lcpi_swe	0.779
	(10.67)**
shad	0.086
	(2.59)*
_cons	1.751
	(10.16)**
R^2	0.56
N	95

* $p<0.05$; ** $p<0.01$

Table 20: Sweden

	cbpr_tur
lgdp_tur	-0.250
	(0.32)
lcpi_tur	0.796
	(3.93)**
shad	2.602
	(1.13)
_cons	6.876
	(0.67)
R^2	0.17
N	95

* $p<0.05$; ** $p<0.01$

Table 21: Turkey

	mmr_rus
lgdp_rus	0.099
	(1.11)
lcpi_rus	0.425
	(6.17)**
shad	-0.138
	(0.78)
_cons	-0.316
	(0.28)
R^2	0.30
N	95

* $p<0.05$; ** $p<0.01$

Table 22: Russia

	mmr_tun
lgdp_tun	0.015
	(1.45)
lcpi_tun	-0.117
	(3.30)**
shad	0.057
	(2.59)*
_cons	5.560
	(42.30)**
R^2	0.17
N	95

* $p<0.05$; ** $p<0.01$

Table 23: Tunisia

	mmr_ukr
lgdp_ukr	0.119
	(2.02)*
lcpi_ukr	0.078
	(0.87)
shad	-1.028
	(4.10)**
_cons	7.173
	(9.24)**
R^2	0.26
N	71

* $p<0.05$; ** $p<0.01$

Table 24: Ukraine

	cbpr_ind
lgdp_ind	0.006
	(0.33)
lcpi_ind	-0.289
	(8.03)**
shad	0.236
	(9.37)**
_cons	6.901
	(43.04)**
R^2	0.56
N	95

* $p<0.05$; ** $p<0.01$

Table 25: India

	cbpr_ecb
lgdp_ecb	0.254
	(5.88)**
lcpi_ecb	0.382
	(1.94)
shad_fed	0.253
	(6.87)**
_cons	1.394
	(3.09)**
R^2	0.66
N	95

* $p<0.05$; ** $p<0.01$

Table 26: Euro Area

A.2. For Post-Crisis Period

	cbpr_arm
lgdp_arm	0.007
	(0.95)
lcpi_arm	0.090
	(2.66)**
shad	-0.310
	(4.08)**
_cons	6.586
	(26.83)**
R^2	0.21
N	83

* $p<0.05$; ** $p<0.01$

Table 27:Armenia

	cbpr_bul
lgdp_bul	0.014
	(0.80)
lcpi_bul	0.134
	(2.34)*
shad	0.777
	(4.41)**
_cons	1.299
	(3.59)**
R^2	0.75
N	83

* $p<0.05$; ** $p<0.01$

Table 28:Bulgaria

	cbpr_can
lgdp_can	0.060 (2.93)**
lcpi_can	0.173 (2.22)*
shad	0.276 (5.74)**
_cons	1.152 (7.43)**
R^2	0.45
N	83

* $p<0.05$; ** $p<0.01$

Table 29:Canada

	mmr_cro
lgdp_cro	-0.104 (1.76)
lcpi_cro	0.080 (0.32)
shad	1.599 (4.04)**
_cons	3.468 (3.61)**
R^2	0.33
N	74

* $p<0.05$; ** $p<0.01$

Table 30:Croatia

	cbpr_den
lgdp_den	0.020 (2.14)*
lcpi_den	0.223 (2.73)**
shad	0.755 (12.54)**
_cons	1.263 (6.12)**
R^2	0.83
N	83

* $p<0.05$; ** $p<0.01$

Table 31:Denmark

	cbpr_chi
lgdp_chi	0.070 (2.64)**
lcpi_chi	0.554 (10.60)**
shad	-0.177 (1.59)
_cons	2.136 (8.11)**
R^2	0.65
N	83

* $p<0.05$; ** $p<0.01$

Table 32:Chile

	mmr_cze
lgdp_cze	0.006 (0.96)
lcpi_cze	0.110 (2.79)**
shad	0.678 (12.38)**
_cons	1.786 (12.92)**
R^2	0.88
N	83

* $p<0.05$; ** $p<0.01$

Table 33:Czech Republic

	mmr_ice
lgdp_ice	0.042 (2.15)*
lcpi_ice	0.504 (10.24)**
shad	2.318 (12.89)**
_cons	5.192 (11.39)**
R^2	0.93
N	60

* $p<0.05$; ** $p<0.01$

Table 34:Iceland

	cbpr_isr
lgdp_isr	0.033
	(2.21)*
lcpi_isr	0.348
	(3.28)**
shad	0.134
	(1.22)
_cons	1.088
	(3.01)**
R^2	0.41
N	83

* $p<0.05$; ** $p<0.01$

Table 35:Israel

	mmr_jor
lgdp_jor	0.021
	(1.11)
lcpi_jor	0.100
	(5.37)**
shad	0.109
	(1.61)
_cons	2.954
	(18.67)**
R^2	0.43
N	83

* $p<0.05$; ** $p<0.01$

Table 36:Jordan

	mmr_msia
lgdp_msia	0.038
	(4.34)**
lcpi_msia	0.139
	(7.66)**
shad	-0.057
	(2.11)*
_cons	2.453
	(36.98)**
R^2	0.51
N	83

* $p<0.05$; ** $p<0.01$

Table 37:Malaysia

	mmr_jap
lgdp_jap	0.003
	(6.13)**
lcpi_jap	0.037
	(11.29)**
shad	0.088
	(26.36)**
_cons	0.199
	(38.11)**
R^2	0.91
N	83

* $p<0.05$; ** $p<0.01$

Table 38:Japan

	mmr_kor
lgdp_kor	0.046
	(3.60)**
lcpi_kor	0.236
	(3.09)**
shad	0.241
	(3.28)**
_cons	2.393
	(8.92)**
R^2	0.50
N	83

* $p<0.05$; ** $p<0.01$

Table 39:Korea

	mmr_mex
lgdp_mex	0.060
	(2.86)**
lcpi_mex	0.387
	(4.47)**
shad	0.887
	(16.52)**
_cons	4.286
	(10.72)**
R^2	0.86
N	83

* $p<0.05$; ** $p<0.01$

Table 40:Mexico

	cbpr_nor
lgdp_nor	0.000
	(0.03)
lcpi_nor	0.419
	(4.31)**
shad	0.801
	(10.28)**
_cons	2.176
	(8.39)**
R^2	0.76
N	83

* $p<0.05$; ** $p<0.01$

Table 41:Norway

	mmr_rom
lgdp_rom	-0.042
	(1.45)
lcpi_rom	-0.008
	(0.06)
shad	2.277
	(9.06)**
_cons	8.019
	(9.12)**
R^2	0.71
N	83

* $p<0.05$; ** $p<0.01$

Table 42:Romania

	mmr_swe
lgdp_swe	0.014
	(1.98)
lcpi_swe	0.507
	(10.27)**
shad	0.347
	(6.45)**
_cons	1.293
	(11.99)**
R^2	0.82
N	81

* $p<0.05$; ** $p<0.01$

Table 43:Sweden

	mmr_pol
lgdp_pol	0.030
	(2.15)*
lcpi_pol	0.353
	(4.92)**
shad	0.273
	(3.29)**
_cons	2.952
	(10.86)**
R^2	0.58
N	83

* $p<0.05$; ** $p<0.01$

Table 44:Poland

	mmr_rus
lgdp_rus	-0.019
	(0.51)
lcpi_rus	0.624
	(5.86)**
shad	-1.383
	(5.57)**
_cons	-0.772
	(0.70)
R^2	0.33
N	83

* $p<0.05$; ** $p<0.01$

Table 45:Russia

	mmr_tun
lgdp_tun	0.015
	(1.30)
lcpi_tun	0.124
	(2.04)*
shad	0.115
	(2.77)**
_cons	3.964
	(14.01)**
R^2	0.17
N	83

* $p<0.05$; ** $p<0.01$

Table 46:Tunisia

	cbpr_tur
lgdp_tur	0.002
	(0.05)
lcpi_tur	0.835
	(6.57)**
shad	1.486
	(8.35)**
_cons	2.870
	(2.61)*
R^2	0.64
N	83

* $p<0.05$; ** $p<0.01$

Table 47:Turkey

	mmr_ukr
lgdp_ukr	-0.097
	(1.02)
lcpi_ukr	0.404
	(3.14)**
shad	-0.884
	(1.05)
_cons	4.759
	(2.35)*
R^2	0.15
N	83

* $p<0.05$; ** $p<0.01$

Table 50:Ukraine

	cbpr_uk
lgdp_uk	0.087
	(2.88)**
lcpi_uk	0.361
	(2.66)**
shad	0.821
	(8.03)**
_cons	0.366
	(0.81)
R^2	0.57
N	83

* $p<0.05$; ** $p<0.01$

Table 48:United Kingdom

	cbpr_ind
lgdp_ind	-0.018
	(0.74)
lcpi_ind	-0.099
	(1.88)
shad	-0.707
	(7.73)**
_cons	7.591
	(14.30)**
R^2	0.46
N	83

* $p<0.05$; ** $p<0.01$

Table 51:India

	cbpr_ecb
lgdp_ecb	0.304
	(9.61)**
lcpi_ecb	-0.719
	(5.69)**
shad_fed	0.912
	(12.95)**
_cons	2.608
	(9.36)**
R^2	0.78
N	83

