THE ROLE OF THE EXCHANGE RATE
IN INFLATION AND MONETARY POLICY IN RUSSIA

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Approval of the Graduate School of Social Sciences

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This is to certify that we have read this thesis and that in our opinion it is fully adequate, in scope and quality, as a thesis for the degree of Master of Science.

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ABSTRACT

THE ROLE OF THE EXCHANGE RATE
IN INFLATION AND MONETARY POLICY IN RUSSIA
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Russia has passed through a difficult political and economic transition for the last three decades. The collapse of the USSR deteriorated the economic structure that had been built within 70 years. The main aim of Russian monetary authorities has been to restore economic and financial stability of the country. The major obstacles in achieving stable economy have been fluctuations in exchange rate and high inflation rates. The aim of this study is to analyze the main factors those influence inflation in Russia and test the hypothesis of an asymmetric monetary policy stance with respect to exchange rate fluctuations for the period 2001-2015. The data obtained through a Vector Autoregressive Model (VAR) with the variance decomposition (VDC) and impulse response function (IRF) on inflation show that the supply side factor, exchange rate, is the most important factor on the inflation rate. Further analysis reveals that Russian inflation is more affected by the exchange rate depreciation. Especially after the Global financial crisis of 2008, the effect of the currency depreciation on inflation dynamics became very high. Furthermore, the Central Bank of Russia exhibits an asymmetric behavior towards the dynamics of the exchange rate in the period under investigation. It tolerates appreciation and applies aggressive measures to curb depreciation. Further analysis of the two separate periods demonstrates that before the Global financial crisis of 2008 the CBR had mostly symmetric response to currency changes, while during the period after the crisis, Bank authorities started to tolerate appreciation, and respond depreciation.

Keywords: Exchange rate, Inflation factors, Russian Central Banking

ÖZ

DÖVİZ KURUNUN RUSYA'DA ENFLASYON VE PARA POLİTİKASI ÜZERİNDEKİ ROLÜ
Gayanova, Elina
MA, İktisat Bölümü
Danışman: Yrd. Doç. Dr. Hasan Cömert
Ekim 2016, 173 sayfa

Rusya geçtiğimiz üç yıl boyunca zor bir siyasi ve iktisadi geçiş süreci yaşadı. Sovyetler Birliği'nin çöküşü 70 yılda kurulan ekonomik alt yapıyı paramparça etti. Bu anlamda Rusya'da para politikalarına yön verenlerin temel amacı ülkenin ekonomik finansal istikarını sağlamak oldu. İstikrarlı bir ekonomiye giderken en önemli engeller döviz kurundaki salınımlar ve yüksek enflasyon oranlarıydı. Bu çalışmanın amacı Rusya enflasyonu etkileyen esas faktörleri incelemek ve 2001-2015 dönemi için döviz kurundaki salınımlara göre bir asimetrik para politikası duruşu hipotezini test etmektir. Enflasyona dair varyans dekompozisyonu (VDC) ve etki tepki işlevi (IRF) ile birlikte Vektör Otoregressif Model (VAR)'dan elde edilen veriler enflasyon oranı üzerindeki en etkili faktörün arz faktörü, değişim oranı olduğunu göstermiştir. Daha da derin analizler Rusya'daki enflasyonun ulusal paranın dış değer kaybından etkilendiğini göstermiştir. Özellikle 2008 küresel finans krizinden sonra, ulusal paranın dış döviz kaybının enflasyon dinamikleri üzerindeki etkisi çok yüksek olmuştur. Dahası, Rusya Merkez Bankası (CBR) incelenen dönemde döviz kuru dinamiklerine karşı asimetrik bir tutum almıştır. Değer kaybının önüne geçmek için paranın kıymetlendirilmesine izin vermiş ve agresif önlemler almıştır. İki farklı döneme dair yapılan bir diğer analiz 2008 küresel finans krizinden önce CBR'nin döviz kurunun değer kaybetmesi veya kazanmasına karşı şu ya da bu ölçekte simetrik bir cevap üretirken, krizden sonrasına denk düşen dönemde Banka otoritelerinin kıymetlendirmeye izin verdiklerini ve değer kaybına tepki gösterdiklerini açığa çıkartır.

Anahtar Kelimeler: Döviz Kuru, Enflasyon Nedenleri, Rusya Merkez Bankası

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LIST OF ABBREVIATIONS

ADF	Augmented Dickey Fuller
CBR	Central Bank of Russia
CPI	Consumer Price Index
ERPT	Exchange Rate Pass Through
GDP	Gross Domestic Product
IRF	Impulse Response Function
IMF	International Monetary Fund
IT	Inflation Targeting
OECD	Organization for Economic Cooperation and Development
OLS	Ordinary Least Squares
RTS	Russian Trading System
SPI	Sensitive Price Indicator
US	United States of America
USSR	Union of Soviet Socialist Republics
VAR	Vector Autoregression
VDC	Variance Decomposition
WPI	Wholesale Price Index

CHAPTER 1

INTRODUCTION

Russia has experienced through a difficult political and economic transition for the last three decades. The collapse of the Soviet Union resulted in the disintegration of the economic structure that had been built within 70 years. Furthermore, the economy suffered from separation of the former Soviet Republics into the independent countries. Under such difficult conditions, Russian monetary authorities had a difficult task: to restore the economy and achieve microeconomic and macroeconomic stability.

The major obstacles in achieving stable economy have been fluctuations in the exchange rate and high inflation rates. Russian monetary authorities have concentrated on smoothing exchange rate dynamics. However, such interventions have led to higher inflation rates to became one of the important problems for the Central Bank of Russia (CBR) as well. After the Global financial crisis of 2008, the Bank announced the transition to the inflation targeting (IT) regime within several years. The IT regime means that the bank would announce the target inflation rates for future periods. The central bank began to use interest rate as its short-term monetary policy instrument. The aim of the IT is to curb inflation, which is seen as the main pre-requisite for achieving economic stability.

Many developed and developing countries follow IT regime. However, the adoption of this regime does not guarantee the achievement of the desired level of inflation. It is often the case, especially in developing countries, that monetary authorities do not reach aimed inflation rates. It is important to know the main

factors lying behind the inflation for a particular country in order to form an effective monetary policy.

The aim of this study is to find the main factors of inflation in Russia and test the hypothesis of an asymmetric monetary policy stance with respect to exchange rate fluctuations for the period 2001-2015. Since Russia is transitioning to the new regime, the findings of this work will be of a high interest for the monetary authorities.

A considerable number of academic papers investigate inflation factors and exchange rate pass-through in Russia. Most of the works pay attention to the asymmetric effect of the exchange rate on inflation rates as a part of the monetary policy and price level (Ponomarev et al, 2014). I discuss them in detail in chapters five and six. However, my analysis differs from the rest of the literature in many aspects. First, it investigates a different period. My analysis starts from 2001 and ends in 2015. More than that, I analyze the behavior of the economic factors in two different periods: before the Global financial crisis of 2008 and after. The analysis of the two different periods allows to investigate the evolution of the CBR's monetary policy throughout time. Second, I define two separate variables for the exchange rate appreciation and depreciation for estimating the asymmetry of Russian monetary policy stance, and their independent effect on inflation dynamics. Although there is a vast literature investigating the importance of exchange rate in developing economies, including Russia; I think, there are no other studies investigating the importance of exchange rate for Russian inflation and monetary policy, setting behaviors and utilizing econometric Vector Autoregression model.

The main contribution of this study is that I pay attention to the asymmetric effect of the exchange rate dynamics on the short-term interest rates, as one of the basic monetary policy instrument of the CBR. I claim that the analyses that I use in the chapters five and six have not been utilized before neither for the investigation of factors influencing inflation in Russia, nor for the asymmetric behavior of Russian monetary policy.

The main finding of this study is that a vector autoregressive model with the variance decomposition (VDC) and impulse response function (IRF) on inflation

demonstrate that the supply side factor, exchange rate, is the most important factor of the inflation rate in Russia in the period under investigation. Demand side factors do not play a big role in the dynamics of Russian inflation. The inclusion of exchange rate appreciation and depreciation variables into the model reveals that Russian inflation is more affected by the exchange rate depreciation. Especially after the Global financial crisis of 2008, the effect of the exchange rate depreciation on inflation dynamics became enormously high. Furthermore, the CBR exhibits the asymmetric behavior towards the dynamics of the exchange rate in the period under investigation. It tolerates appreciation and applies aggressive measures to curb depreciation. Further analysis of the two separate periods demonstrate that although CBR, before the Global financial crisis of 2008, had more or less symmetric response to depreciation or appreciation of the exchange rate, while during the period after the crisis, Bank authorities started to tolerate appreciation, and respond depreciation.

After the introduction chapter, I explore the evolution of Russian economy since the collapse of the Soviet Union, in the second chapter. I start the investigation from the early 1990s. Relying on the statistical data of the Russian Central Bank, I trace the evolution of the most important economic indicators.

In the third chapter, I look at the evolution of the Russian financial system closely. I investigate the structure of the banking system in Russia. The chapter shows that the CBR was mainly concerned about the value of domestic currency. It has considerably been intervening on foreign exchange markets in order to support the level of the exchange rate. Meanwhile, decreasing inflation has been also one of the main important tasks for the monetary authorities. Although officially Russian economy has been following managed floating exchange rate regime, the CBR has been announcing target inflation level for each year. Subsequently, in 2008, the Bank announced a future transition to the inflation targeting regime by 2015. Taking into attention the importance of the exchange rate for Russian monetary policy, second section of the chapter includes the investigation of the exchange rate policy of the CBR.

In the fourth chapter, I theoretically investigate the role of the exchange rate in an economy I frame a theory on exchange rate pass through channel and the effect of exchange rate dynamics on the economy. Further, I consider exchange rate pass through to domestic price level with respect to different exchange rate regimes.

In the fifth chapter, I apply econometric methods in order to find the factors influencing inflation in Russia. I start the chapter with the investigation of the literature on the factors of inflation in developing countries in general and in Russia in specific. Using vector autoregressive model, I find that the supply side factors appear to be the most important in shaping the inflation in Russia. Specifically, the changes in nominal exchange rate influence the dynamics of inflation. Detailed analysis of the influence of exchange rate appreciation and depreciation on inflation shows that the latter has greater impact on the price level. Furthermore, the analysis of the period before the crisis, indicate that during 2001-2007, inflation was affected by both exchange rate depreciation and appreciation almost identically; while after the crisis it was mostly affected by the dynamics of exchange rate depreciation.

In the sixth chapter, I analyze the asymmetric monetary policy stance with respect to fluctuations in the exchange rate. For this purpose, I use a classic monetary policy reaction function. The results of Variance decomposition and Impulse Response function for the interest rate for the period 2001-2015 show that monetary authorities tolerate exchange rate appreciation, and extensively respond exchange rate depreciation. The results are not surprising, taking into attention that Russia shares many characteristics of developing economies. Developing economies are generally concerned with the fluctuations of the exchange rate, because it has a high effect not only on inflation, but on many other economic indicators, and on overall economic development of the country. Even under the officially free-floating exchange rate regimes, they implement interventions in the foreign exchange markets, in order to limit large shifts of the exchange rate. Second section of the chapter concentrates on the investigation of the exchange rate effect on the short-term interest rate within the two separate periods: 2001-2007 and 2009-2015. The findings prove that the impact of the exchange rate on monetary policy instrument increased significantly in the second period. It caused strong asymmetric response from the monetary policy instruments to the exchange rate depreciation.

The last chapter is the conclusion of the study. In this chapter, I summarize the results of the analyses, consider possible explanations of the results and point limitations of the study. The chapter also includes the ideas on future studies and research ideas, related to the present work.

CHAPTER 2

RUSSIAN ECONOMY SINCE 1990

The collapse of the Soviet Union deteriorated the economic life in all of the former Soviet Republics, including Russia. After the transition from centrally planned economy to market-based economy, Russian economy has faced the biggest currency devaluation of the modern world and many other economic downturns, for the last three decades During this period, high inflation was one of the central problems for the CBR. So, investigating the evolution of modern Russian economy can enable one to understand current issues in Russian economy better.

In order to see the whole picture clearly, I will investigate the Russian economy in four separate periods in this chapter.

Table 2.1. Average values of main Russian economic parameters.

Period	Average inflation, %	Average short-term interest rates, %	Average exchange rate, rubles per $1 US	Average GDP growth rate, %
1991-1997	442.65	114.99*	2291.89	-6.74
1998-2007	22.73	12.18	27.062	5.85
2008-2010	10.87	9.66	27.66	0.64
2011-2015	7.02	7.41	42.4	2.41
* Average refinancing rate				

I start the investigation of Russian economy from the period 1990-1997. This period can also be called as the transition period. In this era, Russian government was dealing with the transition from Soviet central-planned economy to Russian market-based economy. The second part analyzes the period 1998-2007, when weak Russian economy had to tackle with its first financial crisis and the biggest default. In this part, I explain the causes of the economic crisis of 1998 and the results of anti-recessionary measures applied by the CBR. In the third section of the chapter, I

look at the period 2008-2010, which includes the Global financial crisis of 2008 in Russia and developments after the crisis. In this part I explore the policies which the CBR implemented after the crisis, and how effective they were. Also, I study possible reasons why the crisis hit Russian economy stronger than economies of other countries. The fourth section of the chapter explores the period 2010-2014, which is characterized with the slowdown in Russian economic growth. In this part, I focus on the recent policies implemented by the CBR, and policies of the Russian government. This part also investigates the recent financial crisis in Russia, which started in the end of 2014. Table 2.1 represents average values of the most important economic variables for each of the periods. The last section of the chapter concludes my findings and arguments.

The reason why I separated periods in this way, is that I want to pay more attention to the crises which Russian economy experienced recently: the global financial crisis in 2008 and modern economic crisis in 2014. Also, since the reform of Russian domestic currency took place in 1997, I include the investigation of the crisis in 1998 to the second period. This periodization lets to follow the dynamics of exchange rate in a more comfortable way.

2.1 The transition period: 1990-1997

The history of modern Russian economy starts in the early 1990s. In 1987, Russia started long transition from centrally planned economy to market-based economy. The transition period was called "perestroika"[1]. New economic structure of the country and new economic regime required well-conducted fiscal and monetary policies.

In 1991, the first president of Russia Boris Yeltsin offered an ambitious plan for economic reforms, which was similar to Poland's "shock therapy" reform plan. A shock therapy promotes economic, political and social change (Murrell, 1993). Deputy prime minister Yegor Gaydar, under the guidance of Boris Yeltsin, formulated a shock therapy reforms for Russia, which included a sharp decrease in

[1] Perestroika (English: "restructuring") was a political movement for reformation. It implied the transition to the market based economy. However, the period of perestroika involved combining centralized planning with elements of a market economy (Balassa, 1990).

government spending, imposition of new taxes, restriction of the money supply growth, removement of the old supply system, removement of the price controls, relaxation of rules of foreign exchange trading, liberalization of imports and privatization (Murrell, 1993). First, the government implemented price controls on goods, energy, and food. Second, as a part of efforts to organize Russian tax system the government introduced Value Added Tax, equal to 28 percent, also income tax, business income tax, import tariffs, export taxes, taxes on domestic energy use, and new taxes on oil and natural gas import. Third, taking into account fast ruble devaluation, a fixed exchange rate system was introduced. These reforms appeared to be more radical than the shock therapy in Poland. Popov (2001) argues that shock therapy in Russia led to the unprecedented output loss, large supply side shock; and the whole transition to the market-based economy turned into a chaotic process (see figures 2.3, 2.4, and 2.5).

As I discuss later in the chapter three, the CBR became independent only in 1993. Thus, being also responsible for the government debt payments, the CBR financed its budget deficits mostly by money creation, which resulted in higher inflation rates (Graniville et al, 2005). Figure 2.1 shows a sharp increase in inflation rates, up to 2000% in 1992.

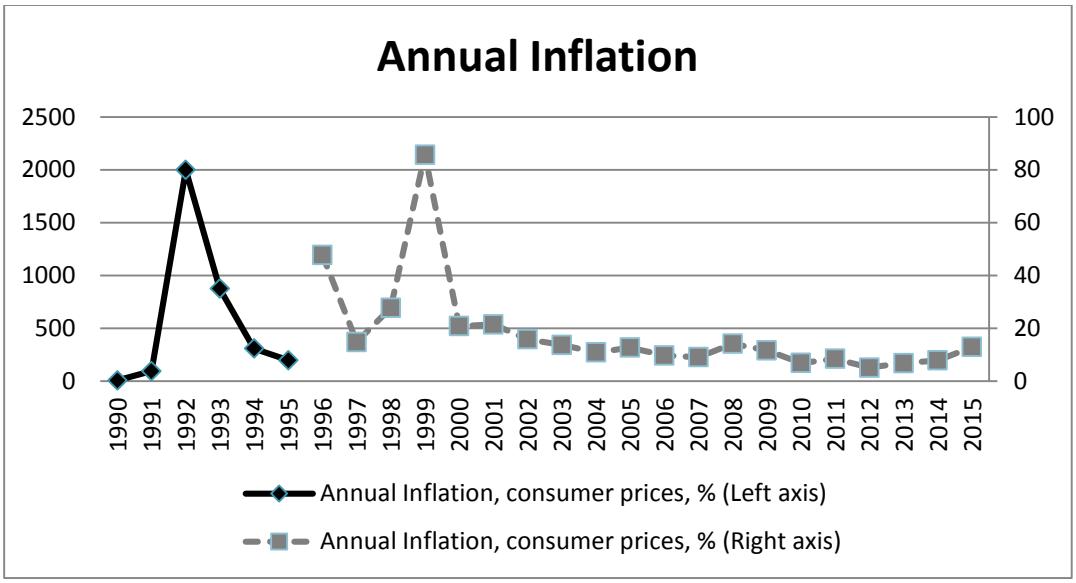

Figure 2.1. Inflation, consumer prices (annual %). (Source: cbr.ru)

In July 1992, ruble was allowed to be exchanged for US dollar for the first time since the transition. The equivalent value of $1 was 144 rubles. Later on, ruble started to lose its value.

In autumn1994 a panic erupted in foreign exchange market. October 11th, 1994 is called the “Black Tuesday”. It is the day when ruble lost its value by 27 percent in a few hours (Curtis, 1998). The effectiveness of monetary policy in that period was halted by the institutional break due to the transition from centrally planned to market-based economy. Sharp ruble devaluation resulted in high inflation: up to 300% in 1994 (see Figure 2.1).

In 1995, the CBR announced an exchange rate corridor system for the ruble, according to which, the level of exchange rate should stay within the band of 4300 rub/dollar – 4900rub/dollar amounts. Tightened monetary and fiscal policies helped to accumulate reserves, which were used to support the value of ruble. Figure 2.11 shows the change of the foreign exchange reserves in percent. As one can see, in the end of 1995, there was a significant increase in the value of ruble, the exchange value of $1 US decreased. However, in 1996 exchange rate corridor borders moved downward and became 5000-5600 rubles per $1 US (see Figure 2.2).