* $p<0.05$; ** $p<0.01$

Table 49:Euro Area

Appendix B: The Graph of All Variebles of Dynamic Taylor Rule

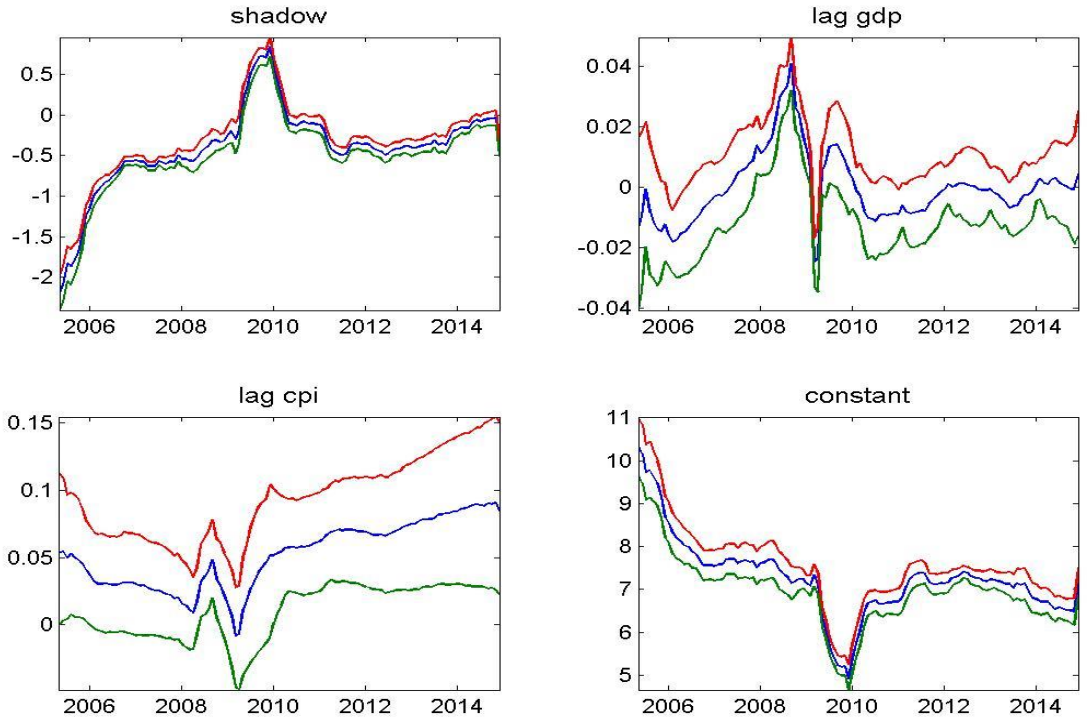

Figure 3: Results of Time Varying Regression Belong to Armenia

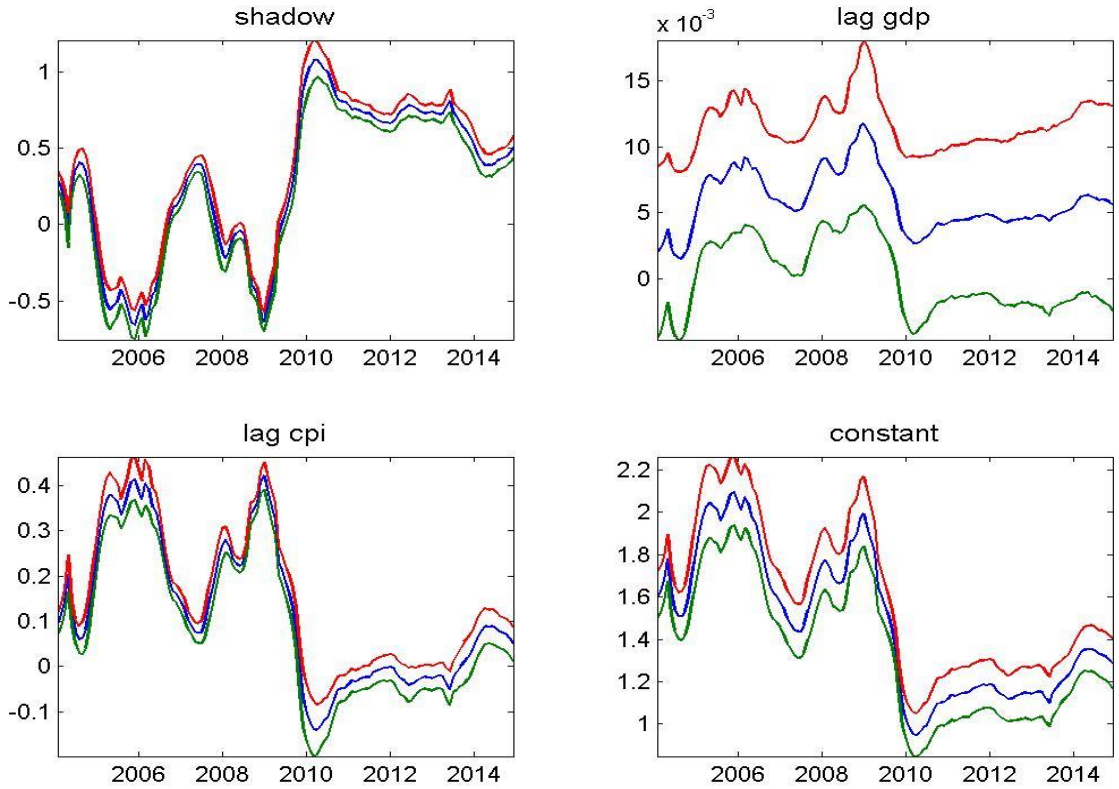

Figure 4: Results of Time Varying Regression Belong to Bulgaria

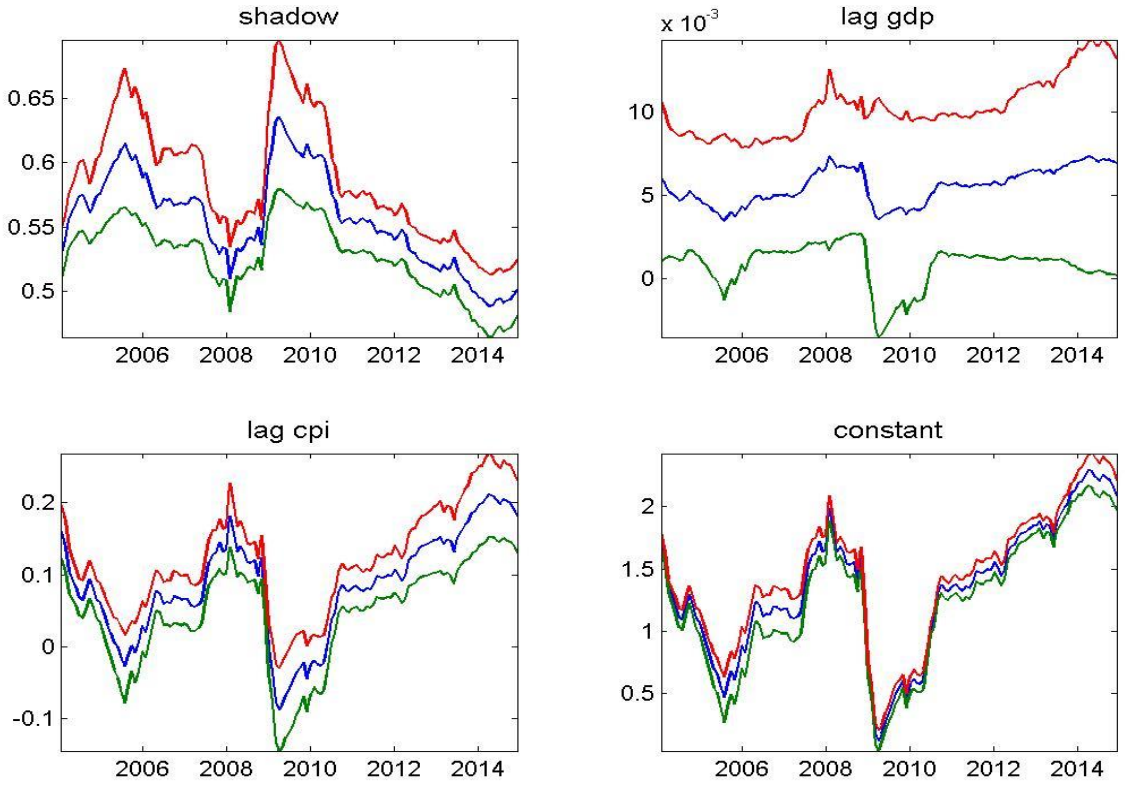

Figure 5: Results of Time Varying Regression Belong to Canada

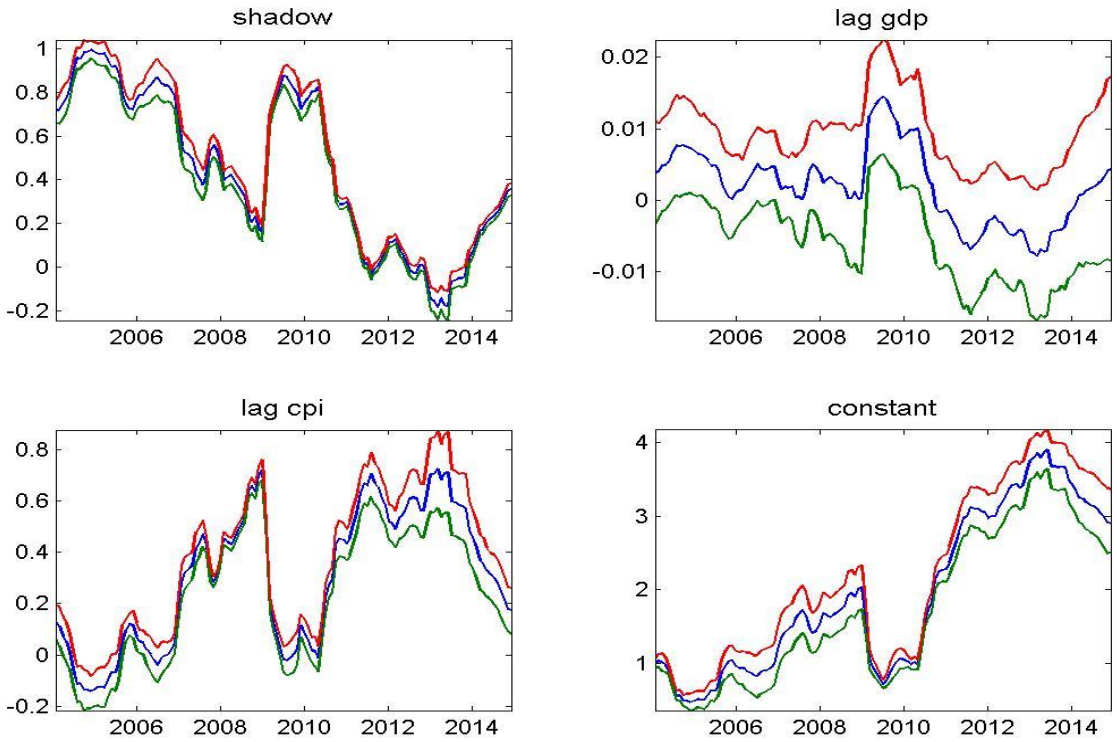

Figure 6: Results of Time Varying Regression Belong to Chile

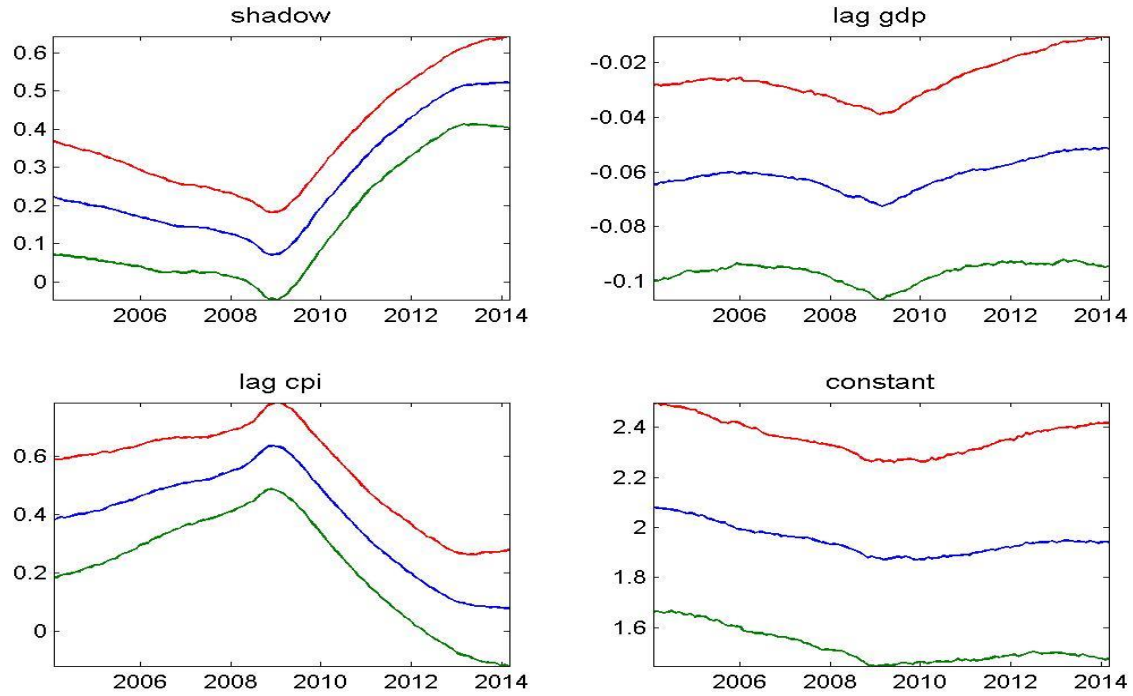

Figure 7: Results of Time Varying Regression Belong to Croatia

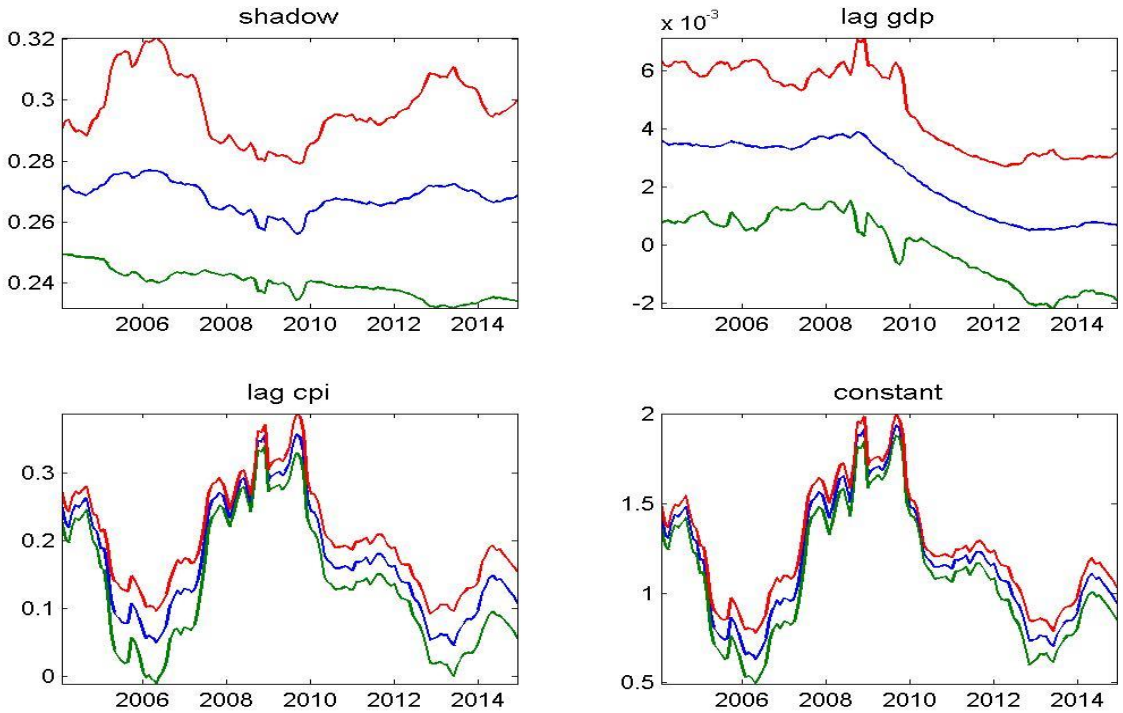

Figure 8: Results of Time Varying Regression Belong to Czech Republic

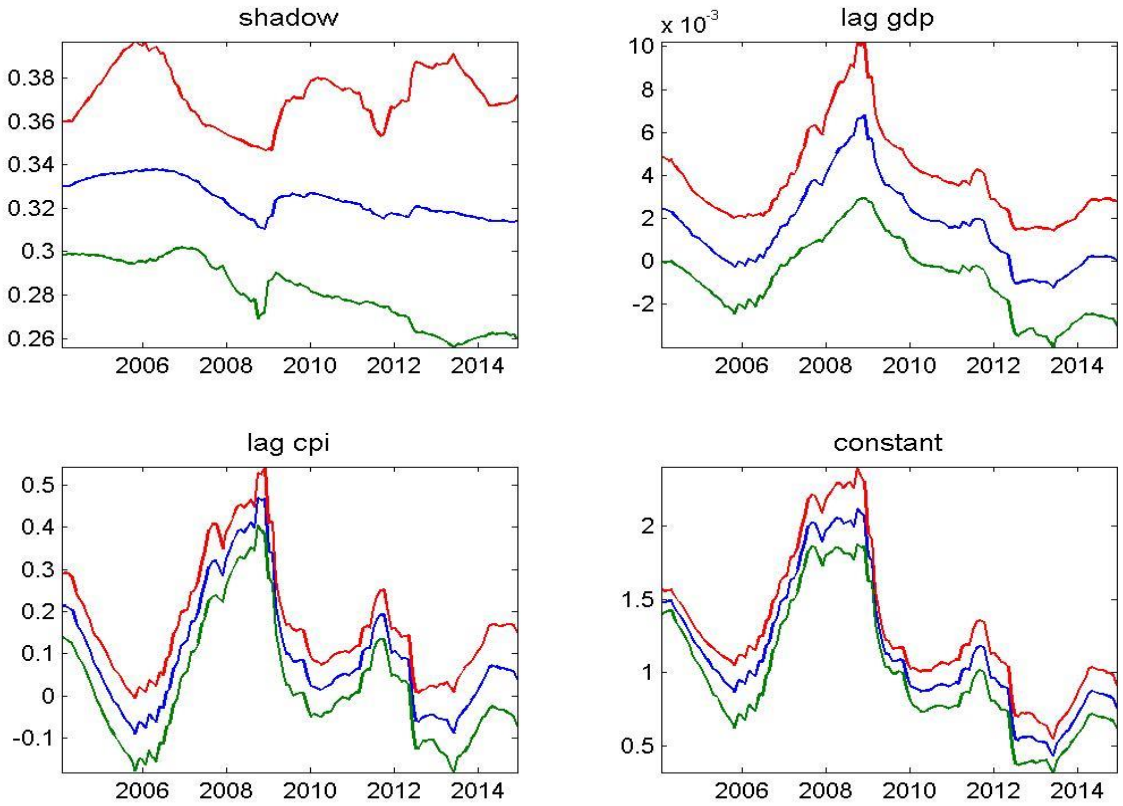