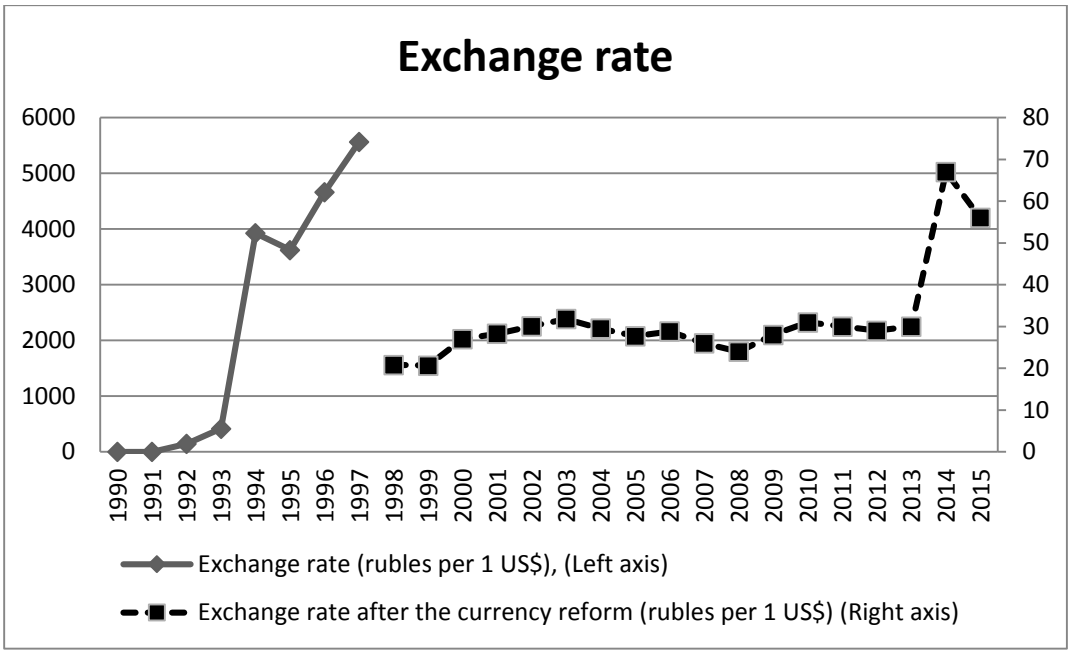

Figure 2.2. Exchange rate. (Source: cbr.ru)

Curtis (1998) notes that Russian government issued bonds for the first time in its history in 1994. Government bonds were mainly used to finance budget deficit and were sold at market rates. As one can see from Figure 2.3, government balance was negative in 1994, and positive in 1995.

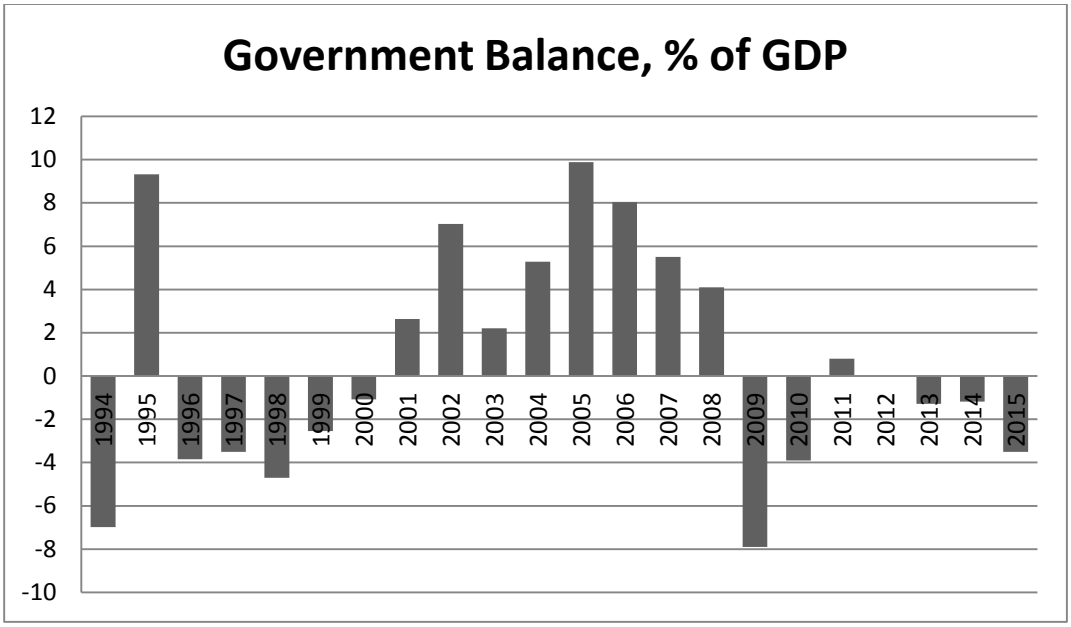

Figure 2.3. Government Balance of Russian Federation, % of GDP (Source: www.cbr.ru)

Within a couple of years after the transition, nearly all industrial branches suffered. First of all, the shift from the centrally planned economy to privatize one was unorganized, and this caused painful consequences. Privatization is an economic program, which was supposed to help with the transformation of the Soviet Command system into a market economy. The original aim was to create profit seeking corporations, privately owned by outside shareholders[2], who were free from government subsidies (McFaul, 1995). Most of the government enterprises were privatized through employee buyouts and public auctions. Russians purchased shares of different enterprises. To the end of 1993, almost one-third of all enterprises have been privatized.

[2] McFaul argues that the original aims of privatization were not fulfilled. The particular set of institutions of Russia was not capable of realizing the main objectives of the new policy. Leaders of the big enterprises during the Soviet times already seized many of the rights associated with the ownership of the property. Thus, the biggest shareholders were not from the outside of the corporation.

Moreover, production shifted from heavy industry to consumer production. Russian service and retail sectors started to play an increasingly vital role in the economy, accounting for nearly half of GDP in 1995. The production level decreased. This also result in the loss of profits of the enterprises and, as a result, reflected negatively in workers' wages. The privatization left many of them without jobs, simply because plants were not producing in the same pace. In general, education of the population was high, but people, educated in Soviet times might not be ready to work in a market economy. According to the Russian Labor Source Balance ("BTR") by the year 1994, 53% of the labor force had been employed in the heavy industry sector, and only 37% in the service sector; on the contrary, in the United States the situation was completely reverse (Curtis, 1998).

Figure 2.4 shows that unemployment situation was very unstable, especially in the first years of the transition period. It is worth claiming that during the first years of the transition it was very hard to collect viable data on unemployment rates, mainly because some unemployed people were being recruited in the private sector. Another reason is that, sometimes the number of officially employed people was different from the number of people actually working. More than that, the structural changes in the Russian Statistical Service "Rosstat" also contributed to the difficulties of the data collection process. Therefore the unemployment rates for the 1990s are not be very reliable[3].

[3] Data reliability issue is relevant for other variables as well.

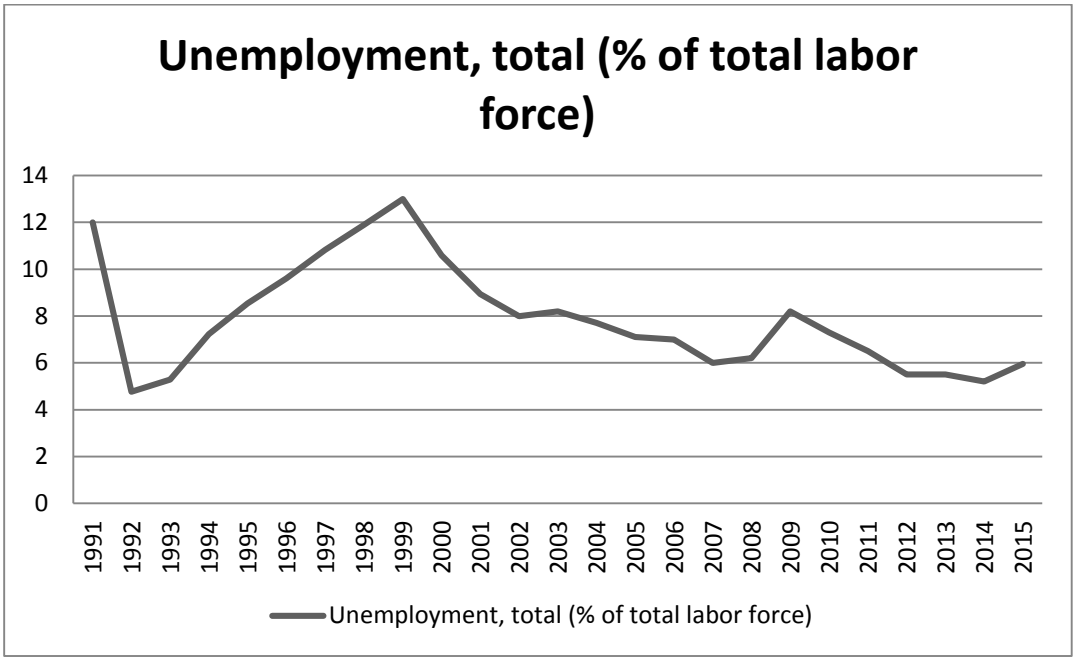

Figure 2.4. Unemployment, total (% of total labor force). (Source: www.imf.org)

The “Black Tuesday” in October 1994 sank Russian economy to the bottom. It is the day when the ruble lost 27% of its value in one day (Brodsky, 1997). As one can see from Figure 2.1, the inflation rate was 300%, and Figure 2.4 shows an increase in the unemployment rate in 1994. Figure 2.5 indicates a fall in GDP growth as well. The GDP growth was negative during the years of the transition, and until the end of 1997. It can be partially explained by the loss of the significant part of the territories after the disintegration of the USSR: Soviet Republics were separated into independent countries, as Kazakhstan, Ukraine, etc., thus Russia lost significant part of its revenue coming from agricultural, heavy industry and other sectors. More than that, the fall in output of Russian heavy industry had a great impact on the country’s GDP, because it had an important role in the total production.

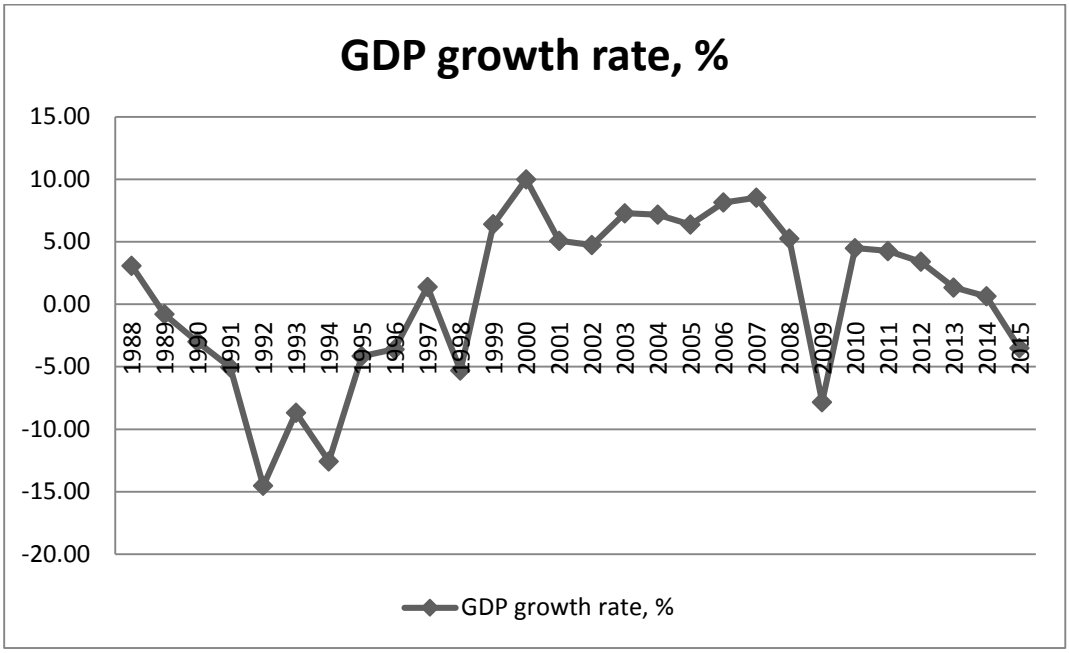

Figure 2.5. Russian GDP annual Growth rates, %. (Source: www.imf.org)

Russian financial and banking sector also went through many reforms during the transition years. First of all, after the "perestroika" of 1987, Soviet banking system became two-tiered. The Gosbank – government bank, already lost its monopoly and other big banks began to provide credits to different sectors of the economy. There are the Agroprombank – for the agricultural sector, the Zhilsotsbank – for the private sector, the Promstroybank – for the industrial sector, and the Sberbank – main savings bank (Johnson, 2001). After the transition, these three banks became independent commercial operators, forming the foundation of the Russian commercial system. In 1991, the government bank "Gosbank" was reorganized as the Central Bank of Russia.

Second, according to the law enacted in April 1995, the CBR earned a legal authority as the main bank of Russia (Curtis, 1998). The responsibility of the bank includes the control over money supply, the monitor of the transactions among banks, the implementation of the federal budget, the servicing of Russian foreign debt, the control over exchange rate policies, and the licensing of commercial banks. Money supply control is carried out through lending funds to commercial banks. In 1995, the CBR introduced discount rate for other commercial banks' borrowings, in order to meet "Bank for International Settlements" standards.

The appearance of the commercial banks became another economic innovation of the post-Soviet Russia. By the end of 1995, more than 3000 commercial banks were operating in Russia (Curtis, 1998). However, the CBR's tightening requirements, in particular on high reserve requirements, caused bankruptcies among small banks, and they desperately merged with bigger commercial banks. By the beginning of the 2000s, there were only 1000 commercial banks operating, providing different kinds of financial services to enterprises. Commercial banks started to provide new services for Russian citizens: foreign exchange service, investments service, and corporate service.

There were no foreign investments during Soviet times due to political reasons. Thus, first foreign investments came only in 1992 after the Foreign Investment Law was enacted in 1991 (see Fig.2.6). According to the Law, foreign investors are promised to be treated in the same way as domestic investors, and they are protected against nationalization. Curtis (1998) claims that these investments were directed to trade and catering, financing insurances and pensions, fuel industries, and chemical industries. First investments did not flow in high amounts, due to the instability in the Russian economy.

Instability of Russian economy during the transition years resulted in the emergence of a financial environment that was not attractive for investors. It caused a depreciation of domestic currency and more than $110 billion capital flight out of Russia in the period 1993–1997 (Soubbotina et al, 2000). More than that, inflation in Russia got worse and the country had poorly developed tax collecting system, tightened exports and imports regulation, all of these in general constituted not a safe economic environment for foreign investors.

After the transition to the market based economy, international financial organizations became the most important creditors for Russia. Thus, Russian monetary authorities received loans form the IBDR (equal $5.1 US billion) and IMF organizations in 1997 (Annual report of the CBR, 1997). In the Figure 2.6.2, one can see a significant increase of the portfolio investments in 1997. Although total inflow of foreign investments during the year increased by 1.7 times, portfolio investments increased more than 5 times (Annual report of the CBR, 1997). The CBR explains a huge increase in portfolio inflows as follows:

"…In 1997, the restructuring of Russian indebtness on the debt of the former USSR to the London Club, …, improved the structure of Russia's foreign debt, making some overdue indebtness a part of the regular debt. The CBR issued bonds worth $22.1 US billion for the principal and $6.1 US billion for overdue interest. This operation was reflected in the Balance of payments as a decrease of the public sector's debts on credits and a corresponding increase in the debt on portfolio investments…"

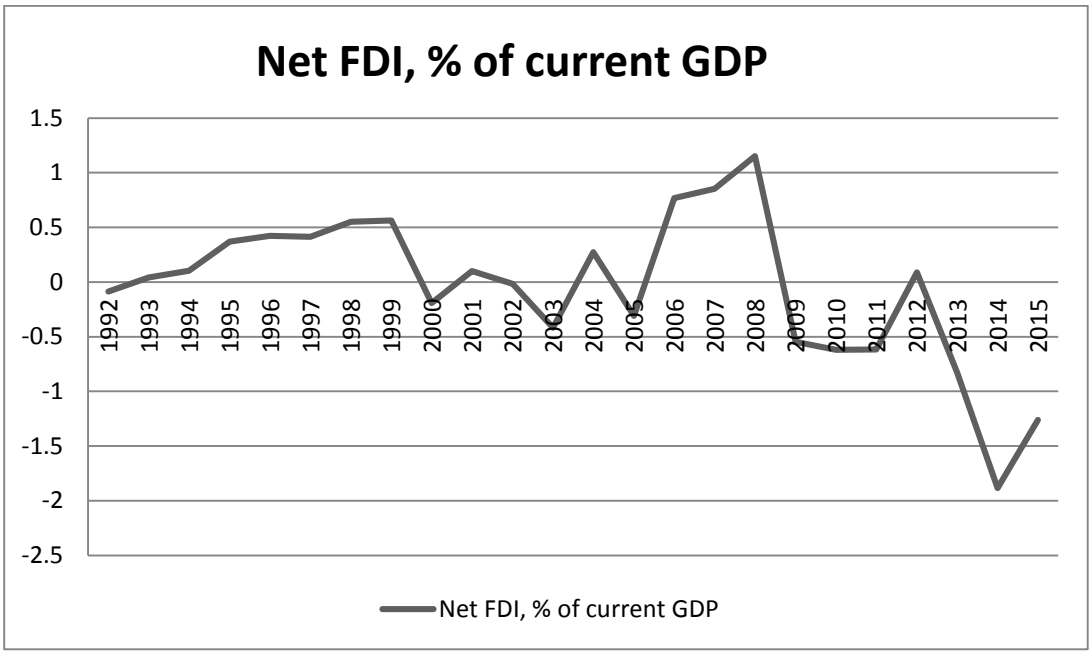

Figure 2.6.1 Foreign direct investments, percent of GDP (Source: CBR Statistics)

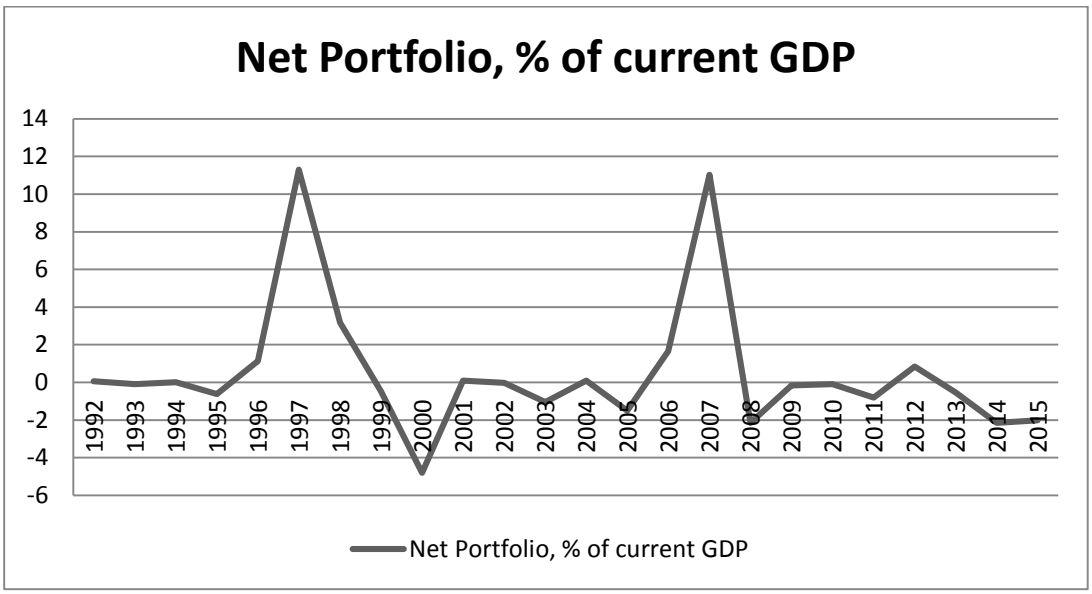

Figure 2.6.2 Portfolio investments, percent of GDP (Source: CBR Statistics)

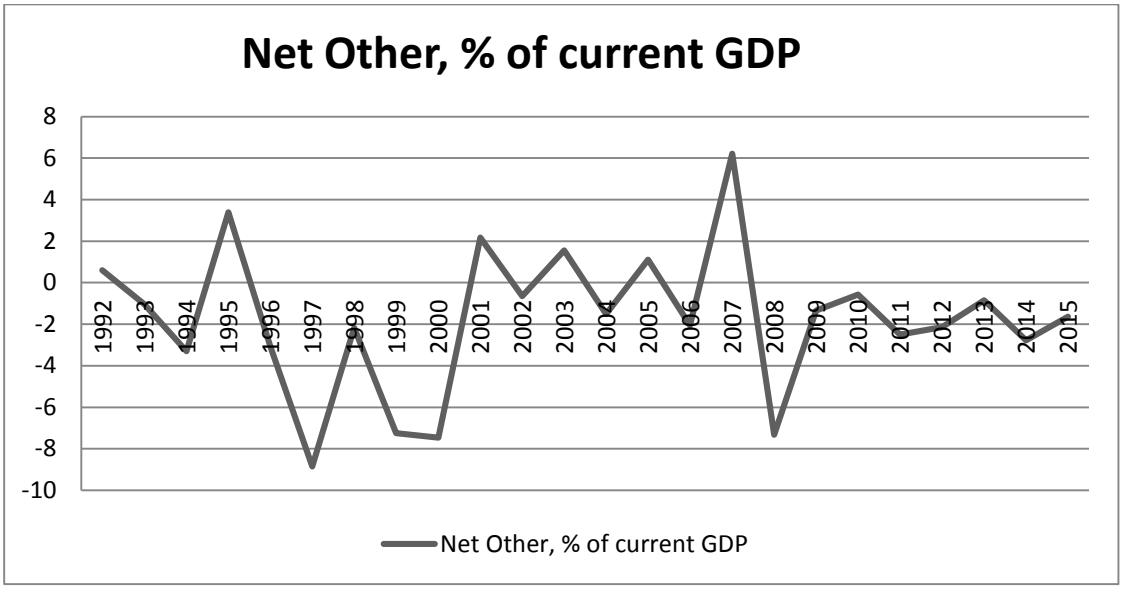

Figure 2.6.3. Other investments, percent of GDP[4] (Source: CBR Statistics)

[4] The data is presented in accordance with the BoP5 version, where negative values indicate the outflow of investments and that this form of resident investment in foreign assets exceeded the corresponding inflow of foreign investment.

The composition of financial flows is important; the ratio of FDI and Portfolio investments plays a crucial role in defining the financial stability of the country. As one can see from the figure 2.6.1, portfolio investments were dominating in financial flows coming to Russia: while FDI investments barely constituted 1% of the GDP, portfolio investments are taking much larger values. Since, the latter can easily enter or leave the country, the economy cannot rely on them.

Feasible investments were not coming to Russia until 1995 due to the economic chaos after the transition and privatization program. In general, the amount of FDI investments in Russian economy was increasing, to the contrast of volatile portfolio investments. The implementation of foreign exchange interventions in recent years, ruble devaluation, and the slowdown in economic growth since 2010 (see Fig.2.5) shook the economic stability

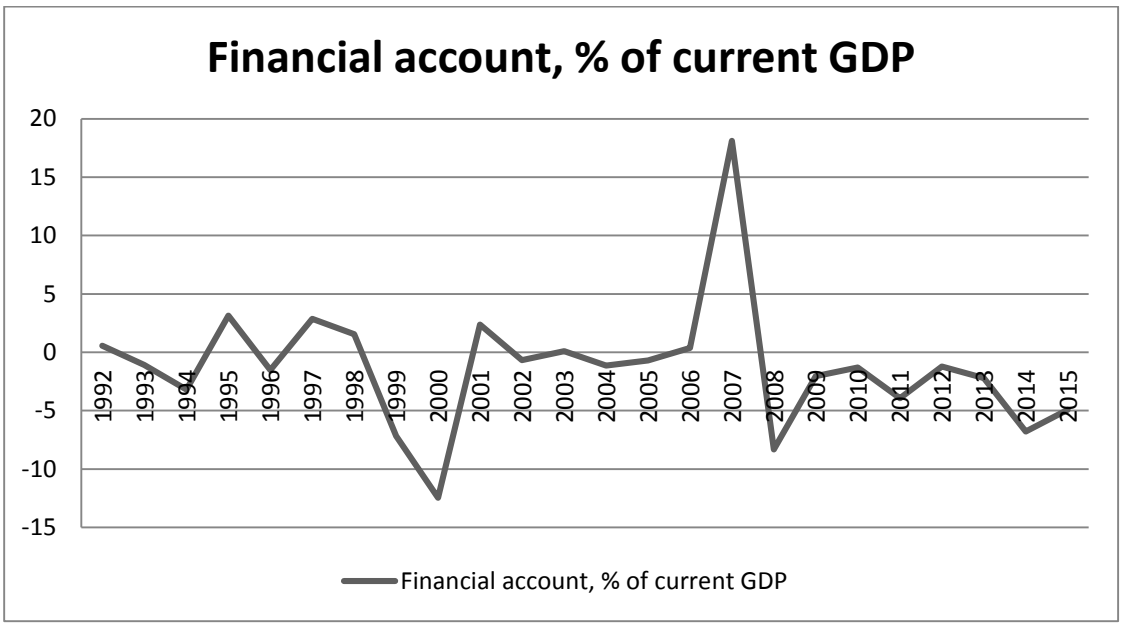

Figure 2.7. Financial Account.

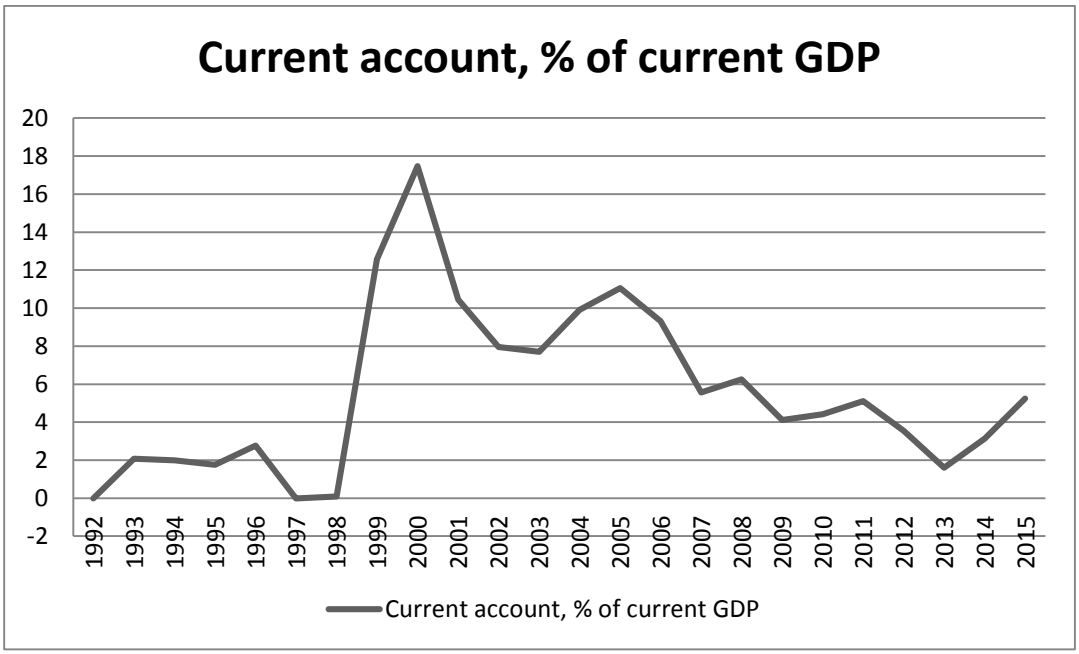

Figure 2.8. Current account balance, percent of GDP. (source: CBR statistics).

The financial situation of Russian economy can be overviewed in Figures 2.7 and 2.8. Although the financial account was positive in 1992, when Russia started receiving foreign financial flows, it was negative until 1995. In 1995, the economic situation in Russia became more stable.

of the country and worsened financial environment. All these events lead to the loss of investors' confidence in domestic assets and currency. Thus, from 2012, one can see a significant capital outflow, that is decreases in FDI and portfolio investments.

Russian international trade also evolved since the collapse of the Soviet Union. In 1993, Russian government introduced a liberalized import regime. The imports relative to GDP increased significantly after 1993 (See Fig.2.9). At the same time, Russia's exports relative to GDP have almost doubled since 1990. After the economic transition, Russian trade changed its direction: During the Soviet age, trade was oriented to the East, China; after the transition Russian government started selling goods to Europe, North America and Japan (Curtis, 1998).

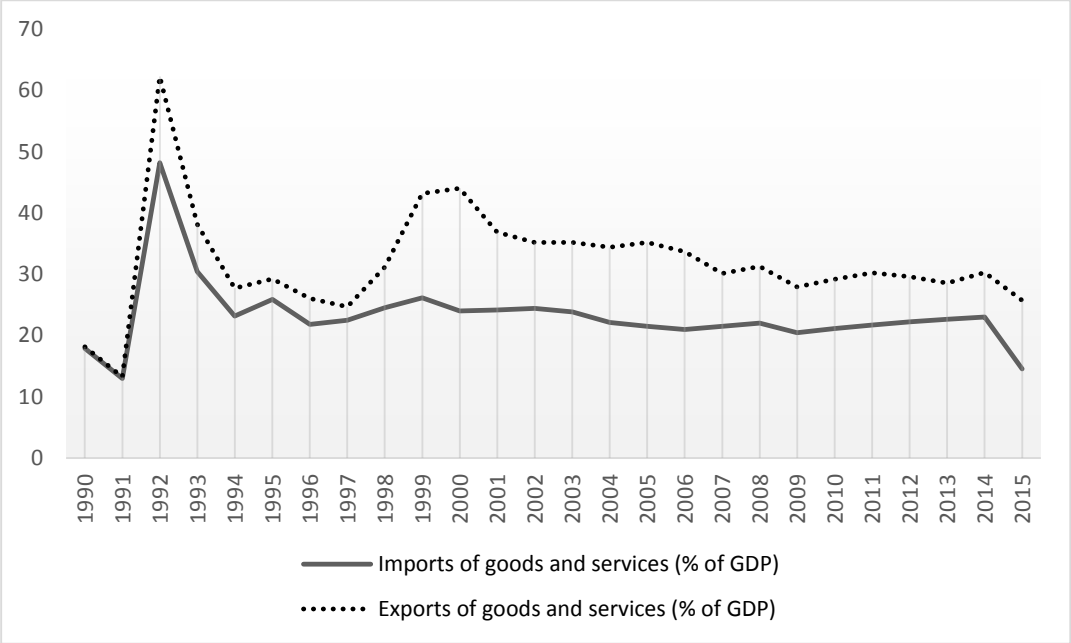

Figure 2.9. Import and export of goods and services.

The most important components of Russian GDP are oil and natural gas production. In 1980, Soviet Russia became the leader in global oil production. By 1987, oil production reached its maximum 624 million tons of oil (Vatansever, 2010). Collapse of the USSR in 1991 coincided with the collapse in oil industry. Due to the fall in oil prices (see Fig. 2.12), which had started in early 1980s, oil production became relatively unprofitable. In modern Russia the oil production decreased to 303 million tons by the end of 1996. Oil export decreased by 1 million tons relative to previous year. Low oil export revenues were reflected in GDP growth rates (see Fig. 2.5).

2.2 Economic crisis 1998 and economic growth 1998-2007

For the first time since the transition Russian GDP had a positive growth rate in 1997 (see Fig.2.5). During the period when Russian economy was running fixed

exchange rate regime, which, as Wiel (2013) claims, together with fragile fiscal position caused sensitivity of Russian economy to international spillover effects of financial distresses. As a result of fear of ruble devaluation and a default on the domestic debt, Russian bonds and currency markets collapsed, the interest rates rose compared to 1997 (see Fig. 2.10), and foreign investors rushed to withdraw their capital from the country. In the Figure 2.6.3, one can see negative values of net other foreign investments, which means the outflow of investments and that this form of resident investment in foreign assets exceeded the corresponding inflow of foreign investment.

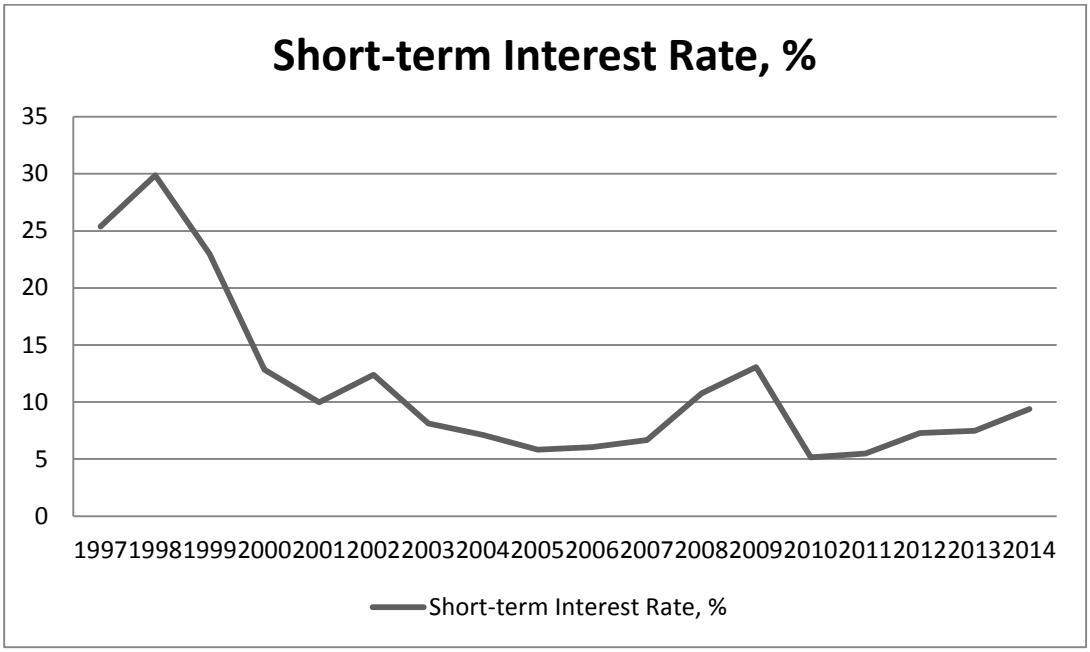

Figure 2.10. Annual Short-Term Interest rate, %. (Source: www.oecd.com)

1998 Russian crisis is related with the Asian crisis. A surge of capital inflows into Asian countries in the middle of the 1990s reflected in a rapid increase in lending. Stiglitz (2000) sees the main cause of the Asian crisis in the rapid financial and capital market liberalization. He believes that the first thing to be done should have been an establishment of an effective regulatory framework. Graniville (2005) claims that in order to improve their liquidity positions, Asian banks started selling their holdings of Russian high-yielding bonds. The latter put a pressure on Russian ruble and on the Russian bond market. In order to defend the ruble, the CBR increased refinancing rate and let interest rates increase to a necessary level to keep exchange rate within the band. Such a high level of interest rate was fiscally

unstable and led to the domestic debt default and currency devaluation in August 1998.

In August 1998, Russian government applied emergency measures, including significant ruble devaluation (exchange rate corridor borders were widened), default on short-terms treasury bills, and moratorium for 90 days on payments by commercial banks to foreign creditors. In September, the government announced the transition to floating exchange rate policy. The immediate impact of the currency devaluation is the rise in inflation (to 27% in 1998 and 87% in 1999 (see Fig. 2.1)). Inflation increased dramatically because Russia began to import many intermediate and final goods.

After ruble devaluation, many Russian citizens lost their deposits in banks and savings. The trust in banks was lost and banks deposits decreased significantly.

Wiel (2013) finds the reasons of the crisis in imperfect tax collecting system, weak Russian economic institutions, their reliance on short-term foreign capital, and expensive war in Chechnya, which cost over $5 US billion.

Another reasonable cause of currency devaluation is the impossible "trilemma" combination: before the crisis Russian government was simultaneously running fixed exchange rate policy (exchange rate corridor), free capital flow, and trying to conduct independent monetary policy. Pegged exchange rate attracted foreign direct investments (see Fig. 2.6.1). Furthermore, appreciated exchange rates stimulated growth of Russian citizens' investments to foreign markets (see Fig. 2.6.2 and 2.6.3). Higher interest rates than in the rest of the world attracted more investors seeking for short-term high-yielding investment opportunities. More than that, free capital flow policy let these capital inflows come in an unrestricted manner. A sudden change in investors' decisions led to the sudden stop of capital inflows, making strong pressure on the domestic currency value. Russian ruble suffered from speculative attacks, because the ruble value was unreasonably high in comparison with the value of dollar, which came out of fixed exchange rate policy. When foreign exchange reserves were not able to sustain ruble value anymore, the government made a decision to let the exchange rate float after spending $6 US billion (see Fig. 2.11.1). The latter resulted in severe devaluation. Figure 2.11.1

shows that significant amounts of foreign exchange reserves were depleted in 1998, which accompanied by a fall in GDP growth rates (see Fig. 2.5).

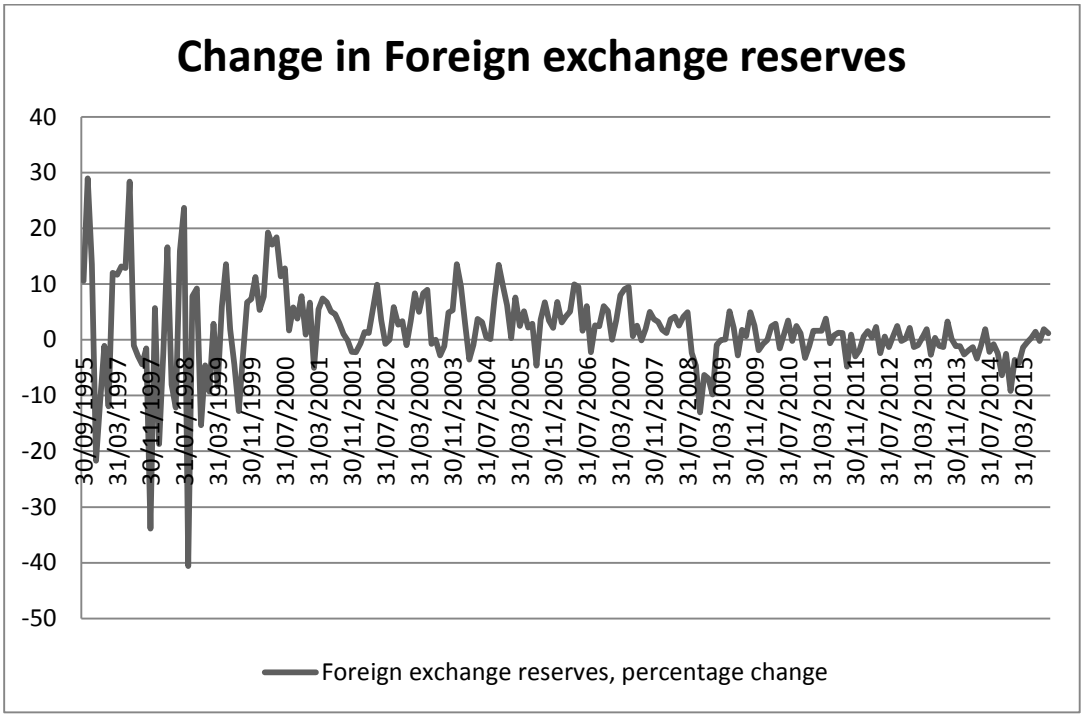

Figure 2.11.1. Percentage change of foreign exchange reserves. (Source: www.cbr.ru)

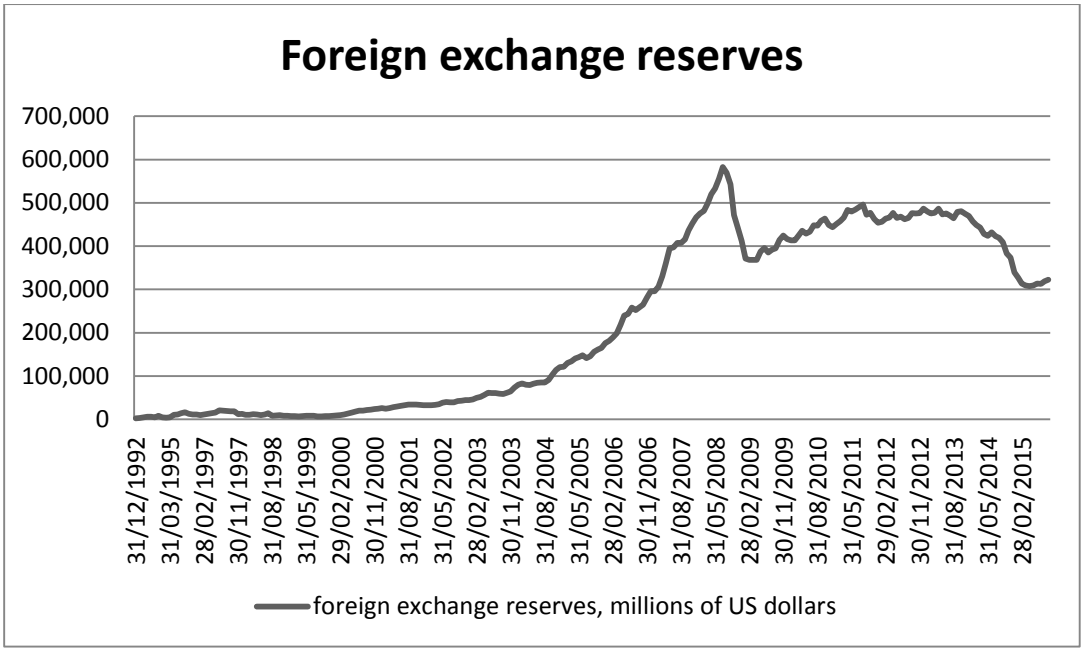

Figure 2.11.2. Foreign exchange reserves (Source: www.cbr.ru)

The crisis had severe effects on the whole Russian economy as the outflow of foreign portfolio investments (see Fig.2.6.2), a fall in current account balance and negative financial account (see Fig.2.8 and 2.7 respectively), deterioration in banking sector, and a negative GDP growth rates (See Fig 2.5). Nonetheless, the majority of Russian enterprises were not relying on banks due to the poor development of the banking services, the crisis hit all types of industries. It caused losses in production, late wages payments, and growth in unemployment (see Fig.2.4). Many of the enterprises of that time had their short-term debt obligations in dollars. Thus, sudden domestic currency devaluation left them unable to pay their debts, causing their bankruptcy.