Figure 9: Results of Time Varying Regression Belong to Denmark

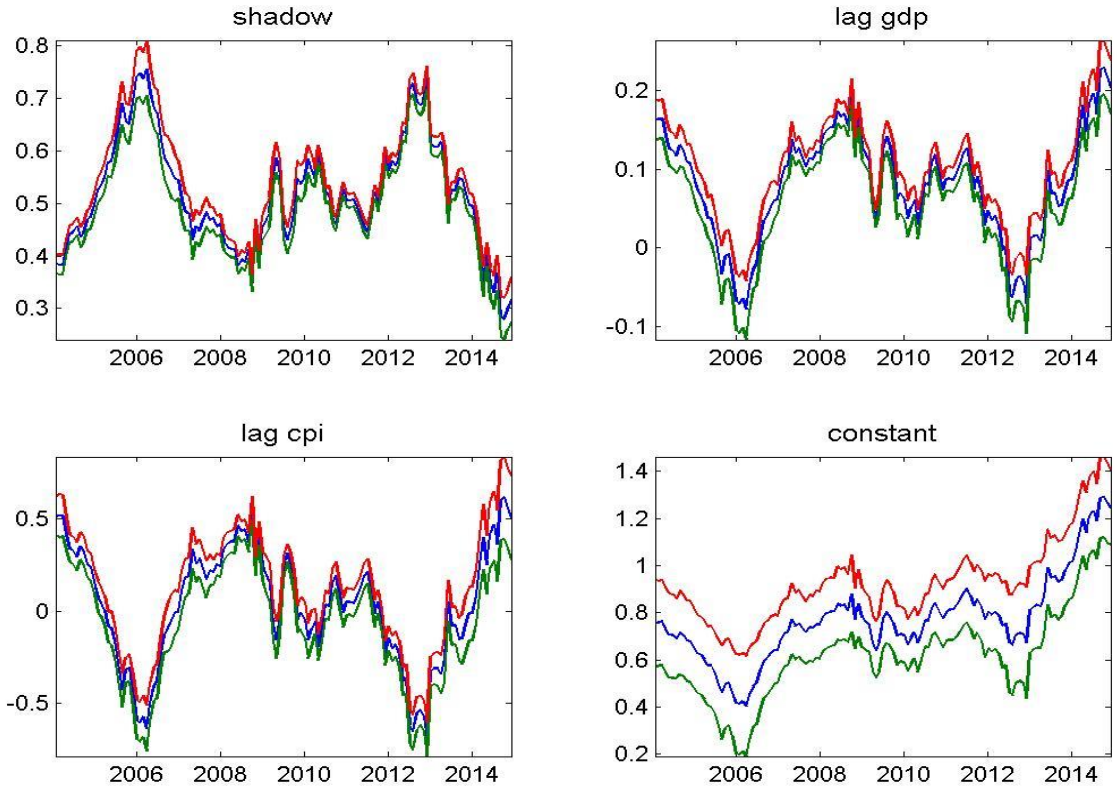

Figure 10: Results of Time Varying Regression Belong to Euro Area

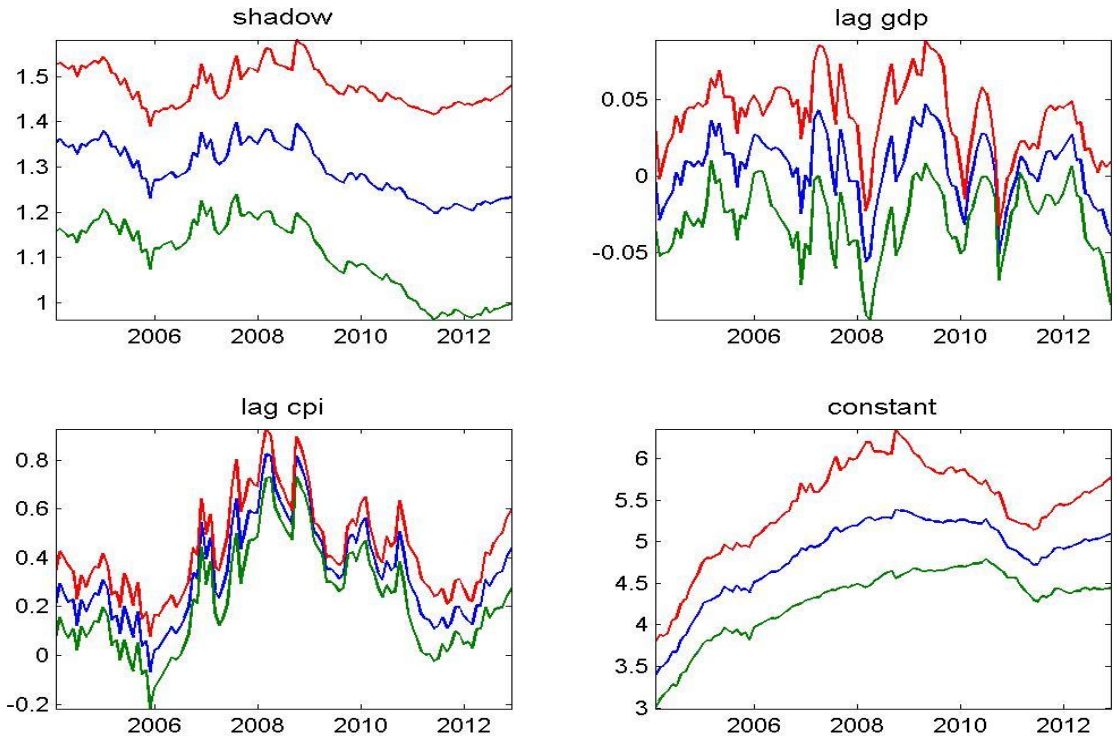

Figure 11: Results of Time Varying Regression Belong to Iceland

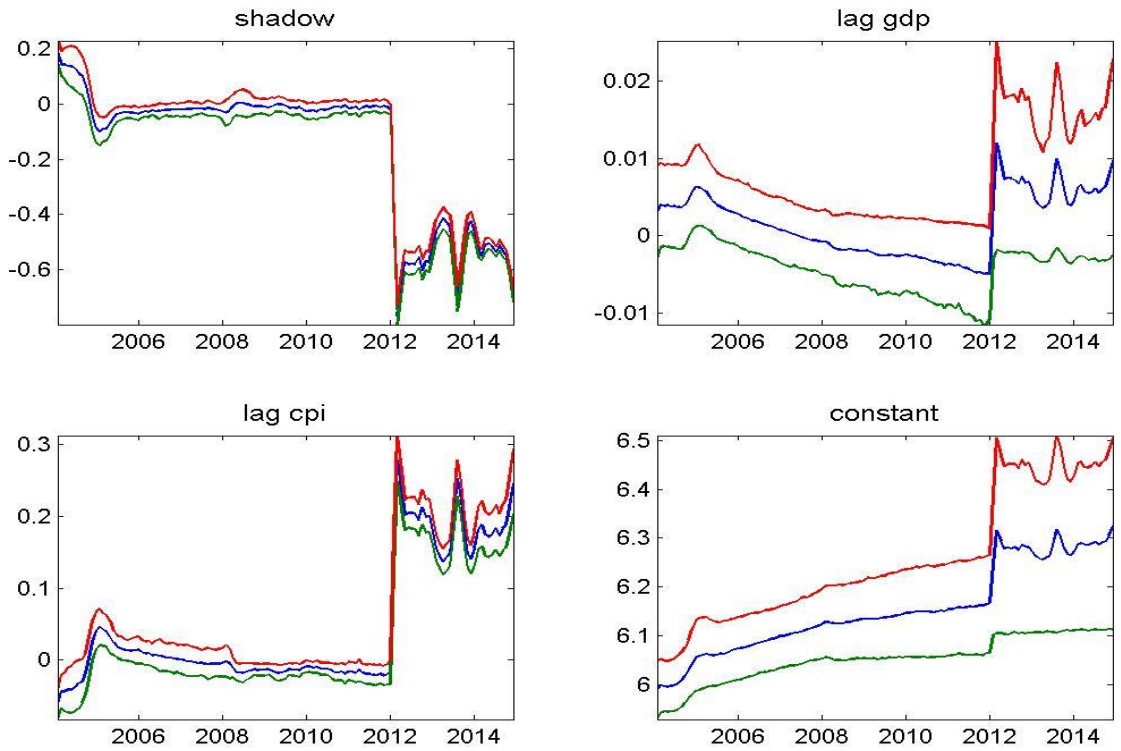

Figure 12: Results of Time Varying Regression Belong to India