Figure 2.2 indicates a huge difference between the exchange rates in 1997 and 1998. It is explained with the denomination of ruble. The value of Russian currency was very low in terms of US dollars: more than 5000 rubles per one dollar. Thus, the CBR decided to get rid of three zeros, and the price of dollar became 5.6 rubles per $1 US. Initially the exchange rate corridor was fixed at 5.27-7.13 rubles per one US dollar. However, the effect of the Asian crisis forced monetary authorities to adopt floating exchange rate regime, and the domestic currency lost its value significantly. Exchange rate fell to 20 rubles per $1 US.

Rise in oil (see Figure 2.12) and commodity prices helped Russia to recover from the crisis within a short time period. It is a well-known fact that oil is one of the main exports of Russia. After the crisis oil prices started to rise (see Figure 2.12). Figure 2.13 shows that oil export, as a percent of total Russian export, sharply decreased after the crisis. The share of oil export grew significantly after 2000, when oil prices started growing as well (see Fig. 2.12).

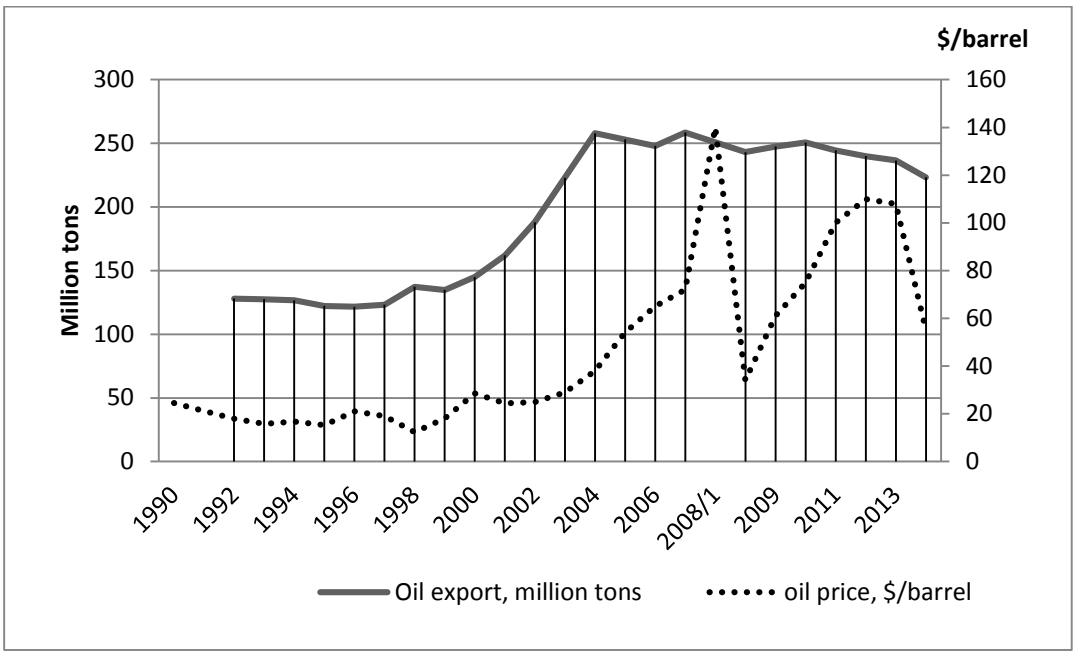

Figure 2.12. Oil export, million tons; and Oil price, US $/barrel (Source: www.cbr.ru)

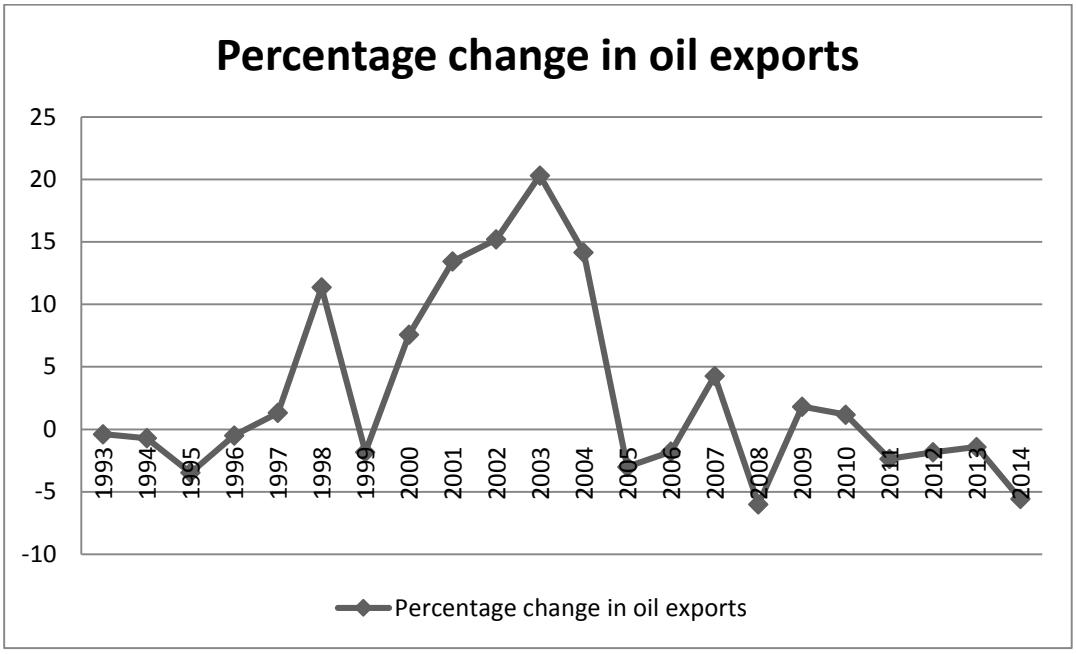

Figure 2.13. Oil export, % of Total export. (Source: www.cbr.ru)

Graniville (2005) considers the 1998 crisis as a positive event for the development of Russian economy. The crisis brought about radical changes in fiscal and macroeconomic policies. In 2000-2002, Russian government implemented a comprehensive tax reform. Russian economy entered a stable growth period in

2002. Figure 2.5 indicates that average GDP growth rates rose to 7% from 2002 to 2007.

The disposable income doubled, foreign direct investments increased, credits to the population rose (see Fig. 2.14) so as the consumption. Figure 2.4 shows a fall in the unemployment rates. Statistics related with Russian economic suggest that the number of people living below the poverty line decreased from 30% in 2000 to 14% in the end of 2008. More than that, the economy could at last enjoy budget surpluses (see Fig. 2.3). After the crisis, inflation rates fell to 20.7% and 21.5% respectively in 2000 and 2001 and remained relatively low.

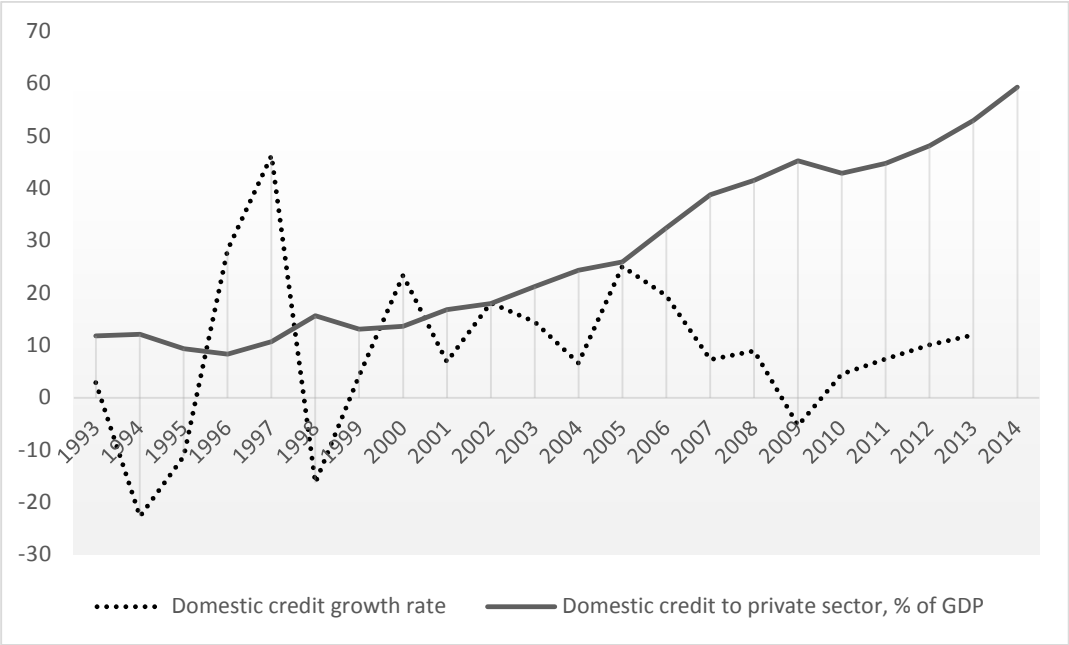

Figure 2.14. Domestic credit. (Source: www.cbr.ru)

Between 2002-2007, Russian position in the world economy became stronger. Russian citizens actively started taking part in foreign investment process. At the same time, bigger amounts of foreign financial flows began to come to Russia. Figures 2.6.1-2.6.3 and 2.7 show a significant rise in foreign inflows in 2007. Annual report of the CBR points that in the first half of the 2007, Russia received over 80% of the previous year's total net capital inflow to the private sector.

Petridou (2008) claims that investments of the European Union countries to the BRIC countries increased by 53% in 2007. The main reason was the growth in

investments to oil-rich Russia. Petroleum, chemical, rubber, and plastic products sectors attracted the most part of the investments to Russia by EU countries. Large capital inflows pushed the Balance of Payments surpluses to the highest figures. They became an important source of reserve accumulation in 2007 (WorldBank Russian Economic report, 2008). The expansion of the international reserves reached $172.7 US billions (Annual report of the CBR, 2007). Financial reserves in 2007 exceeded $500 US billions (see Fig. 2.11.2).

2.3 Global financial crisis in Russia 2008-2010

In 2008, the US financial catastrophe had a huge effect on Russian economy. The increases in oil prices since 2000 resulted in significant trade surpluses, giving false sense of security. But, in fact, Russian economy became more dependent on the volatile prices of energy resources.

The crisis hit Russian economy harder than economies of many other countries. Sharp decreases in oil prices in 2008 (see Fig. 2.12) had a severe effect on Russian revenue. In the beginning of 2008, the price of barrel of oil was $140 US, and in the end of 2008, it fell to $34 US per barrel. The crisis harmed foreign trade levels as well (see significant decrease in both imports and exports in 2009, Figure 2.9), since it caused a sharp decrease in foreign investments (see Fig. 2.6), and toughened external credits conditions. Russian foreign exchange reserves fell by $131 billion in the period 2008-2009 (see Fig.2.11). Barannik (2010) claims that the conflict in Georgia in August 2008, became one of the reasons behind the severe impact of the crisis on the Russian economy.

October 2008 started with a fall in oil prices from $100 US per barrel to $70 US. Later on in November, the price of Urals oil fell further to $50 US per barrel. As a result, GDP growth rates turned to negative[5] (see Fig. 2.5).

[5] Kazakhstan, a big oil exporter of the Asia, also experienced an economic slowdown and fall in GDP growth levels after the fall in oil prices in 2008 (Kuralbayeva et al, 2001). Similar situation happened in Venezuela. Oil export revenues of Venezuela form 97% of its total export revenues (Weisbrot et al, 2008); thus, a shock to oil prices lead to significant decrease in GDP growth rates. Both of the countries experienced large swings in their domestic exchange rate levels, as a result of fall in oil prices and of the effect of Global financial crisis (Kuralbayeva et al (2001) and Jahan-Parvar et al (2011)).

According to the annual reports of the CBR, the first task for the Bank was to fight the liquidity crisis. It provided liquidity for commercial banks, decreased reserves requirement, lowered collateral standards, provided unsecured credits, and started compensation mechanisms for broke banks. These policies were helpful for stabilizing the banking system (Annual report of the CBR, 2009)

However, at the time when most of the developed countries were applying quantitative easing program (i. e. decreasing interest rates) the CBR increased short-term interest rates (see Fig. 2.10). As a central bank in a developing country, the CBR was concerned about the fall in foreign capital inflows, thus, tried to attract investors by increasing interest rates.

The aftermath of the crisis referred to a deterioration of the whole Russian economy. In the real sector, due to the decreases in foreign capital inflows, many of the industrial enterprises suffered huge production falls. It had an impact on the labor demand and, as a result, increased unemployment (see Fig. 2.4). The number of poor people increased by 2.7 million people in 2009 (Barannik, 2010). As a result of the decrease in aggregate demand, the turnover in retail[6] decreased for the first time since 1999.

The devaluation of currency from 24rub/$ in 2008 to 31rub/$ in 2010 effected inflation rates (see Fig. 2.1) through mainly the upward pressure on import prices. Currency depreciation also deteriorated banks' balance sheets. Having short-term liabilities denominated in foreign currency lead to liquidity problems in banks. In order to solve liquidity problems, banks cut back lending (see Fig. 2.14), which further led to bankruptcy of some private banks. Trying to defend ruble devaluation, the government spent a significant part of foreign exchange reserves (see Fig. 2.11).

The crisis also reflected in the Russian economic growth: overall, during the crisis Russia lost 9.5% of the real GDP in 2009, and GDP growth rates fell to -7.82%.

[6] A year-over-year change in Russian retail sales was 18.6% in the period 2007-2008, and it decreased to -10% in the period 2008-2009.

2.4 The Russian economy in the period 2011-2014

Figure 2.5 shows GDP growth performance of Russia. As one can see, after 2010 GDP growth started to decrease and fall sharply after 2012. There are several factors behind this trend. The Minister of Economic Development, Ulyukaev (2013) considers three main reasons: decreases in oil export sales (see Fig. 2.13), decreases in credit demand in real economic sector, and the drought in south regions of Russia in 2011, which is the main provider of cereals.

The decrease in oil exports had a substantial effect on the overall economic situation, because the whole economic system relies on oil revenue. The volatility of world oil export prices showed that it is erroneous to have a natural-resource-oriented economy, as in Russia. It has already been noticed by the president Medvedev, D. during the Global Financial crisis in 2008, the situation unfortunately did not change (Fedosova, 2015).

Low GDP growth (see Fig. 2.5) caused the decrease in the prices of Russian assets. Thus, in September 2011, the RTS index (the main indicator for Russian funds market) started decreasing. After the fall in RTS index, foreign investors lost the trust in Russian assets and started withdrawing capital from Russia (see fig. 2.7). It was followed by further fall in assets' prices. All these events resulted in depreciation of Russian ruble (Annual Report of the CBR, 2011).

In the middle of 2013, the CBR (under the guidance of new head of the CBR E. Nabiullina) started active foreign exchange intervention (see Fig. 3.1) in order to smooth domestic currency depreciation, by spending foreign exchange (see Fig. 2.11.2) and gold reserves. This decision of the CBR worsened Russian investment environment. Since these policies were not effective, domestic currency continued depreciating and the CBR let ruble float and fall further in order to avoid currency speculative attacks.

In 2013 oil export prices notably fell one more time: from $106 US per barrel in 2013 to $60 US per barrel in the end of 2014. Since the majority of Russian revenue comes from oil export sales, the sharp decrease in oil prices (see Fig. 2.12) would have severe effect on the Russian budget. Nevertheless, the effect of fall in oil

prices was moderated with currency depreciation, i. e. the depreciation of the domestic currency allows getting the same amounts of oil export revenue in ruble terms, when oil prices fall (Khlebnikov, 2014).

Political issues also affected Russian economy during the downturns. As a result of military intervention in Ukraine, in 2014-2015, Russia is unlikely to have any foreign capital flow to recover from the crisis (Connolly, 2015). More than that, Russia's annexation of the Crimea and assistance to Novorossiya militants fighting Ukraine in the War in Donbass made the country less attractive to foreign investors. European countries and the United States responded to these events by imposing economic sanctions on Russia. These sanctions, on the one hand, contributed to further decline of the ruble value, what enforced Russia to respond sanctions by imposing embargo on some of imported goods. On the other hand, sanctions decreased financial connections of Russia with the rest of the financial world, lowering the risk that Russia's financial crisis would spread to other financial markets.

The ruble depreciation in 2014 (see Fig. 2.2) affected all sectors of Russian economy, including private sector: households tried to sell off Russian currency that was sharply losing its value, which lead to deeper depreciation. In addition, they started to purchase durable goods such as, household appliances, brown goods, jewelry and cars. Some foreign companies temporarily halted their business activities in Russia, due to high volatility of ruble value and its decline. Because of the instability of ruble, many Western financial institutions started cutting cash flows to Russian companies, causing significant capital outflow in Russia.

2.5 Conclusion

In this chapter, I analyzed the evolution of Russian economy since the collapse of the Soviet Union. Studying economic history of a country is a very useful tool in understanding its development, monetary policy tendencies and overall performance of monetary authorities. Furthermore, recognizing past mistakes helps avoiding them in the future.

The analysis of the Russian economy revealed that the CBR had to solve many difficult economic problems and crises. These were the Asian crisis of 1998 and subsequent greatest currency devaluation, fast economic recovery and growth during 2000-2007, the Global Financial crisis of 2008, the slowdown of the economic growth since 2010, and modern crisis which started in 2014. From table 2.1, one can see that during the first period after the collapse of the USSR and partially as a result of failed shock therapy reforms, Russia had the highest level of interest rates and negative GDP growth rates. During the period of economic growth, 1999-2007, the CBR could significantly decrease inflation, stabilize exchange rates and achieve positive GDP growth rates. However, the Global financial crisis of 2008, and modern economic crisis in Russia deteriorated main important parameters of Russian economy. Thus, the achievement of the economic stability is a number one target for Russian economic authorities.

As it is obvious, during the whole period they were mainly concerned about fluctuations of the exchange rate and high inflation rates. In order to have a full picture of the economic development, in the next chapter I will look at the central bank's policies, its decisions, and the logic behind them closely.

CHAPTER 3

CENTRAL BANKING IN RUSSIA SINCE 1990

Exploring the evolution of Russian economy since 1990 indicates that achieving economic stability has not been an easy task for the Russian monetary authorities. In this manner, the activity of the Central Bank plays a crucial role for the Russian economy. The third chapter studies the main objectives of monetary policy and instruments used to achieve them. Furthermore, one will see how the CBR responded crises, and how successful its policies were.

This chapter is mostly based on the official publications of the CBR. The chapter reveals that main targets for monetary authorities were price stability, inflation and exchange rate level. Although the CBR officially announces that lowering inflation is the prime aim of monetary authorities, in practice, one can notice that the Bank pays more attention to the stabilization of the exchange rate dynamics.

In the first section, I examine the Central Banking in Russia and the CBR's policies in chronological order. The section elaborates on changes in the interest rates policy, reserves requirements, foreign exchange interventions and inflation targets. Also, I investigate which aims were followed by monetary authorities while implementing certain policies, and whether these policies were successful.

I continue second section with the analysis of the role of exchange rate in Russian central banking. As will be explained in the first section, the CBR often carries out its monetary policy by taking into account the dynamics of the exchange rate. Thus, I consider how the exchange rate affects the economy, and how its dynamics are responded by monetary authorities. The third section is a conclusion of my arguments.

3.1 The Development of the Financial System in Russia

The CBR was founded in July 1990. However, the Soviet Gosbank (government bank) continued operating until the end of 1991, even when the CBR took over all central banking responsibilities (Buch, 1996). The CBR achieved total monetary policy independence from the government only in 1993, and earned its legal competency as a government bank in 1995. Yet its operations were still bounded by the need to finance a huge budget deficit (see Fig. 2.3), which appeared after the collapse of the USSR due to a decrease in output. Thus, the first and main objective of the CBR in the beginning of 1990s was to achieve macroeconomic stability.

In July 1992, the CBR unified the ruble-dollar exchange rates. As Buch (1996) claims, until 1995, the Bank was frequently intervening in the foreign exchange market without announcing any exchange rate target. After the collapse of the Soviet Union the CBR was trying to stabilize the value of domestic currency. In 1995, the CBR declared an exchange rate corridor, targeting 4300 rub/$ - 4900rub/$ values. In 1996, due to the currency depreciation, corridor values were adjusted to 4550 rub/$ - 5150 rub/$. Later in July 1996, the CBR moved to a "crawling" exchange rate corridor, which was allowed to shift daily keeping the width of the corridor equal to 600 rubles (Buch, 1996).

When Russian economy showed some signs of stabilization in 1995, the CBR could start tightening its monetary policy using indirect instruments: interest rates and minimum reserve requirements. This policy helped to decrease the inflation rates (see Fig. 2.1)

Although Russian financial markets were liberalized in the beginning of the 1990s, foreign ownership was restricted until 1997. The absence of sharp exchange rate fluctuations and, as a result, decreased inflation expectations formed favorable conditions for foreign investors. But, until the 1997, the CBR required foreign banks to obtain a license from it before beginning to act in the Russian market. The maximum amount of foreign capital in Russian banking system was limited to 12 %. Thus, until the 1997 foreign financial flows came in the economy were not significant (see Figure 2.7).

As discussed in the previous chapter, Russia received high amounts of foreign financial flows in 1997. Huge amounts of foreign financial flows gave a sense of economic stability; nevertheless the Asian crisis of 1998 seriously shook Russian economy. Foreign investors started withdrawing capital from all developing countries, including Russia, which increased downward pressure on the ruble exchange rate. Russian economy, as newly liberalized, became highly dependent on foreign financial flows. In order to prevent the flow of speculative short-term financial flows, monetary authorities adjusted refinancing rate five times during the year. It fell from 48% to 21% in October 1997. In November 1997, in order to avoid the loss of trust in the Bank, to keep macroeconomic situation stable and to avoid high inflation, the CBR increased its refinancing rate[7] to 28% (Annual report of the CBR, 1997).

In 1997, the CBR's policies were mainly concentrated on the growth rate of the money supply and on the stabilization of the nominal exchange rate (Annual report of the CBR, 1997). Russian economy, as an emerging one, depended on exports revenues significantly. Thus, it was concerned about the volatility of nominal exchange rate. The CBR was frequently pursuing foreign exchange interventions in order to smooth changes in nominal exchange rate. Total foreign exchange sales were equal to $13 US billion in 1998. Due to this policy, the domestic inflation and price stability were carrying mostly adaptive function (Vdovichenko et al, 2004).

[7] Refinancing rate was an official interest rate for the CBR until 2013. It represents the ceiling for borrowing money and a benchmark for calculating tax payment.

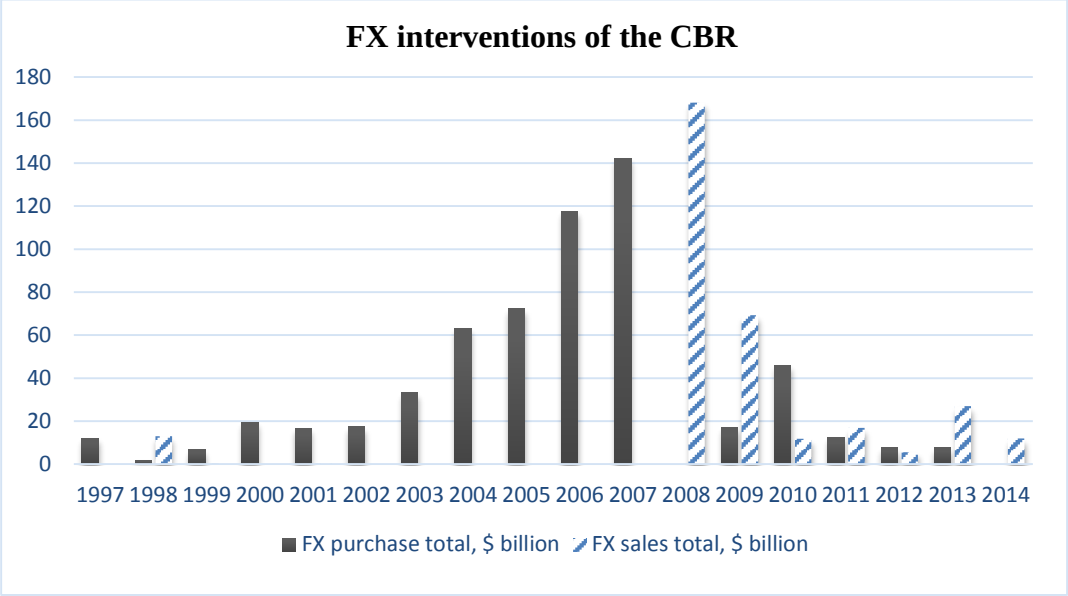

Figure 3.1. Foreign exchange interventions of the CBR. (Source: www.cbr.ru)

As previously discussed in chapter two, the crisis in 1998 caused a serious damage to the Russian economy. The severe outcome of the crisis forced the CBR to reconsider its policies and monetary instruments. In the beginning of the year, it was believed that monetary policy would follow fixed exchange rate regime, which was supposed to serve as an anchor for inflation (see Figure 2.2). However, the decrease of the foreign capital inflow (see Figure 2.7) put an upward pressure on interest rates and put a downward pressure on the value of the domestic currency value. Thus, the CBR adopted managed floating exchange rate regime.

In 1998, main objectives of the monetary policy were achieving price stability and decreasing inflation rate to 5-8% (Annual report of the CBR, 1998). After the crisis, the CBR started using refinancing rates and required reserve ratio (see Figures 3.2 and 3.3) as monetary policy instruments. Corrections in the refinancing rate helped to form positive expectations about future rates, and increased the confidence of the CBR on the international level (Vdovichenko, 2004). In 1998, the CBR could not hit targeted inflation. More than that, actual inflation in 1998 amounted to 84.4% (see Figure 3.4). The reason of huge inflation rate in 1998, as explained in chapter two, is a sudden and sharp devaluation of Russian currency.

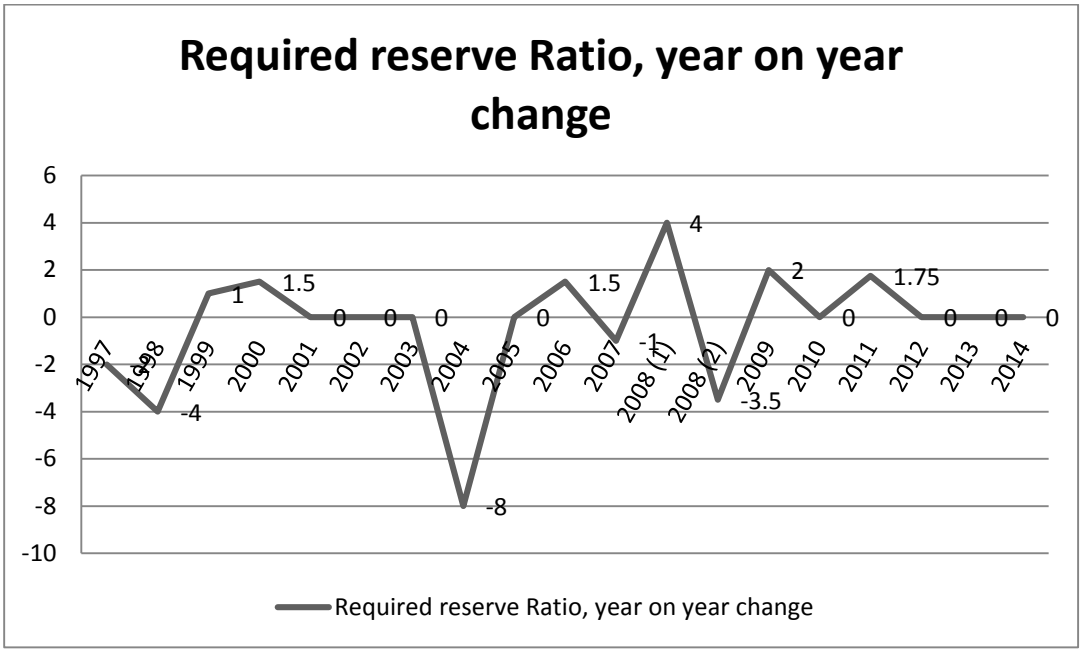

Figure 3.2. Required reserve ratio, year on year change %. (Source: www.cbr.ru)

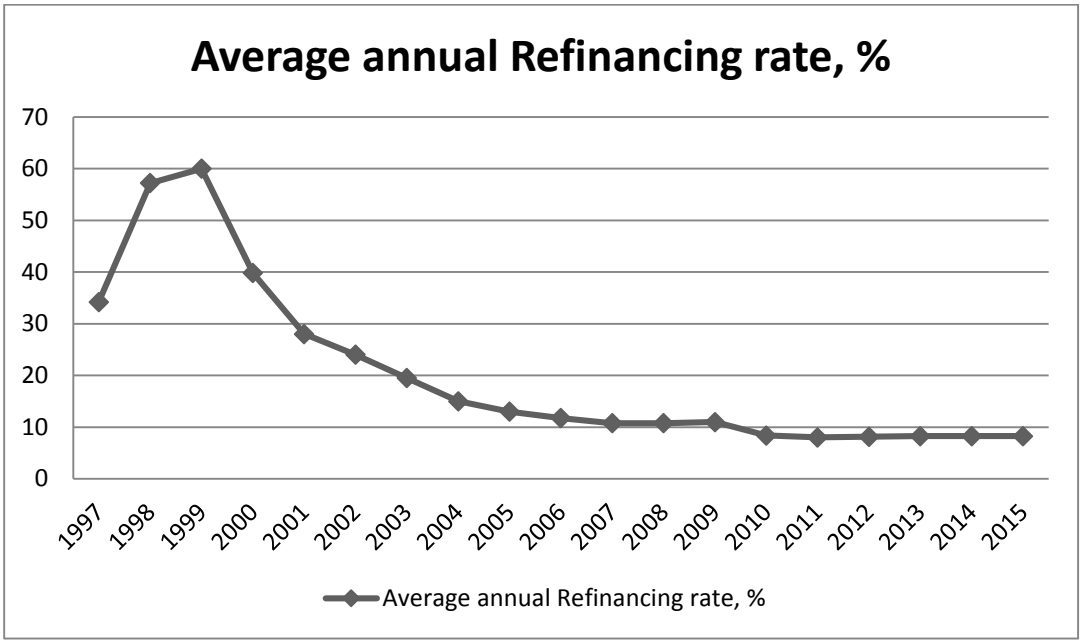

Figure 3.3. Average annual refinancing rates (Source: www.cbr.ru)

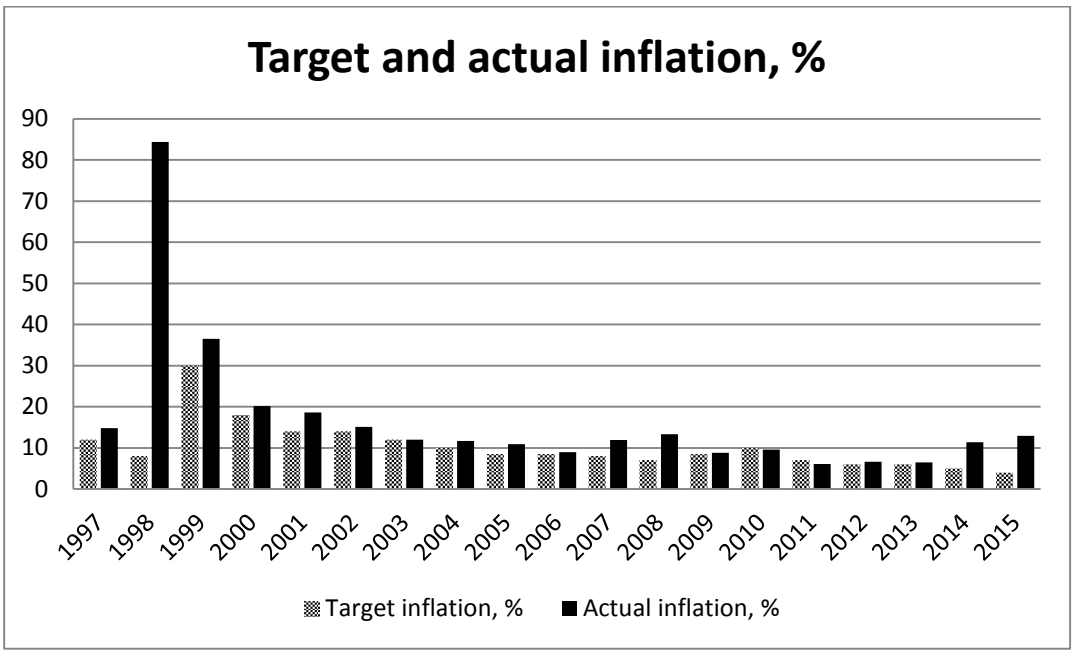

Figure 3.4. Target and Actual inflation rates. (Source: www.cbr.ru)

New monetary policy instruments relatively helped to increase the importance of domestic interest rates and to decrease the influence of the exchange rates on inflation, compared with before the crisis of 1998. Vdovichenko et al (2004) point that, despite the official orientation of the CBR on the anti-inflationary policy, in fact, it was more concerned about exchange rate dynamics. The CBR continued announcing inflation targets, and proceeding foreign exchange interventions not only for smoothing its volatility but also for changing its equilibrium level. The CBR tried to limit domestic currency appreciation. Granville et al, (2010) find that after the Asian crisis, exchange rate dynamics became more important than inflation. Slowing the appreciation was necessary in order to protect domestic producers from import competition. Ruble appreciation increased the price of the domestically produced goods and decreases their competitiveness.

In the period 2000-2007, the officially announced objectives of the CBR's monetary policy were to decrease the inflation and prevent exchange rate volatility. Refinancing rates decreased significantly, comparing to the crisis period (see Fig. 3.3). Also, the CBR succeeded in decreasing inflation rates; achieving 10 percent level and smoothing nominal exchange rate. In order to smooth the volatility of the ruble exchange rate, the CBR conducted foreign exchange interventions. The

amounts of foreign exchange interventions gradually increased throughout years (see Fig. 3.1).

Overall, the performance of the CBR during 2000-2007 can be characterized as successful. As discussed in the second chapter, economic authorities could achieve high economic growth rates partially thanks to increased foreign financial flows (see Figure 2.7) and positive world economic outlook. These developments helped the CBR to decrease inflation, smooth exchange rate volatility and accumulate foreign exchange reserves. In the end of 2007, changes in international reserves amounted around $150 US billion (see Fig. 2.11). However, the CBR could not always achieve its target inflation (see Fig. 3.4), this can be explained by the active foreign exchange interventions. The latter put upward pressure on inflation. More than that, operations in the foreign exchange market caused excess liquidity in the economy. Thus, the CBR pursued policy geared to sterilizing excess liquidity in the economy by manipulating required reserve ratio and other liquidity sterilizing operations (Annual reports of the CBR).

In 2005, the CBR made a transition from dollar operating benchmark of the ruble value to bi-currency basket. The basket value consisted of 0.1 share of euro and 0.9 share of dollar (see Fıg.3.5). The width limit of the borders for the dual-currency basket fluctuations were set at 30 kopeck (0.3 rubles, or 1% of the nominal exchange rate level), meaning that foreign exchange interventions can be pursued only when the value was hitting limits. Bi-currency basket allowed the CBR to pursue more flexible and balanced exchange rate policy in reacting to fluctuations in exchange rates between major world currencies. Some economists argue that new policy helped to decrease exchange rate fluctuations and currency risks (Khvostova et al).

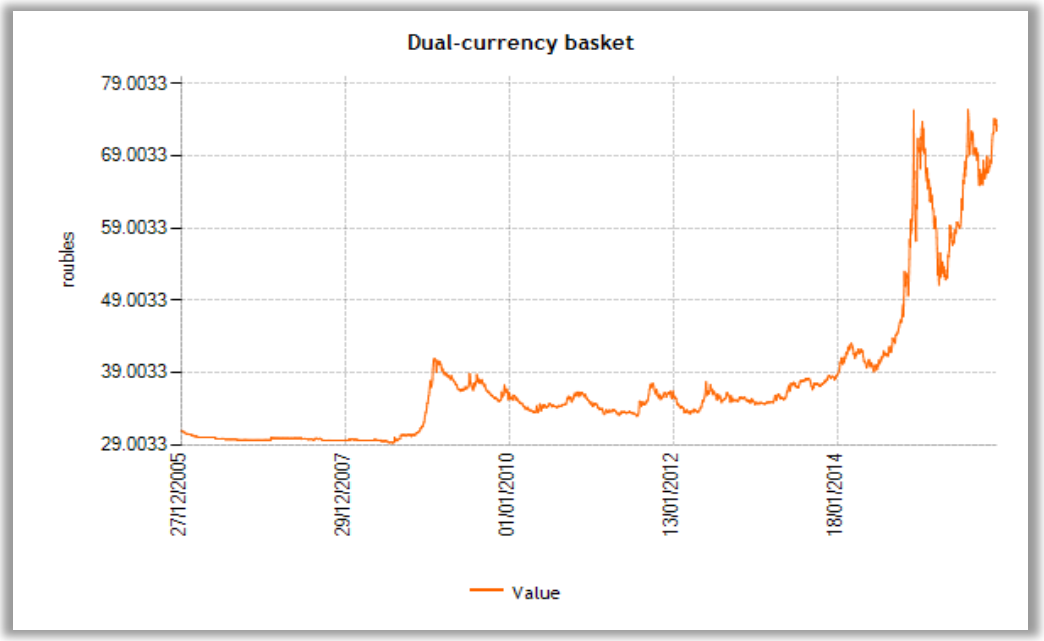

Figure 3.5. Dual currency basket (Source: cbr.ru).

Global financial crisis in 2008 brought huge external shocks to the Russian economy, which required an immediate response from the CBR. As mentioned in the previous chapter, developed countries' central banks were implementing quantitative easing policy, which referred to the loosening monetary policy by decreasing interest rates and providing liquidity for commercial banks and financial markets. The CBR, however, followed another path to support the domestic economy.

First of all, the Bank of Russia provided liquidity to many commercial banks, which suffered from the financial outflow and falls in deposits. It decreased the required reserve ratio to 0.5% in October, bought and sold government securities from its own portfolio, and provided loans to credit institutions. In total, it provided almost 900 billion rubles for the commercial banks in 2008 (Annual report of the CBR, 2008). The major part of the liquidity (725 billion rubles) was distributed between three banks: the Sberbank, the VTB, and the Rosselkhozbank[8] (Aleksashenko et al,

[8] In the Soviet times, there was only one banking system in the country which was under the government control. In December 1990, the responsibilities of the CBR and commercial banks were separated. In modern Russia, banking system includes three tiers, although legally there should be only two (Kirdina et al, 2013). They are the central bank, commercial banks, and state-controlled banks. The latter group represents the intermediate banks which are commercial banks but partially controlled by the state.

2011). Commercial banks' liquidity is an important variable of the domestic economic growth because it can provide credits to the real economic sector, which, in turn, will stimulate economic activity and economic growth. Unfortunately, it didn't work out during the crisis, credit growth activated only in 2010 (Aleksashenko et al, 2011).