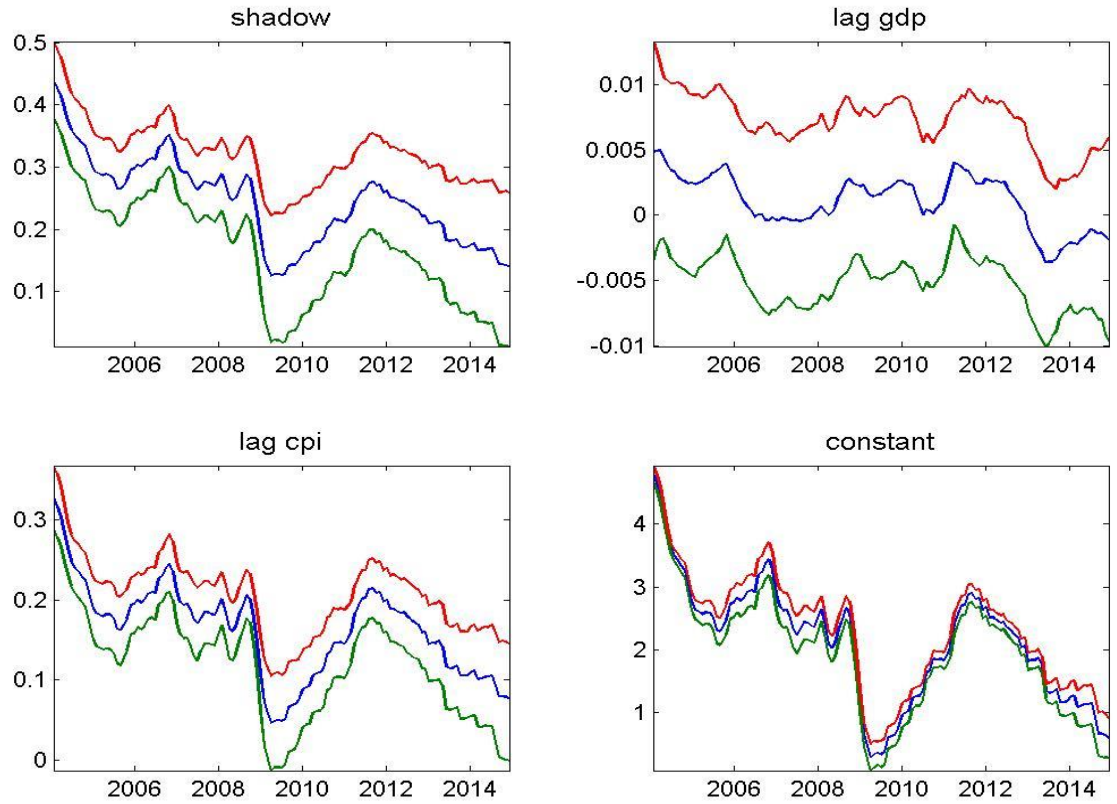

Figure 13: Results of Time Varying Regression Belong to Israel

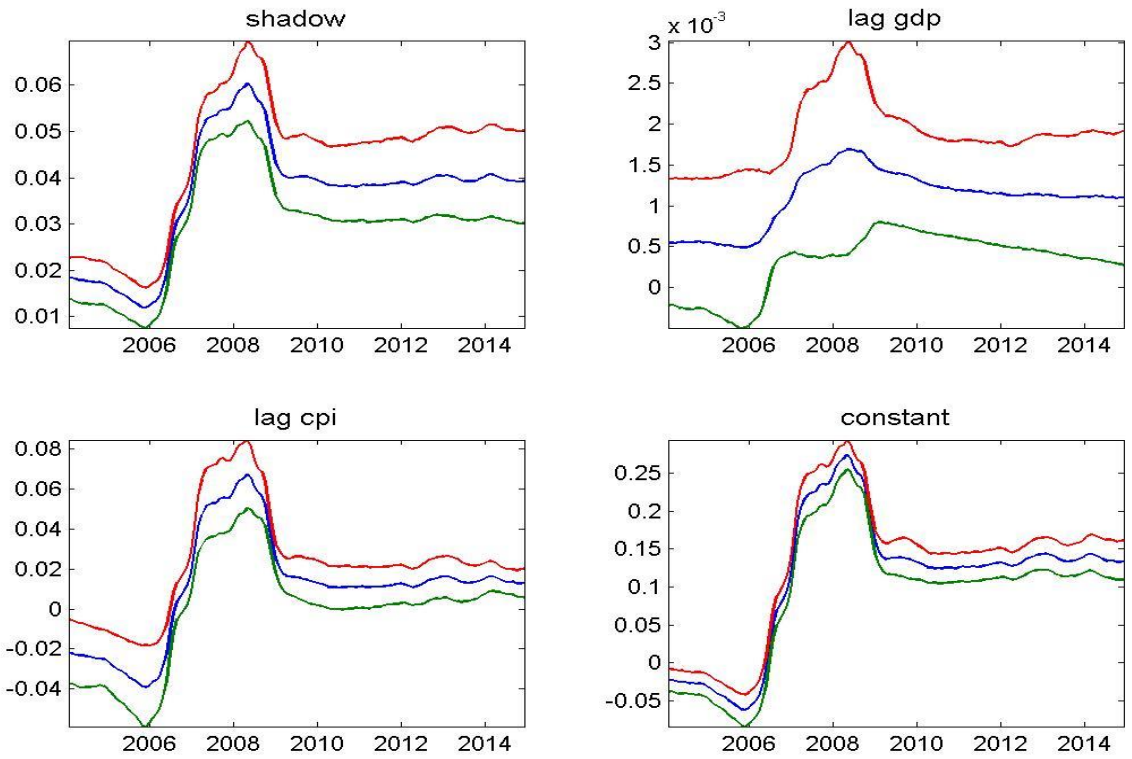

Figure 14: Results of Time Varying Regression Belong to Japan

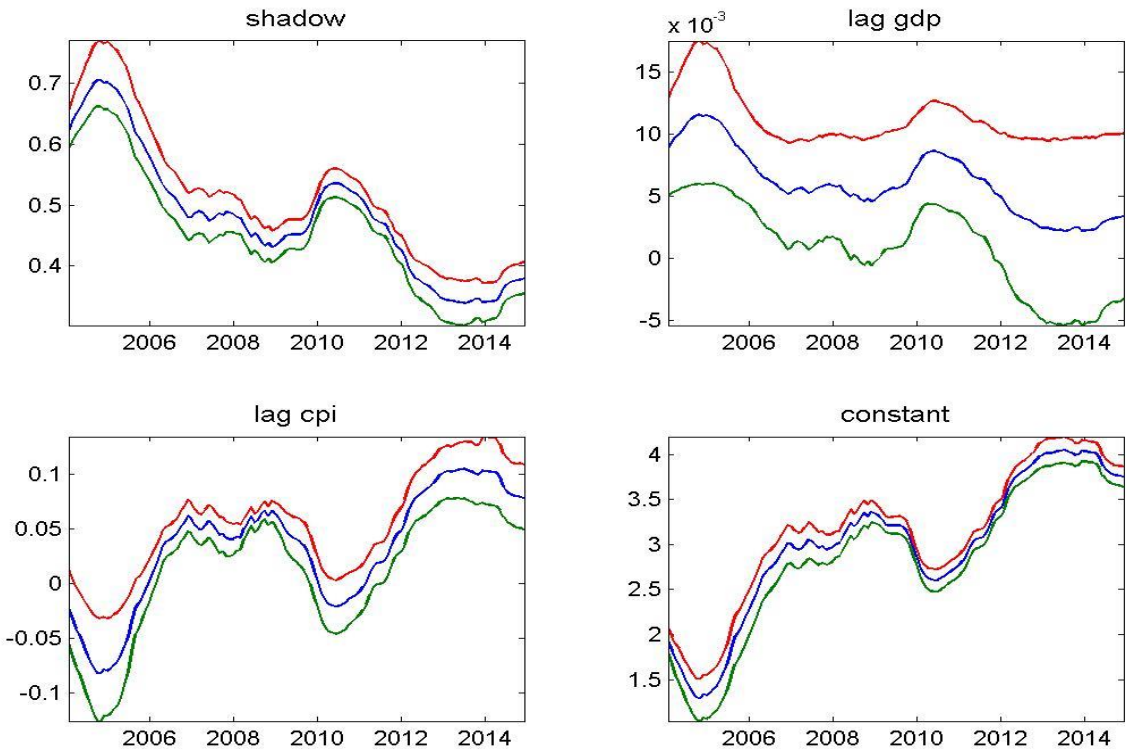

Figure 15: Results of Time Varying Regression Belong to Jordan

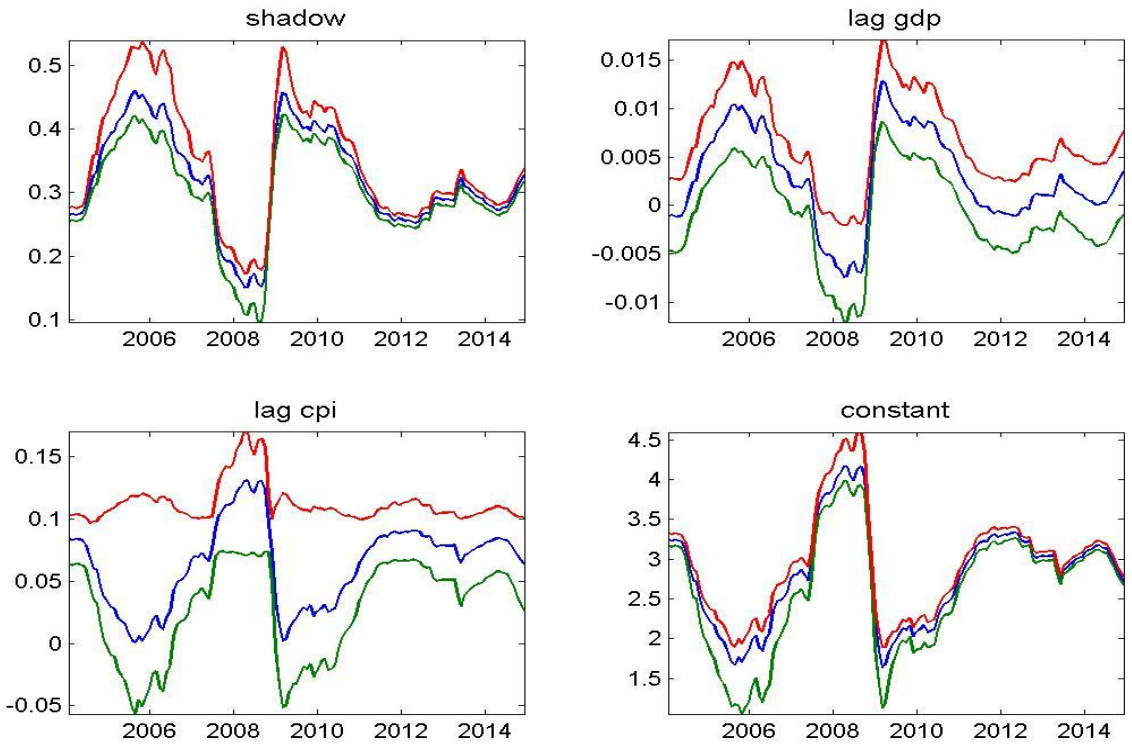

Figure 16: Results of Time Varying Regression Belong to Korea