Before the crisis, the CBR was forced to defend its currency value due to high volumes of foreign financial inflows (see the discussion in the next section). However, when the crisis hit the Russian economy, the CBR prevented ruble from weakening by selling large amounts of foreign exchange (see Fig. 3.1). The third policy of the CBR was to increase interest rates.[9] While interest rates for corporate deposits were increased from 3.8% to 5%; interest rates for private deposits were increased only by 0.4 percentage points. Interest rates on corporate loans were increased from 10% to 12% and interest rates on household loans were increased from 18.6% to 22.5% (Annual Report of the CBR, 2009). This policy was justified by the need to attract foreign capital flows and domestic depositors in order to solve the illiquidity problem. However, the increase in interest rates also resulted in slow credit growth.

In 2008, the CBR made some changes in its foreign exchange policy. It began to schedule its foreign exchange purchases in the domestic financial market. The intention was to improve methods of implementation of monetary policy mechanisms and create conditions for better flexibility of exchange rate policy and gradual transition to the floating exchange rate regime. The dual-currency basket limit corridor was widened. In the end of 2008, the CBR let the ruble to depreciate gradually.

The biggest representatives of intermediate banks are Sberbank, VTB, and Rosselkhozbank. These banks play a special role in transmitting monetary policy, contributing in liquidity creation including times of macroeconomic instability. Rosselkhozbank is generally used to finance agricultural projects while Sberbank and VTB are financing infrastructural projects. The banks became a kind of "hybrid institutions" (Kirdina et al, 2013) representing commercial and development banks at the same time. They have more than one thousand of private shareholders and are regulated by the CBR under standard criteria for commercial banks.
Russian Central Bank set the level of interest rates and sent advisors to banks in order to control the implementation of the new policy.

[9] Russian Central Bank set the level of interest rates and sent advisors to banks in order to control the implementation of the new policy.

In 2009, the CBR decided to loosen its monetary policy. It decreased interest rates in order to boost credit growth and support the recovery of the economy. Decreased interest rates were also helpful in lowering speculative short-term financial flows. During the crisis, the CBR conducted large foreign exchange interventions aiming to prevent the ruble exchange rate from sharp fluctuations. And in 2009, foreign exchange sales were twice smaller than foreign exchange interventions before the crisis (see Fig. 3.1).

After the crisis, the CBR returned to its usual policy orientation, which was concentrated on solving exchange rate fluctuations and maintaining price stability. The senior vice-president of the CBR, Yudayeva (2011) argues that high inflation (see Fig. 3.4) became a traditional problem of the Russian economy. Thus, the CBR planned to move to inflation targeting regime within the next few years in order to achieve price stability.

The main objective of monetary policy for the 2011-2013 was to keep inflation within 5-7% range. During this period, the CBR continued to increase the flexibility of exchange rate applying foreign exchange interventions only when the dual-currency basket exchange rate value went beyond or close to the pre-announced borders. In the beginning of the 2014, the dual-currency basket value significantly exceeded the upper limit, and the corridor was eliminated (see Fig. 3.6).

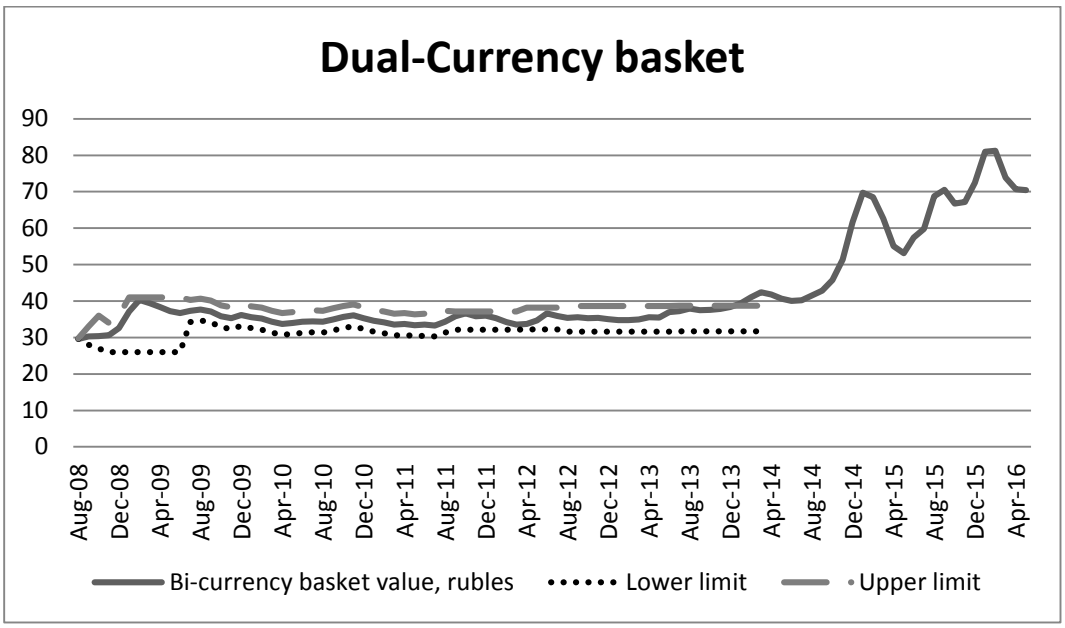

Figure 3.6. Dual-currency basket corridor.

It became obvious that constant foreign exchange interventions limited the effectiveness of monetary policies' transmission mechanism. Thus, on November 10th 2014, the CBR let its nominal exchange rates to float freely. However, recent external shock on the Russian economy led to rapid ruble depreciation. Changes in oil prices in the end of 2014 put a significant pressure on the domestic currency. And the price of $1 reached 67 rubles. In addition, a high degree of the exchange rate pass-through, due to big volumes of imported goods in the Russian economy, reflected in the increase of commodity prices and inflation. According to the latest Annual report of the CBR (2015), the Bank has adopted IT regime in 2015.

Although the CBR announces price stability as its main target, its concern about exchange rate stability is always at the forefront. In the next section, I look at the exchange rate policy of the Bank of Russia and the role of the exchange rate in the economy in a detailed manner

3.2 The Role of the Exchange Rate in Russian Economy

3.2.1 Exchange Rate Policy, Dual Currency Basket and Foreign Exchange Interventions of the CBR

Exchange rate policy has a strong impact on the level of exchange rate. It includes regulation of the foreign exchange reserves, traces the level of domestic currency value, and analyzes the foreign exchange interventions. As discussed earlier, the CBR adopted managed floating exchange rate regime in 1999. The new regime was supposed to help to smooth the effect of the external shocks on Russian economy. Previously, in foreign exchange market the value of ruble was set only according to the US dollar dynamics. In 2005, with the increased importance of the euro, the CBR introduced a dual-currency basket as the operational indicator for the exchange rate policy.

Initially, the currency weights in the basket were as follows: 0.9 US dollar / 0.1 EUR in February 2005. With the growing importance of euro on the financial markets, the weight of it was gradually increased. In February 2007, the weight of euro was 0.45, and the weight of dollar was 0.55 for US dollar.

The CBR set a corridor for the dual currency basket value of the exchange rate. It included the upper bound and lower bound, within which the exchange rate level of the basket was allowed to fluctuate. It is supposed to implement foreign exchange market operations on the borders of the corridor in order to limit excessive fluctuations (see Fig. 3.6).

The width of the dual currency basket corridor was set at 60 kopeck until the second half of 2008, which means that the CBR would not intervene in foreign market while the value of the basket exchange rate increased or decreased by 1%. However, after the Global financial crisis in 2008, the dynamics of the currencies forced the CBR to modify its exchange rate policy framework. In February 2009, The CBR let the corridor borders shift automatically in accordance with the accumulated amount of the foreign exchange interventions (see Fig. 3.1). The width of the band was fixed at 2 rubles. Later on, the width of the band continued increasing in order to increase the flexibility of the exchange rate. This policy was

related to the decision of the CBR to switch to the floating exchange rate regime. In the end of 2010, fixed corridor bands for the dual currency basket exchange rate level were abandoned ("The history of the Bank of Russia foreign exchange policy", 2013).

Under the open market conditions, floating exchange rate helps to adjust the economy to the changes of the external conditions. While managed floating exchange rate regime keeps monetary policy dependent on the policies of other countries. And the central bank has to respond to the changes in the external conditions with foreign exchange interventions. Interventions then can adversely affect other economic parameters as interest rates or inflation.

Within 2010-2011, The CBR cancelled constraints on the exchange rate level of ruble and its fluctuations. The corridor boundaries were automatically adjusted in accordance with the amounts of the foreign exchange market operations. In 2012, the width of the corridor reached 7 rubles, and in 2014 it became 9 rubles.

On the one hand, as focusing on the transition to the floating exchange rate regime CBR decreased the amounts of the foreign exchange interventions. On the other hand, the mechanism of smoothing the exchange rate fluctuations allowed foreign exchange interventions not only on the borders of the currency band, but also within the band. Thus, the band was divided into several ranges, which determined the amount of the allowed foreign exchange intervention volume in millions US dollars per day (see table 3.1). The "neutral" range indicated that, no foreign exchange interventions allowed. The amounts of the allowed interventions per day were higher at the borders of the currency corridor.

Table 3.1. Allowed amounts of the foreign exchange interventions. (Source: cbr.ru "The history of the Bank of Russia Foreign Exchange policy").

September 30th, 2012		
30.25 Rub	Width of the range (rubles)	Upper limit
		Allowed volume of the foreign exchange interventions, mln USD per day
	1	-400
	1	-200
	1	-70
"Neutral" range	1	0
	1	70
	1	200
	1	400
32.25 Rub		Lower limit

A year later, in 2013, the CBR introduced the "technical" range. The range was added to the corridor ranges in order to split the internal ranges in which the foreign exchange interventions were allowed. Inside this new band, the foreign exchange operations were not conducted. Furthermore, the location of the "technical" range could change, related to the directions and amounts of the operations (see table 3.2).

Table 3.2. Allowed amounts of the foreign exchange interventions. (Source: cbr.ru "The history of the Bank of Russia Foreign Exchange policy").

October 1st, 2013			October 7th, 2013	
39.30 Rub Upper limit				
	Width of the range (rubles)	Allowed volume of the foreign exchange interventions, mln US dollar per day	Width (rubles)	Allowed volume of the foreign exchange interventions, mln US dollar per day
	0.95	-400	0.95	-400
	1	-200	1	-200
	1	-70		
"Technical" range	0.1		0.1	0
"Neutral" range	1	0	3	0
	1	70		
	1	200	1	200
	0.95	400	0.95	400
32.30 Rub Lower limit				

As one can see from the table 3.2, the amounts of allowed foreign exchange interventions were adjusted twice in 2013. In October 7th, "Technical" and "Neutral" ranges of the corridor amounted 3.1 rubles, thus eliminating foreign exchange operations for smaller fluctuations of the dual currency exchange rate level. In summer 2014, the amounts of daily foreign exchange intervention were cut

by $200 US million. And in November that year, the dual currency basket corridor limits were abandoned. Although the foreign exchange operations continued, they can be only implemented in situations which threat the financial stability.

Since November 2014, the CBR officially has followed a floating exchange rate regime. It means that the exchange rate level of ruble is not fixed and there are no targets for it. The level of the domestic currency exchange rate is only determined by supply and demand in the foreign exchange market. The CBR only monitors the developments in foreign exchange markets. Foreign exchange interventions can be conducted only for the enrichment of international reserves. More than that, the amounts of the operations should be significant enough for affecting the level of the exchange rate.

Tchibisova et al (2015), Fedosova et al (2015), and some other economists think that the transition to the floating exchange rate regime was not timely applied. Nabiullina (the head of the Bank of Russia, 2013) suggested that foreign exchange interventions, which were pursued in order to maintain the desired level of exchange rate, are nothing but a waste of foreign exchange reserves. Tchibisova et al (2015) argue that free floating exchange rate regime together with the slowdown of economic growth, fall in oil prices and economic sanctions may lead to currency deficit and economic panic. The latter may cause speculations and the appearance of the black market, as it happened after the currency devaluation in 1998.

There are some economists supporting the decision of the CBR to adopt floating exchange rate regime. Trunin et al (2015) think that the transition to the new exchange rate policy is a justified process. They agree with Nabiullina that the maintenance of the ruble value devastates foreign exchange reserves. More than that, they claim that managed floating exchange rate regime is inappropriate and disorients primary aim of the monetary policy, i. e. price stability.

The idea of floating exchange rate regime means independent monetary policy regime and stronger monetary policy instruments. In the next section, I analyze the development of the interest rate as an instrument of the CBR’s monetary policy.

3.2.2 Exchange rate effect on monetary policy

I start the investigation of the effect of exchange rate dynamics on Russian monetary policy since the end of the 1990s. Before the Asian crisis, interest rate policy of the Bank of Russia was constructed in accordance with the inflation dynamics and situation in various segments of financial markets.

In 1997, refinancing rate[10], representing the interest rate policy rate, was adjusted five times, and decreased from 48% to 28%. In November, refinancing rate was decreased to 21%, in order to protect the economy from short-term speculative financial flows, which activated with the Asian crisis. However, the same month refinancing rate was increased back to 28%, in order to keep ruble stable and protect it from the influence of the Asian crisis (Annual report of the CBR, 1997).

In 1998, Russian interest rate policy was determined not only by internal developments, but also by the situation in the world's stock and foreign exchange markets. The CBR announced that refinancing rate gained importance as the main monetary policy tool in this year. In an effort to maintain domestic currency value during the crisis, Russian refinancing rate was increased to 150% (Annual Report of the CBR, 1999). This policy helped to ease the pressure on foreign exchange markets. However, as discussed in chapter one, it also led to domestic debt default and currency devaluation in August 1998.

In the first decade of the 2000s, the CBR announced that monetary policy transmission mechanism improved and the refinancing rate became the main tool of monetary policy. In 2000, stabilized situation in the foreign currency and money markets allowed the CBR to decrease gradually interest rates in its operations. Refinancing rate continued decreasing during the period 2000-2007.

[10] Refinancing rate represented the upper limit of interest rates on central bank's operations. Any change in the refinancing rate shows economic agents how the CBR evaluates the general inflation trend, and thus affect their expectations and interest rates in the economy.

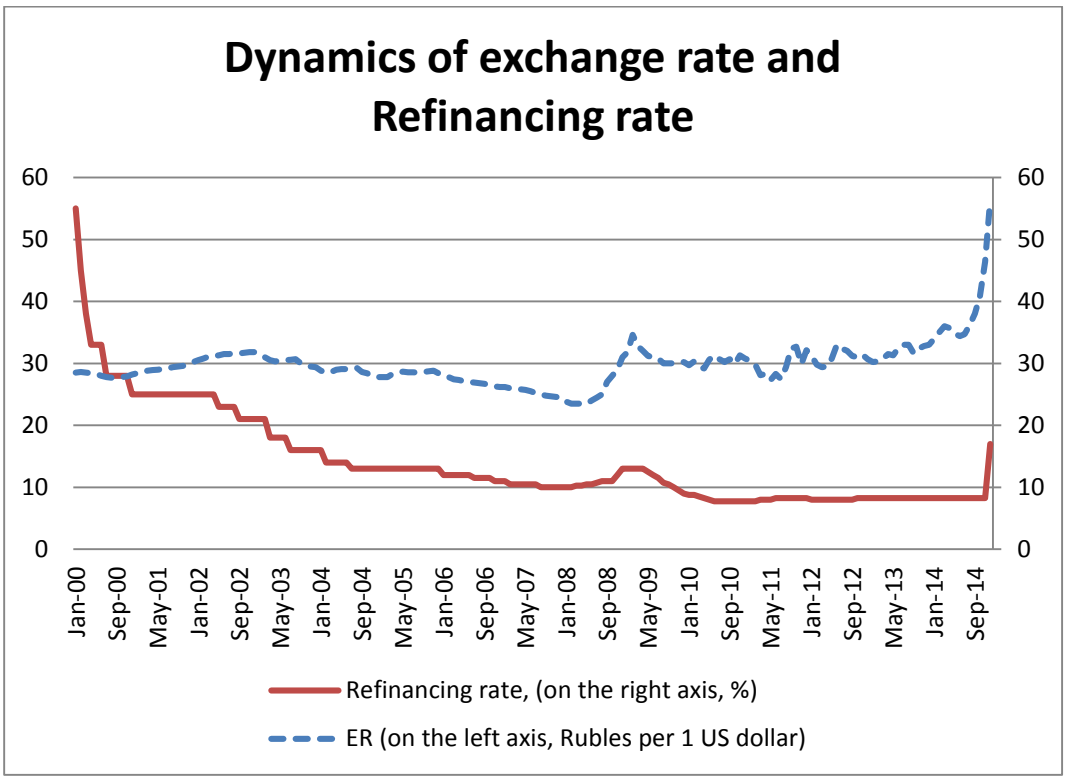

Figure 3.7. Dynamics of the exchange rate and interest rate. (Source: cbr.ru).

Figure 3.7 shows the dynamics of the exchange rate and refinancing rate. As one can see, during the period 2001-2007 as the exchange rate was appreciating, the CBR could decrease refinancing rate. The latter decreased the cost of borrowings making loans more affordable to economic agents. During this period, the CBR controlled volatility of the exchange rate. Monetary authorities let the currency to appreciate restricting only its pace. Currency appreciation was supposed to maintain a balance between inflation dynamics and the existing rate of economic growth.

When the Global financial crisis hit the Russian economy in 2008, the CBR increased its interest rates, in order to contain capital outflow and reduce inflationary pressure (Annual Report of the CBR, 2009). In 2009, following world trend of quantitative easing economic policy, the CBR also decreased interest rates on its operations.

After the crisis, Russian monetary authorities concentrated on inflation dynamics. Planning to adopt inflation targeting regime, the CBR decided to decrease the effect of exchange rate on monetary policy. Thus, it let the currency gradually depreciate

and decreased foreign exchange interventions. Figure 3.7 shows that from 2010 onward the dynamics of exchange rate and refinancing rate do not coincide.

In 2014, when domestic currency depreciated sharply, Russian monetary authorities had to respond exchange rate dynamics with the increase in interest rates. In order to decrease the inflationary pressure of depreciated currency, they increased policy interest rate by 11.5% (Annual Report of the CBR, 2015). The latter helped to stabilize inflation and depreciation expectations.

Since the end of 1990s, the CBR was trying to increase the importance of interest rate as a monetary policy tool. However, until the Global Financial crisis of 2008, Russian interest rate policy was mostly adaptive to the developments of other economic indicators including exchange rate. After the crisis, the CBR could increase the importance of interest rate as an independent monetary policy instrument.

3.3 Conclusion

The central bank constitutes heart of any economy. The trends in main macroeconomic variables can be affected by the activity of the central bank and its policies. Thus, the central banking should be studied together with the overall economic development of a country. It will be beneficial for understanding many aspects of the economic development and for investigating economic aims and trends.

In this chapter, I investigated the evolution of the central banking in Russia. As one can see, the CBR had complicated history since the beginning of the 1990s. Although it was only established in 1990, it had to deal with many economic problems. Throughout years, with the economic stability target in mind, the CBR had always the same intermediate prime objectives (even though not always official): exchange rate volatility and chronic high inflation rates.

In Russia, the exchange rate volatility has been one of the most important issues for the CBR. In this sense, the dynamics of the exchange rate influenced decisions of the CBR. The main concern was to prevent the adverse effect of the exchange rate movements on Russian economy. In order to see how exchange rate fluctuations

can affect an open developing economy, in the next chapter I analyze the role of the exchange rate in the economy.

CHAPTER 4

THE ROLE OF THE EXCHANGE RATE IN AN ECONOMY

Analysis of the Russian economy and the policies of the CBR in previous chapters showed that the role of the exchange rate in an economy should not be underestimated. Exchange rate gained its importance with the increase in globalization. Globalization has affected many aspects of world economies. It decreased transportation costs, which caused international allocation of resources; changed consumption structure, and international trade patterns (Di Mauro et al, 2008).

Developments in the world market can affect the value of a domestic currency of a country. The dynamics of the exchange rate, in turn, affect balance sheets of firms, the competitiveness of domestically produced goods, import and export share, which are reflected in the balance of payments; and the level of domestic prices. Furthermore, exchange rate can affect monetary policy transmission and, thus, the effectiveness of monetary policy.