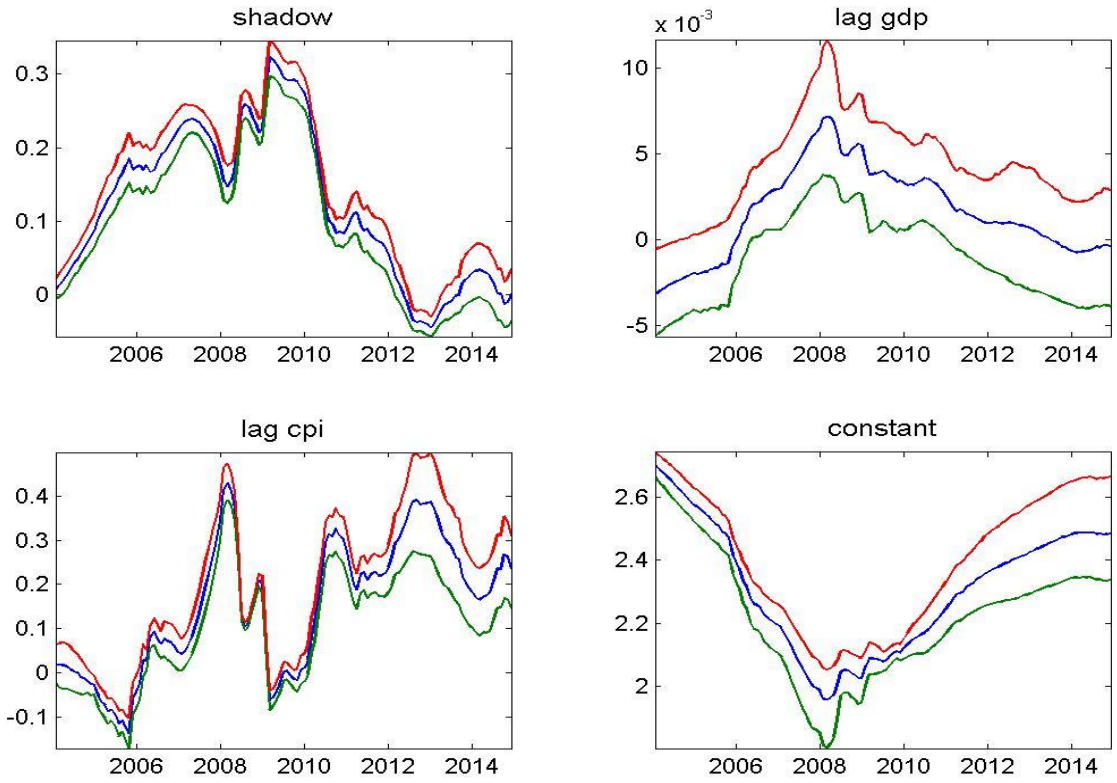

Figure 17: Results of Time Varying Regression Belong to Malaysia

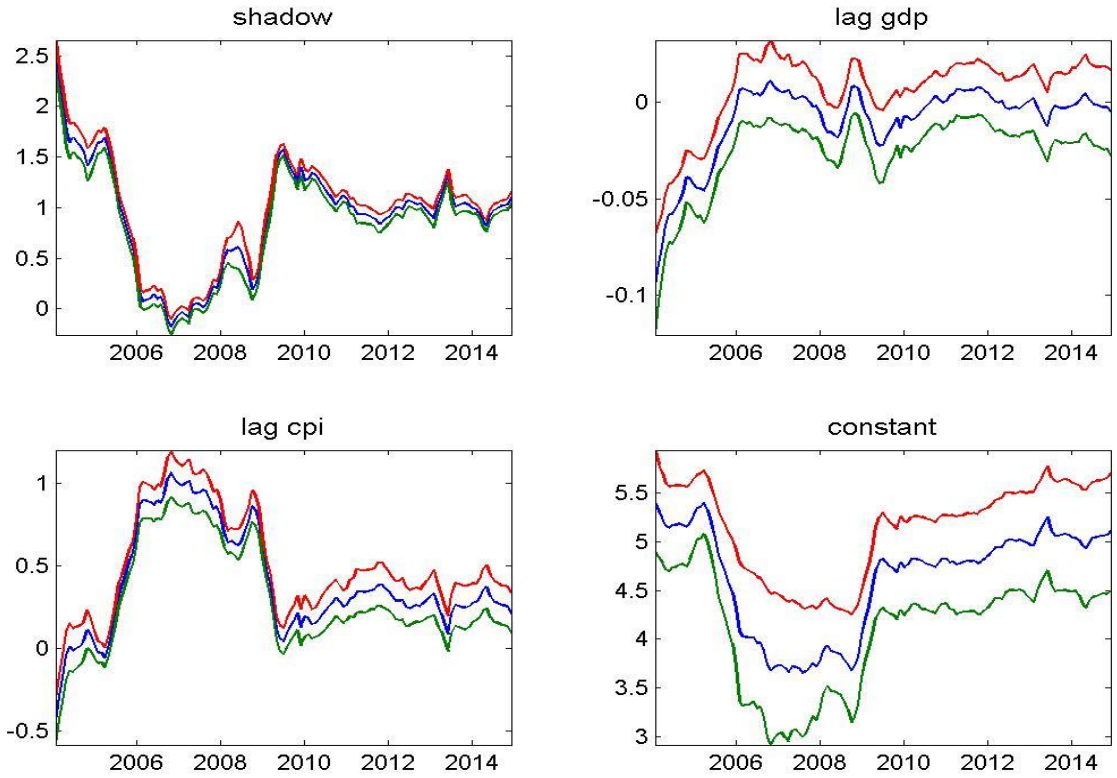

Figure 18: Results of Time Varying Regression Belong to Mexico

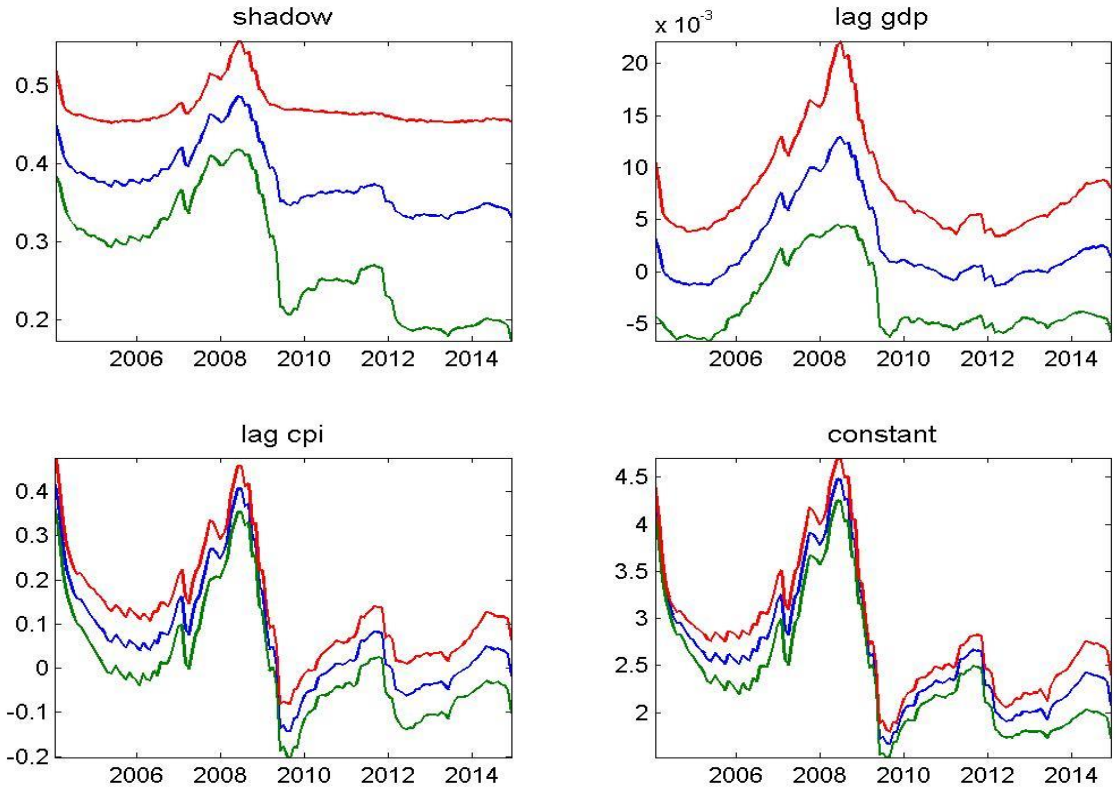

Figure 19: Results of Time Varying Regression Belong to Norway

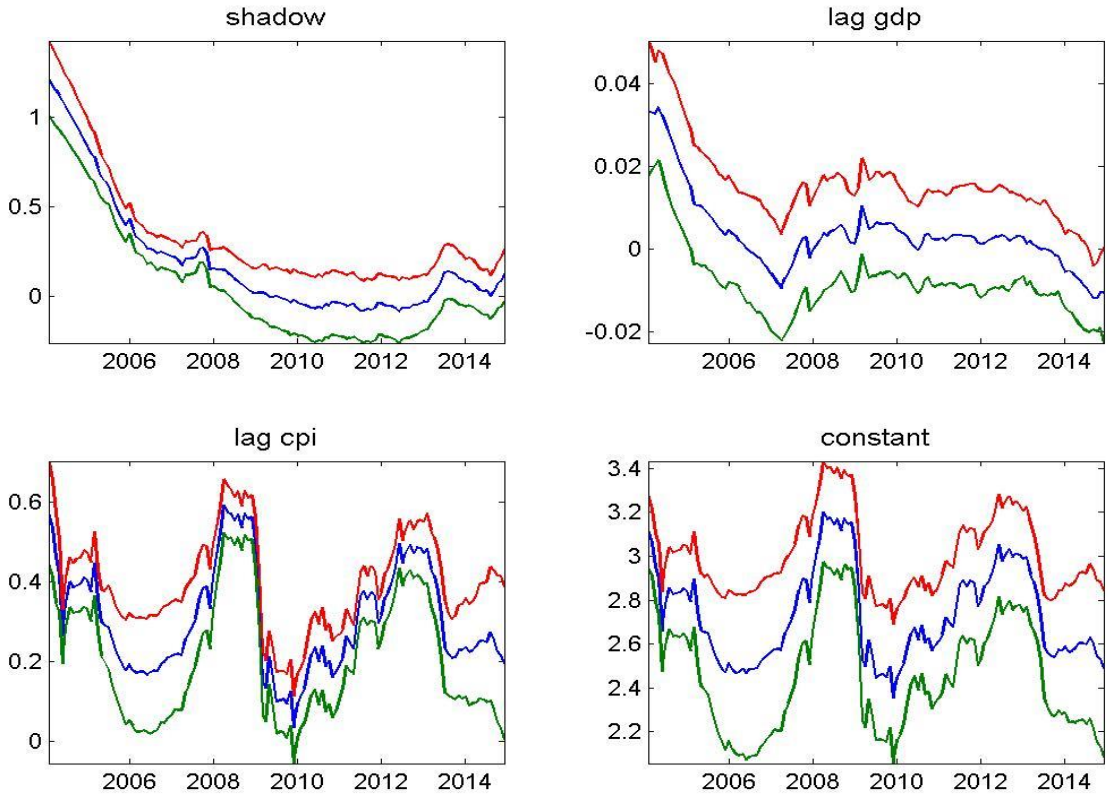