Understanding the role of the exchange rate is crucial for the policy makers in order to develop an optimal policy framework. In the first section of the chapter, I investigate the role of the exchange rate in an economy. The section reveals that an appreciation or a depreciation of domestic currency can have significant impact on the balance sheets of firms, on the competitiveness of domestically produced goods, and on inflation. Second section studies the degree of the exchange rate pass through in different economic regimes. According to the discussions in this part, the level of the exchange rate pass through depends on the exchange rate regime followed by the central bank of a country. Thus, many economists agree that free

floating exchange rate regime is considered to have the lowest ERPT to domestic prices. The last section of the chapter concludes my points.

4.1 The Effect of the Exchange Rate Changes on the Economy

4.1.1 The effect of exchange rate on balance sheets of firms

Dynamics of the exchange rate are closely related to the balance sheets of firms and households, which, in turn, can affect financial stability of a country. There can be direct and indirect effects of the changes in the value of domestic currency on balance sheets that I will discuss in this subsection.

Unanticipated exchange rate depreciation or appreciation imposes a direct effect on balance sheets. Emerging market economies often suffer from uncertainty about the future value of the domestic currency, which makes it easier for them to issue debts in foreign currencies (Mishkin, 1999b). If firm's assets are denominated only in local currency and liabilities are in foreign currency, sharp depreciation or devaluation of the exchange rate will lead to a decrease in their net worth and deteriorate their balance sheets (Céspedes et al, 2000). Céspedes et al (2000) point that large debts denominated in foreign currency made the emerging economy financially fragile and destroyed net worth.

Benavente et al (2003) believe that there can be a positive effect of domestic currency depreciation. With the currency depreciation, the price for domestically produced goods decreases, which means goods are supposed to become more competitive in the world market. The latter means an increase in demand for domestically produced goods, which are supposed to bring about higher profits for firms. However, authors concede the situation when depreciation causes a contraction of investment by foreign currency indebted firms if the negative wealth effect would dominate the expansionary competitiveness effect.

As one remembers from the previous chapter, the dynamics of the exchange rate may indirectly affect emerging market economies' interest rates. Mishkin (1999) claims that the affected rates may also deteriorate balance sheets. Thus, a rise in interest rates increases interest payments of firms and households, decreases the cash flow, and deteriorates balance sheets.

Deterioration of the balance sheet of firms and households is not the mere effect of the exchange rate dynamics. In the next sections, I investigate its effect on other economic determinants in detail.

4.1.2 The effect of exchange rate on competitiveness

Along with the rising globalization new markets became available for the trade activities. This fact increased the importance of the exchange rate effect on the competitiveness of the domestically produced goods. Guerguil et al (1998) argue that changes in the exchange rate dynamics may or may not affect the competitiveness of the domestically produced goods.

In case of the appreciation of exchange rate, this may harm competitiveness. Appreciation of domestic currency increases the demand for imported goods, because they appear to be relatively cheaper than domestic goods. More than that, the share of export may significantly decrease, as domestically produced goods become more expensive. These developments may deteriorate trade balance and reflect on the GDP growth rates.

However, Guerguil et al (1998) find that exchange rate appreciation does not always give harm to the competitiveness. They claim that if the appreciation is accompanied by an increase in production the competitiveness will be improved. The same effect will be expected when the exchange rate appreciation is accompanied by the increased equilibrium level of real exchange rate.

Exchange rate dynamics can affect balance of payments in several ways. First, the appreciation of the exchange rate causes an increase in imports, a decrease in exports, and a loss of the competitiveness of the domestically produced good. Kaminsky et al (1999) claim that this trend can cause widening of the current account deficit, which will be financed by foreign borrowing. As a result, the economy can be also exposed to speculative attacks.

Pegged or managed floating exchange rate regime also contains risks for the balance of payments. In order to keep the value of the domestic currency in a desired range, central bank should support its value by using market operations and direct foreign exchange interventions (Krugman, 1979). In times, when country will

no longer be able to support its exchange rate, there occurs a crisis of balance of payments. The reason behind is that foreign exchange interventions gradually decrease official foreign exchange reserves. In case of a speculative attack on the domestic currency, monetary authorities will have to spend significant amount of the reserves, which may deteriorate their reserves position. In case of a strong shock, the central bank may not be able to defend the currency value anymore.

4.1.3 The effect of exchange rate on inflation

In many countries, the central objective of monetary policy is to effectively tackle with inflation. The changes in the exchange rate can also have a direct and indirect impact on inflation. The direct one includes imposing prices on import. A depreciation in domestic currency will increase the price of imported final goods, and thus, will cause a rise in consumer price level. The latter will lead to an upward pressure on domestic inflation, and decrease the purchasing power of domestic currency.

Another direct impact of the exchange rate on inflation is the effect on imported intermediate goods. The depreciation of the exchange rate results in more expensive imported intermediate goods. It will increase the cost of the domestic production of final goods, and will increase consumer price level. Hüfner (2012) claims that the lag between the exchange rate changes and the effects on the inflation rate is the shortest.

The indirect effect of changes in the exchange rate on inflation can be observed on the aggregate demand. The depreciation of domestic currency increases the competitiveness of the domestically produced goods. It raises the demand for export as well as the domestic demand for substitute goods. This, in turn, boosts the demand for labor and the level of wages. As a result, the price of the domestically produced goods may increase as well. For the currency appreciation, the process is the same, only with downward pressure on inflation.

Economic openness and the growth of the international trade volumes increase the exchange rate pass through. However, the level of the exchange rate passes through

to inflation varies for countries with different exchange rate and monetary policy regimes, which I analyze in the next section.

4.2 Exchange Rate Regimes in Financially Open Economy

During the last two decades, financial markets openness developed in a very high pace. If previous monetary authorities were mainly concentrating on domestic economic issues, now they would have needed to pay attention to external shocks as well, while constructing monetary policy framework. Exchange rate is an important factor bringing about external shocks to domestic economy.

Recent literature has been focusing on the investigation of optimal exchange rate regimes for the financially open economies. "For countries open to capital flows, it leaves open a wide range of arrangements running from free floating to a variety of crawling bands with wide ranges, and then very hard pegs sustained by a highly credible policy commitments…" (Fischer, 2001). In this section, I examine different exchange rate regimes, and their effectiveness especially in terms of exchange rate pass through.

4.2.1 Exchange rate peg

In early 1990s, many developing countries adopted exchange rate pegging regime. Pegging domestic currency to a currency of a developed country seems to be a right choice. First, it was creating an economic anchor. Emerging markets, pegging their currency to a currency of a country with stable economy, were also adopting a monetary policy. It helped to buttress exchange rate fluctuations and stabilize inflation at a lower level. Second, a pegged regime eliminates the need to hedge and reduces the risk of borrowing in foreign currencies (Fischer, 2001). However, this regime limits the ability of monetary authorities to have independent policy decisions. Thus, a shock that hit the developed countries is directly reflected on the developing country. Even domestic shocks may move the equilibrium nominal exchange rate from the official rate. The latter can be followed by higher interest rates and current account deficits.

Pegged exchange rate regime is especially not recommended for oil exporting countries, one of which is Russia. Setser (2007) claims that, since oil price is

expressed in dollars, many of oil exporting countries have a feature to peg their currency to dollar. But, this is a big mistake. Author finds that changes in oil prices under pegged exchange rate regime have an immediate effect to domestic inflation: an increase in the price of oil will increase the inflation as well. In this case, the adjustment of the real exchange rate will come through changes in prices. Furthermore, changes in domestic inflation will lead to large shifts in real interest rates. Setser (2007) considers managed floating exchange rate, currency basket with the included oil price dynamics, or free floating exchange rate regimes as alternatives to the exchange rate peg. These regimes will leave a room for maneuver to adjust domestic exchange rates or apply stabilizing foreign exchange interventions, in order to limit the effect on inflation.

4.2.2 Free floating exchange rate regime

To what extent exchange rate changes the inflation is decided by the exchange rate regime in the country (Achsani et al, 2010). Recent literature suggests that the free-floating exchange rate regime is considered to be the best in maintenance of low price level. It promotes economy's adaptation to changes in the external conditions by decreasing the impact of external factors.

The Asian crisis of 1998 showed that following pegged exchange rate regime is risky for most of the developing countries. From the beginning of 2000s, the number of countries adopted floating exchange rate regime started increasing. Gagnon et al, 2004 claim that monetary policy which focuses on decreasing domestic inflation, also succeeds in lowering the exchange rate pass through to price level. Fischer (2001) finds the inflation targeting regime as a beneficial one for lowering the effect of changes in exchange rate on inflation. In this regime, exchange rate movements are taken into account to the extent that they will influence future inflation. Thus, helping to form adequate inflation targets and adjust monetary policy decisions.

However, shifting to the free-floating exchange rate regime is a challenging task for developing economies. It may form expectations for currency depreciation, for the increase in the foreign exchange cash demand, and for overall deterioration of the financial stability. Calvo et al (2000) find that for emerging market countries the

decision to let their currency float is not an easy one. Even after announcing official free floating exchange rate regime, central banks generally continue to implement foreign exchange interventions in order to smooth large fluctuations of the exchange rate.

4.3 Conclusion

Thus far, I studied the role of the exchange rate in an open economy and its effect on the important economic variables. Exchange rate became one of the most important issues of the economies since the financial openness was accepted worldwide. There are direct and indirect channels of the exchange rate pass through to the domestic price level, thus, to the inflation. Furthermore, the dynamics of the exchange rate affect the competitiveness of domestically produced goods, and balance sheets of firms.

Recent literature suggests that following inflation targeting regime with free-floating exchange rate regime is the optimal solution, which allows decreasing the effect of exchange rate fluctuations on an economy. However, emerging market economies are reluctant to let their currency float. They continue to do foreign exchange interventions in order to limit exchange rate fluctuations.

Hence, the effect of the exchange rate dynamics on the main economic factors is of current interest. In the next chapter, I empirically analyze the effect of the exchange rate dynamics on the Russian inflation.

CHAPTER 5

ECONOMETRIC ANALYSIS FOR THE SOURCES OF INFLATION IN RUSSIA

High inflation has been a chronic problem in Russia since the collapse of the Soviet Union. In the beginning of the 1990s, Russia faced fast ruble depreciation and hyperinflation (see Figure 2.1). Tighter monetary and fiscal policies could decrease the inflation down to 20% in 1996. However, the Asian crisis of 1998 brought Russian inflation back to very high levels, up to 86%. From the 2000s onward, available world markets and effective monetary policies caused again a decrease in the inflation rate. As a result, inflation declined to 9% in the end of 2006. The Global financial crisis of 2008 resulted in annual inflation higher than 14% in 2009. The inflation in Russia was high during the observed period due to many factors, most of which may not be related with monetary policy control.

In this chapter, utilizing econometric techniques and with the help of the "Eviews" program software, I analyze the reasons of inflation in Russia. The findings of the analysis indicate that the supply side factors have a greater effect on Russian inflation, than the demand side factors. In particular, I find that inflation in Russia is the ultimate response to the changes in nominal exchange rate. The analysis of the asymmetric exchange rate pass through effect revealed that Russian inflation has greater response to the exchange rate depreciation than to appreciation.

First, I start with analyzing literature on inflation determinants related to different countries and different periods, paying attention to the econometric techniques and the results of the analyses. Second section studies the literature on Russian inflation and its reasons. In the next two sections, I consider the methodology for the

econometric model for the Russian inflation. I run the Vector Autoregressive models for inflation factors and asymmetric effect of the exchange rate pass through in Russia.

5.1 Literature review on inflation factors

Recent literature considers two main sources of inflation: Demand side factors, which include output gap, monetization, money growth; and Supply-side factors, including exchange rate effect and international commodity prices' effect (Benlialper et al, 2015). Another strand of literature examines three different hypotheses on how the inflation is generated. Kim (2001) considers the monetary theory as the first approach, which analyzes the effect of excess money supply on inflation. The second approach is labor market theory. It focuses on the relation between wage growth and inflation. The third approach is the external theory. The last theory looks at foreign transmission effects on domestic inflation, including exchange rate effect, import prices, and openness of the domestic economy. Using cointegration analysis, Kim (2001) finds that excess wages and external factors are the most important inflation factors in Poland for the period 1990-1999.

Lim (1997) claims that the inflation dynamic in Turkey is mostly related to the monetary policy variables. Using ordinary least squares and instrumental variables, Lim studies two separate periods: 1972-1980 and 1981-1995. He finds that the dynamics of the exchange rate and money supply, including the inertial factors, have a central role in the inflationary process.

Cottarelli et al (1998) focuses on non-monetary factors of inflation analyzing data of 47 industrial and transmission economies in the period 1993-1996. They find that fiscal policy has stronger effect on inflation in the economies with less developed securities markets. Authors indicate that the pegged exchange rate regime and central bank independence are two important factors in achieving lower inflation rates.

Mehrota et al (2009) evaluate reasons of inflation with a money supply rule in four central and Eastern European member states. They point that the analysis of inflation determinants is crucially important for the country that is adopting

inflation targeting regime. The authors investigate inflation determinants in four countries which are pursuing or have pursued an inflation targeting regime: Czech Republic, Hungary, Poland and Slovakia. The results of the analysis show that money supply has an important indicator role in determining inflation dynamics.

Khan et al (2007) investigate determinants of recent inflation in Pakistan. They claim that reasonable rate of inflation can be beneficial for an economy since it encourages investments, production, and wage growth. Estimating the regression using ordinary least squares (OLS) authors find that the most important factors creating inflation in Pakistan are: inflation expectations, private sector borrowings, import prices, and government sector borrowings.

Another study on inflation in Pakistan (Khan et al, 2010) includes four measures of inflation in order to have better insights about the reasons of inflation. They run OLS models separately for each inflation, including consumer price index (CPI), wholesale price index (WPI), sensitive price indicator (SPI), and GDP deflator. They focus on the period 1971-2005. Explanatory variables consist of budget deficit, exchange rate, interest rate, value of imports, money supply, inflationary expectations, wheat support price, and support prices of sugarcane, cotton, rice, and wheat together. The findings of their study indicate that lagged inflation is the most important cause of current inflation in Pakistan. Other significant variables determining inflation are exchange rate, value of import, and support prices of sugarcane, cotton, rice and wheat together. Authors find wheat support prices and money supply are insignificant in determining inflation.

Gottschalk (2008) analyzes the causes of inflation in Sierra Leone. Considering the effect of monetary policy as one of the most important factors for the inflation, he divides its effect into 2 separate groups. The first one is direct effect of monetary policy on inflation through the money growth. The second one is indirect effect through the inflation expectations. Constructing Vector Autoregressive model, he examines the effect of international oil prices, CPI, money reserve, and the nominal exchange rate on inflation. Gottschalk (2008) finds that inflation in Sierra-Leone has greatest responses to the changes in the money reserves and exchange rate.

Achsani et al (2010) explore the relation between inflation and exchange rate in Asia. For the analysis, they use annual data for the period 1991-2005. With the help of panel data model authors investigate the relationship between inflation, output gap, and exchange rate. According to their study, inflation rates in Asian countries are significantly influenced by real exchange rate and lagged domestic inflation; while non-Asian countries' inflation is generally influenced by the dynamics of domestic inflation itself, and by foreign inflation rates. Furthermore, authors find that output gap has no significant effect on inflation at all.

Nguyen et al (2012) estimate inflation factors for Vietnam by using a Vector Autoregressive model. Vietnam is a developing country with a large traditional economy. During the Global financial crisis in 2008, it had the highest inflation rate among other Asian countries. Authors investigate the period from January 2001 until February 2009. Their analysis demonstrates that inflation rate in Vietnam is mostly caused by inflation inertia, money supply, and foreign inflation. Furthermore, in contrast to the previous study, authors find that output is a significant factor for the inflation in Vietnam.

The reasons of inflation are varying for each economy. Their role in inflation dynamics depends on the economic regime, economic development, and countries' role in the world market. In order to see which inflation factors were found to be the most important in Russia, in the next section, I look at the current literature on the causes of inflation in Russia.

5.2 Literature Review on Sources of Inflation in Russia

Russian economy followed a managed floating exchange rate regime during the period 1999-2014. Although it is different from the inflation targeting regime, the dynamics of the price level are still important for the Russian economy. More than that, since Russian monetary authorities consider moving to the IT regime, the inflation has one of the central roles in the formation of the CBR's policies. In this section, I debate some works on the factors for the inflation in Russia.

Dabrowski et al (2001) analyze the inflation in Russia dividing its determinants into three main groups. The first group investigates frictions in the goods market,

including the effect of output gap on inflation. The second group examines the trade-off between inflation and employment. And the last group emphasizes on the effect of frictions in the money market. Authors use VAR approach and divide the data into two periods: Before the crisis of 1998, and after the crisis. Leaving the money supply as the main inflation factor, the paper points out that while before the crisis dynamics of the exchange rate do not play any role in the emergence of domestic inflation, exchange rate dynamics have a direct effect on inflation in Russia after the crisis, Authors explain the result with the exchange rate band policy adopted by the CBR.

However, Baranov et al's (2007) results are contrary to those of Dubrowski et al (2001). Through investigating inflation factors in Russia, authors apply cointegration analysis for the periods 1994-1999 and 1999-2006. Interestingly, they find that the dynamics of the exchange rate together with the money supply were two the most important factors affecting domestic inflation before the crisis. And after the crisis, these factors were complemented with real GDP growth rate and inflation expectations.

Oomes et al (2005), combining mark-up theory and monetary theory of inflation, apply two-stage estimation procedure for the short-run and long-run inflation factors. They find that exchange rate dynamics, unit labor cost, and utility price are the most important determinants of inflation in Russia. Also, they claim that money supply dynamics in Russia appear to be inflationary, and broad money growth has the strongest effect on the short-run inflation.

Kataranova (2010) claims that there is an asymmetric effect of changes in the exchange rate on inflation in Russia. Using Dummy variables in the exchange rate pass-through model, she finds that when Russian currency depreciates by 1% the inflation increases by 0.2%, and when the currency appreciates the inflation decreases by only 0.1%. More than that, she found that only ruble-dollar exchange rates are important in creating inflation, on the other hand, ruble-euro rates do not have a significant effect.

The results of most of the considered works indicate that the inflation in Russia is created by the supply side factors. By reference to these works, I choose inflation

determinants for my model. In the next section, I construct a model for the inflation determinants.

5.3 A VAR model for the Sources of Inflation in Russia

In this section, I will present the econometric model that I chose to examine the causes of inflation in Russia. Based on the literature reviews above I will justify my choice of the endogenous variables.

Following the works of Dabrowski et al (2001) and Benlialper et al (2015), I will use Vector Autoregressive (VAR) econometric model in order to analyze the factors affecting inflation. VAR model would be more suitable for the case because it allows analyzing each variable as a linear function of past lags of itself and past lags of the other variables. More than that, this approach helps to analyze the responses of inflation to the shocks of other endogenous variables with the help of impulse response function and a variance decomposition approach. While the impulse response analysis helps to trace the effects of a shock to one endogenous variable on to the other variables in the VAR system, variance decomposition separates the variation in an endogenous variable into the component shocks to the VAR.

The VAR model includes the following variables: consumer price inflation (increase in prices to the corresponding month of the previous year) for the monthly inflation ($InflCPI_t$), percentage change of the world price index (WPI_t), output gap ($Ygap_t$), exchange rate variable measured as a percentage change of the nominal exchange rate ($ERchange_t$), and interest rate (IR_t).

The model has the following general form:

$$Y_t = \beta_0 + \beta_1 Y_{t-1} + \dots \beta_m Y_{t-m} + u_{t;} \qquad (1)$$

where Y_t is a vector of variables, which include monthly $InflCPI_t$, $Ygap_t$, $ERchange_t$, IR_t, WPI_t. The model is similar to that developed by Benlialper et al (2015) who analyze the sources of inflation in Turkey.

Models of Baranov et al (2007) and Dubrowski et al (2001) for the Russian inflation include changes in the money supply to the equation**.** However, empirically testing, I found that money supply does not play a significant role in determining inflation

in Russia. More than that, since the beginning of the 2000s the CBR works on increasing the importance of interest rate as the main monetary policy tool. Thus, I include only interest rate variable in my model.

5.3.1 Data

The data for the inflation variable is taken from the CBR's statistical reports and represents consumer price inflation for goods and services.