Figure 20: Results of Time Varying Regression Belong to Poland

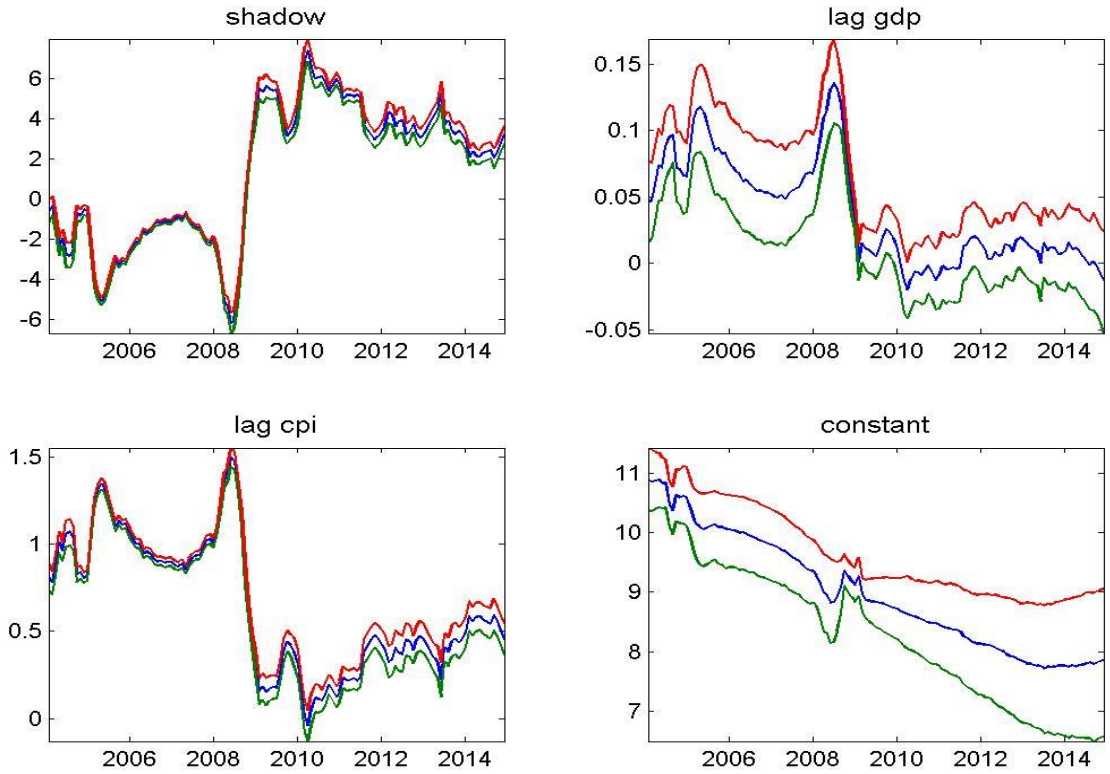

Figure 21: Results of Time Varying Regression Belong to Romania

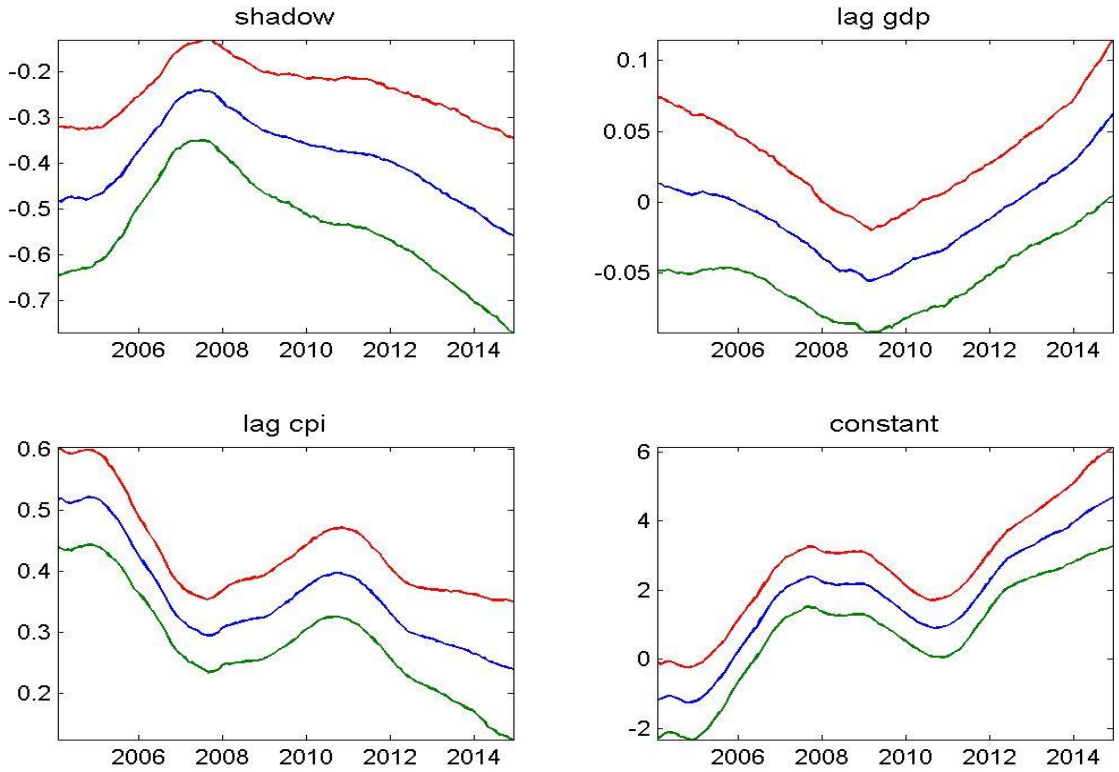

Figure 22: Results of Time Varying Regression Belong to Russia

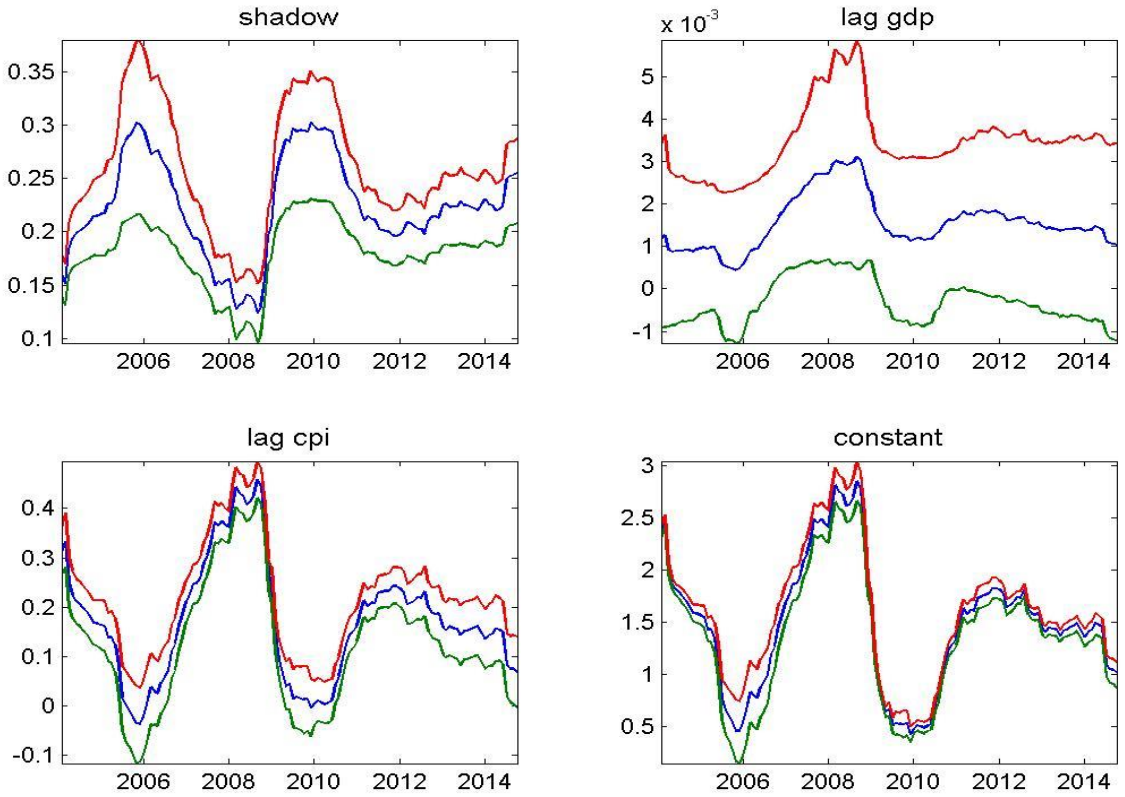

Figure 23: Results of Time Varying Regression Belong to Sweden

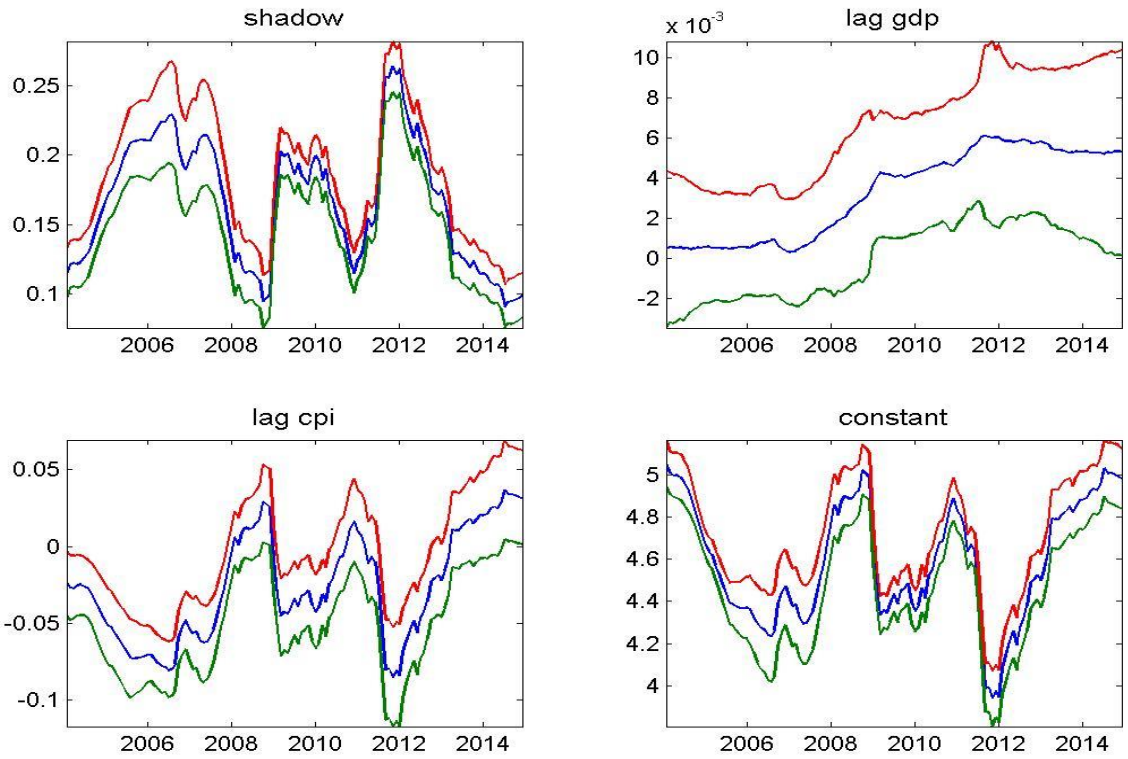

Figure 24: Results of Time Varying Regression Belong to Tunisia

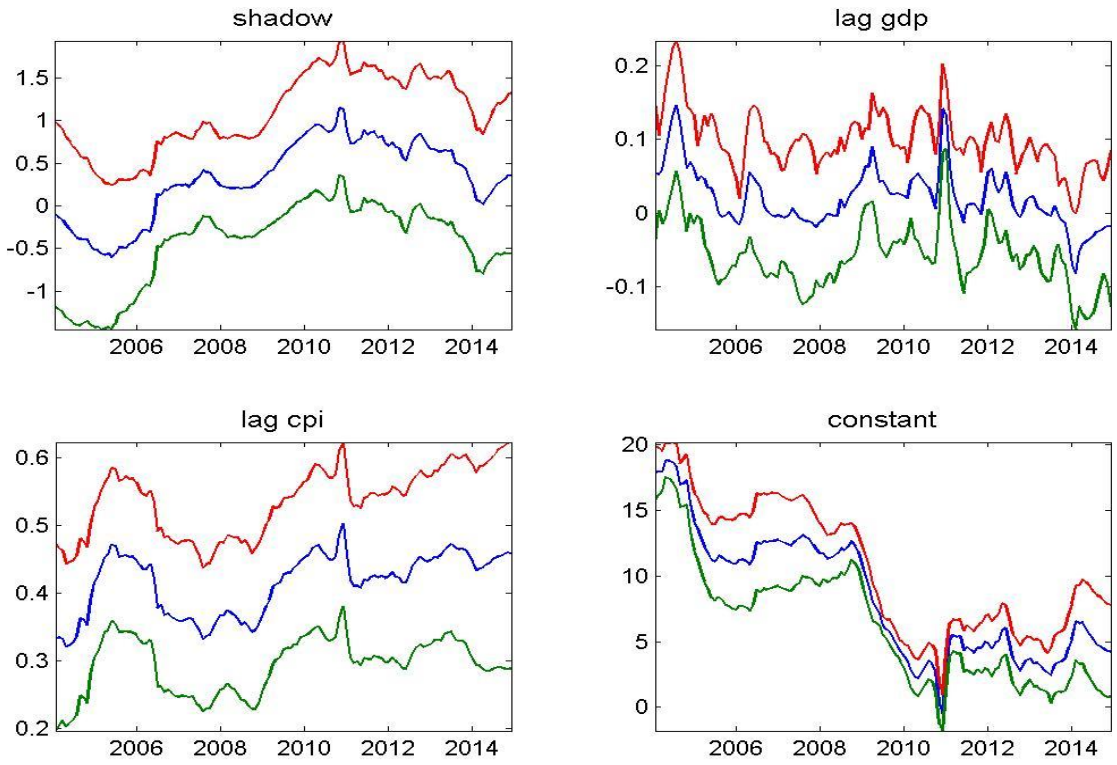

Figure 25: Results of Time Varying Regression Belong to Turkey

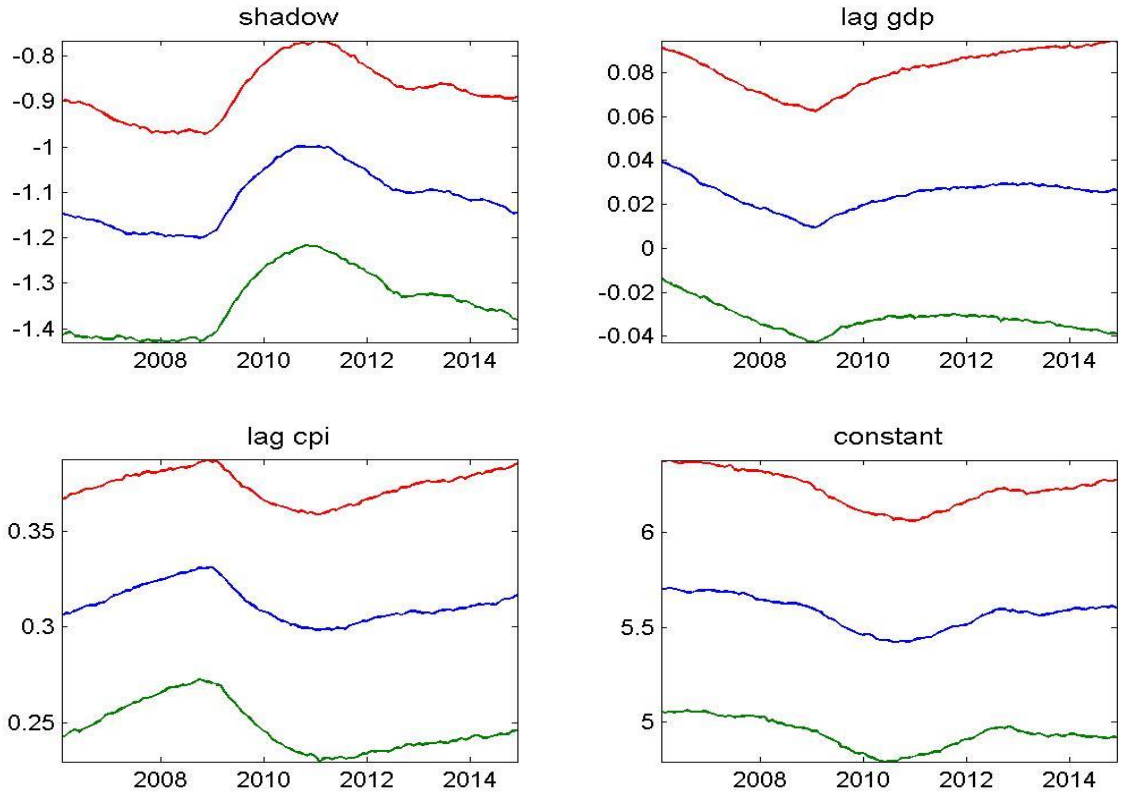

Figure 26: Results of Time Varying Regression Belong to Ukraine

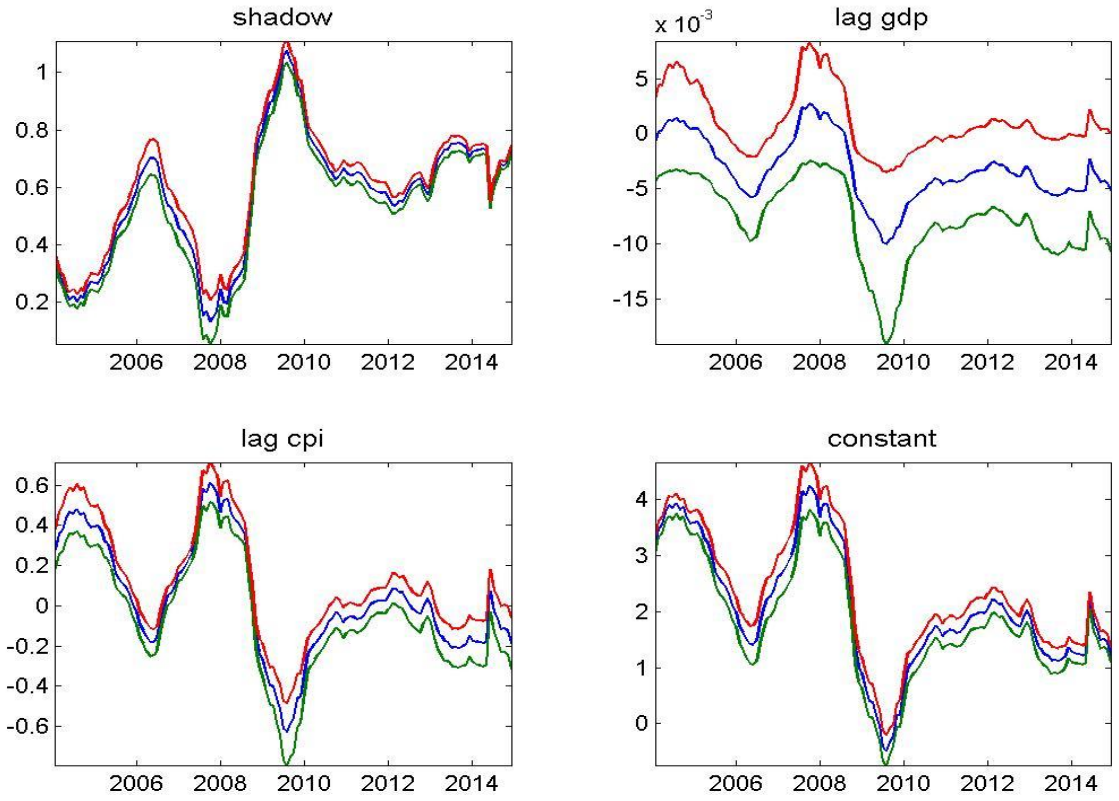

Figure 27: Results of Time Varying Regression Belong to United Kingdom