The data for the nominal exchange rate is taken from the Central Bank of Russia statistics. The nominal exchange rate is an important factor in determining inflation because it can affect the inflation through direct and indirect ways. As being discussed in the chapter four, direct channel includes the effect of the changes in exchange rate on imported goods prices, and imported intermediate goods prices. The indirect channel includes the effect on aggregate demand.

As mentioned in the chapter three, the CBR adopted dual-currency basket exchange rate, which consisted of a share of US dollar, and Euro. However, I use ruble-dollar nominal exchange rate values. The first reason for this is that my analysis includes the period of 2001-2015, and the values of the dual-currency basket exchange rate can be traced only for 2005-2014. Second, the share of US dollar in the dual-currency basket was always greater than the share of Euro. For the robustness of the results of the analysis, I ran the model including dual-currency basket exchange rates, and the results did not change significantly. Furthermore, Kataranova (2010) claims that ruble-Euro exchange rate does not have a significant role in the emergence of inflation in Russia. Thus, for the analysis, I use monthly percentage changes of the ruble-dollar nominal exchange rates. I take the dollar-ruble ratios, where the value of one US dollar is expressed in rubles[11].

I incorporate output gap variable into the model. It is an important demand-side factor affecting inflation. The output gap is calculated as similar to the Benlialper et al (2015). It is taken as a proxy to the difference between seasonally adjusted industrial production index and its trend (calculated with the help of Hodrick-

[11] Such interpretation means that when the $ERchange_t$ variable increases, the value of the ruble decreases, and domestic currency depreciates.

Preskott filter with smoothing parameter 14400 for monthly data). For the analysis, I resort to seasonally adjusted output gap ($YgapSA_t$) variable, since original data appear to be suffering from seasonality.

Monthly short-term interest rate[12] data is taken from the OECD statistics for the period 2001-2015. As I discussed in chapter four, monetary policy of the CBR was represented by the refinancing rate. However, refinancing rate was not the only monetary policy instrument of the Bank. For the analysis, I use short-term interest rate data provided by OECD statistics, which reflects not only the dynamics of refinancing rate, but also the dynamics of other short-term operations of the Bank[13].

I do not estimate the model using official monetary policy refinancing rates, because it does not reflect the dynamics of many other importants interest rates, such as interbank rates, short-term or long-term deposit rates, etc. Many other economists in their works also preffered to use a proxy for the refinancing rate. Vdovichenko et al (2006) used interbank market interest rate on one-day credit and overnight deposit interest rate of the CBR for studying the monetary policy rules in Russia. For the investigation of monetary policy transmission mechanism in Russia Vymyatnina (2006) looks interbank interest rate as a proxy for the refinancing rate. Graniville et al (2010) also believe that refinancing rate is not the best proxy for the policy interest rate for the investigation of the monetary policy in Russia. Authors estimate vector error correction model using overnight interbank lending rate as a proxy for the refinancing rate. Thus, based on the experience of these studies, I choose short-term interest rate as a proxy for the refinancing rate[14].

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[12] Monthly short-term interest rates are defined by the OECD as, " the rates at which short-term borrowings are effected between financial institutions or the rate at which short-term government paper is issued or traded in the market. Short-term interest rates are generally averages of daily rates, measured as a percentage. Short-term interest rates are based on three-month money market rates where available. Typical standardized names are "money market rate" and "treasury bill rate".

[13] From the chapter three, one remembers that refinancing rate affects all other interest rates on the Bank's operations. Remembering, that it reflects the dynamics of other rates as well, I take monthly short-term interest rates as the proxy to the refinancing rate.

[14] On the figure A.1 of the Appendix A, one can find the dynamics of the nominal exchange rate and short-term interest rate. The figure suggests that the dynamics of the indicators are interrelated. Thus, I can concede that short-term interest rate used in the model can represent monetary policy interest rate of the CBR.

Also, I added monthly percentage changes in the world commodity price index[15] into inflation determinants model. The data is provided by the Monetary Fund. For the highly opened economies, world commodity prices are expected to be a key source of the inflation. They transmit the changes to domestic prices mainly through trade channels (Chuah et al, 2015).

I look at the period from January 2001 to December 2015. I do not include the earlier periods in the model in order to have more reliable results. The main reason is that for a few years after the collapse of the centrally-based economy, the Russian economy experienced very high inflation, and the exchange rate was highly volatile. Also, I start the analysis from 2001 in order to minimize the possibility of dealing with structural breaks and estimation errors related to the crisis of 1998. And I decide not to observe 1999-2000 because it includes the transmission period to the managed floating exchange rate regime.

Many authors, who analyzed the sources of inflation, added the oil price indicators into their analysis. However, my model does not include variations in the oil prices because Russia, as an energy products exporter, does not rely on imported energy resources. Furthermore, I do not consider wage variable in the regression. It is almost impossible to track the effect of wage changes on inflation, due to uncontrollable shadow economy in Russia. The data on official wages might not coincide with actual wages. More than that, there are no wage contracts in the national level in Russia (Dabrowski et al, 2001).

Taking specificities of the Russian economy and principles of the Russian Central Bank's policies into account, I expect these variables to be more beneficial for specifying the inflation factors in Russia.

5.3.2 Estimation Results

The model for sources of inflation in Russia consists of $InflCPI_t$, $Ygap_t$, $ERchange_t$, IR_t[16], WPI_t and dummy variables. I include the dummy variable which is supposed

[15] Commodity Price Index, 2005 = 100, includes both Fuel and Non-Fuel Price Indices.

[16] I also estımated the model with the Money Supply variable, as a monetary policy indicator, following the method of Dubrowski et al (2001). According to my estimations it does not have significant explanatory power for the inflation.

to take care of initial sharp impact of the Global financial crisis of 2008 (see Figure 5.1). The dummy variable has value equal 1 for the period September 2008 – February 2009, and zero otherwise.

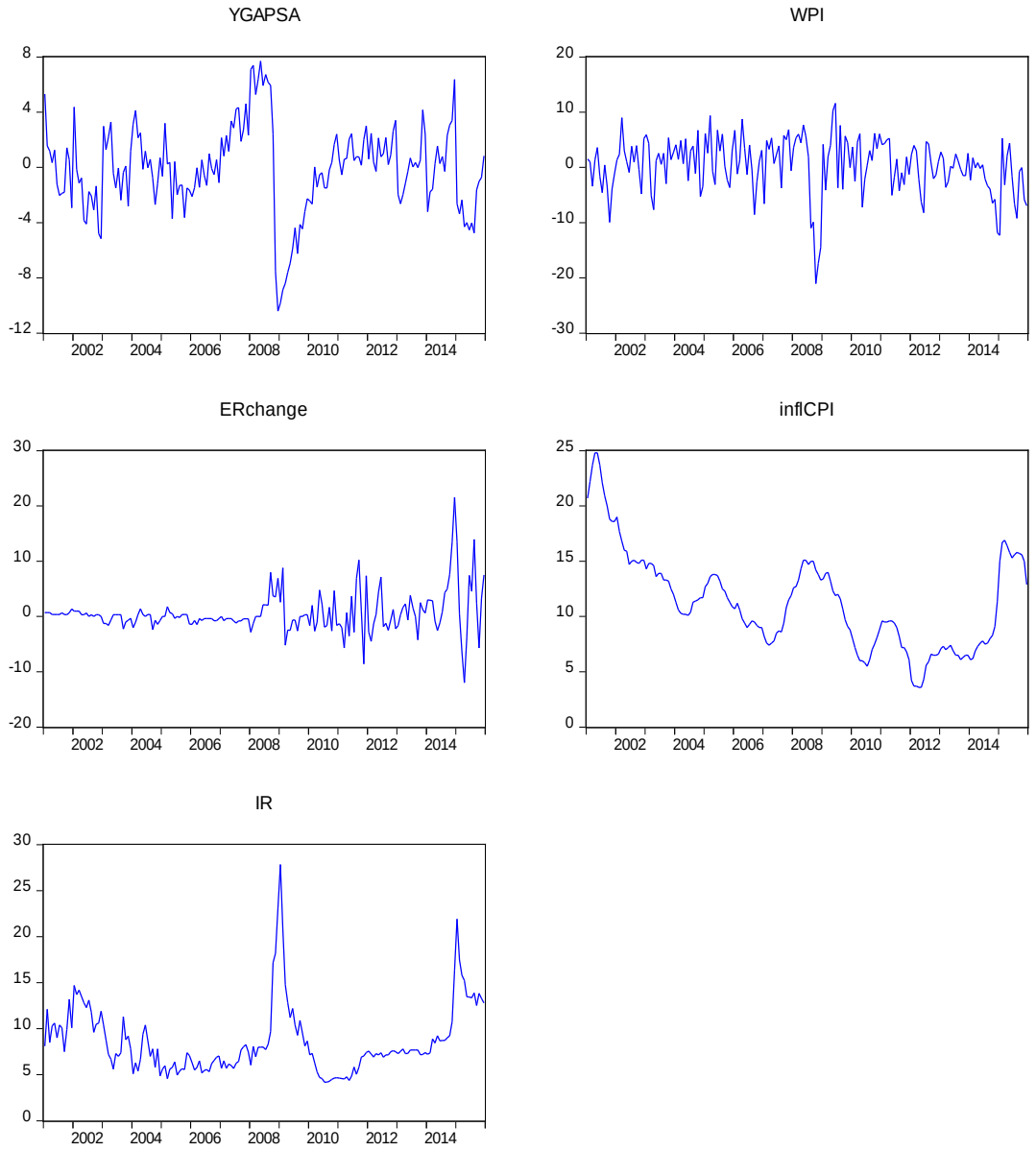

Figure 5.1. Individual graphs of the variables used in the model 1.

Descriptive statistics of the variables are presented in Table A.1 of the Appendix A. The stationarity properties of the variables were tested. The results of the Augmented Dickey-Fuller test are presented in the Table A.2 in the Appendix A. The lags of the ADF test are chosen automatically according to the Akaike information criterion. The $InflCPI_t$ and IR_t variables are stationary under the

hypothesis that they are random walk with intercept only. Other variables are stationary no matter of the random walk specification.

For the Vector autoregressive model the ordering of the variables is significant. The correct variables' ordering will show more reliable results of the variance decomposition and the impulse response function. The results of the pairwise Granger causality test are ambiguous (see Table A.3 in the Appendix A). I assume that the WPI_t variable is the most exogenous variable since the domestic economic indicators will unlikely to have a significant effect on the world price index. Next, I assume the $YgapSA_t$, InflCPI, and $ERchange_t$ variables to be more exogenous than the IR variable. Following this logic, the Cholesky ordering for the model will be: WPI_t, , $YgapSA_t$, $ERchange_t$, $InflCPI_t$, and IR_t. However, running the model with other orderings did not significantly change the results.

For the analysis, I construct a VAR model with two lags, in accordance with the lag length criteria (Table A.4, Appendix A). The model is stationary and free from autocorrelation (see Table A.5 and Figure A.2). Estimation results of the model can be found in the Appendix A, Table A.6.

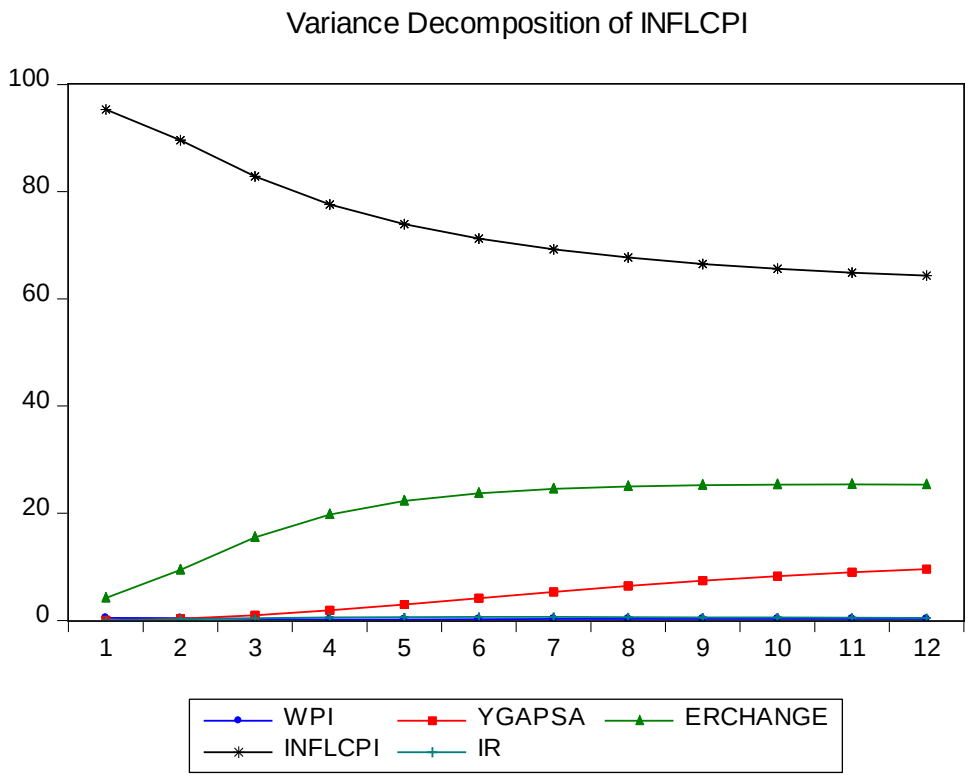

Figure 5.2. Variance decomposition for inflation for the model 1.

Figure 5.2 shows the results of the variance decomposition. The variance decomposition analysis demonstrates that an impulse, or an innovation or a shock to the exchange rate will account for the fluctuation in inflation more than a shock to other variables. ERchange variable will account for 25% of the fluctuation in the domestic inflation. Output gap explains more than 9.5% of the variations in the InflCPI variable, while interest rate explains only 0.5%, and WPI explains 0.24% of them. The rest of the variations are explained by the variations of the InflCPI itself (see Table A.7, Appendix A). In this sense, lagged values of inflation have the highest explanatory role in understanding current inflation.

These findings demonstrate that supply side factors are important in inflation fluctuations in Russia. A shock to the YgapSA variable also plays a significant role in inflation, but this is not as important as the exchange rate. A significant role of the exchange rate as an inflation factor is obvious. As discussed in chapters two and three, real aim of the monetary authorities mostly was to keep the dynamics of the exchange rate over the price stability. The absence of the significant effect of the shocks to the WPI variable on the fluctuations in inflation in Russia is not surprising. Russia, as an exporter country, is not depended on the world commodity price index as other countries with emerging economies. In fact, Russia is one of the countries that may set these prices.

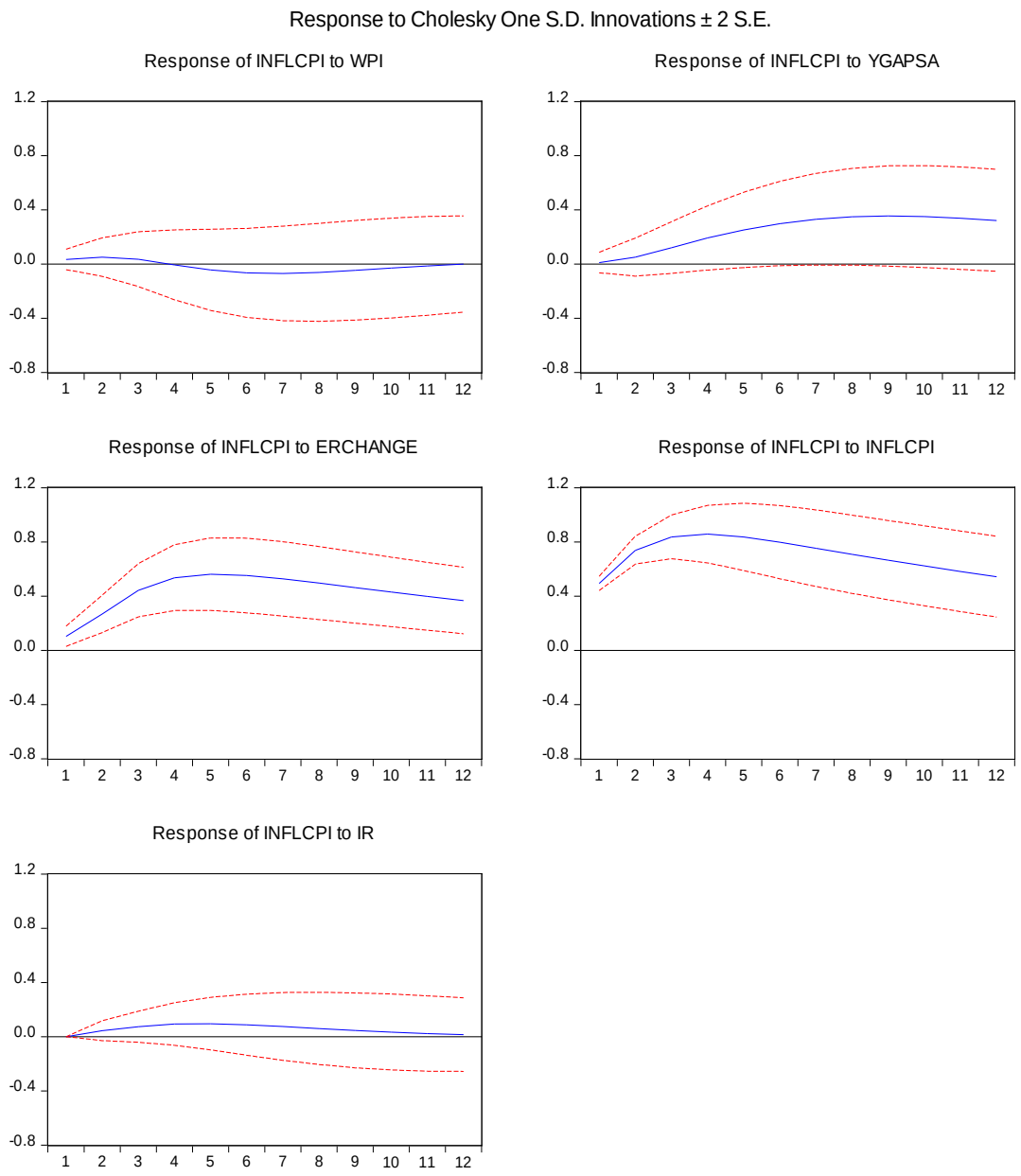

Figure 5.3. Impulse response function of inflation for the model 1.

The results of the impulse response analysis are presented on Figure 5.3. Impulse response function of the domestic CPI inflation suggests that a shock to the exchange rate variable will get the highest response from the InflCPI. The increase in the ERchange variable, meaning the domestic currency depreciation, will be followed by a strong increase in inflation within the first five periods. From the sixth period, the response of InflCPI loses its effect. Shocks to the IR, YgapSA, and WPI variables will be followed by mostly insignificant response of the inflation. The highest response of inflation is following the shock to the inflation itself (see

Table A.8, Appendix A). The latter indicates that inflation inertia has a big role in the emergence of current inflation. It means that current level of prices increases in accordance with past inflation, which makes it difficult to achieve disinflation in the future (Anagnostopoulos et al, 2007).

The results of the IRF and the VDC suggest that the most important variable in the inflation dynamics in Russia is the exchange rate. A shock to the exchange rate has the greatest immediate response on inflation. And an innovation in the exchange rate accounts for the highest percentage of the fluctuation in the inflation.

Next section analyzes the asymmetric effect of the exchange rate fluctuations on inflation.

5.4. Asymmetric exchange rate pass-through

The asymmetric effect of the exchange rate dynamics on the inflation in Russia was studied by Kataranova (2010). The author estimates short run and medium run effect of the exchange rate on domestic prices for the 2000-2008 period. She investigates questions of endogenous monetary policy in Russia with respect to exchange rate and the asymmetric effect of the exchange rate appreciation and depreciation on inflation.

Kataranova uses the model with distributed lags for the analysis. The model allows tracing the short run effect of many variables with different number of lags included. She uses dummy variables in the model for the appreciation and depreciation of the exchange rate:

$$D\_a = \begin{cases} 1, \text{ if } ERad < 0; \\ 0, \text{ otherwise.} \end{cases} \qquad D\_d = \begin{cases} 1, \text{ if } ERad > 0; \\ 0, \text{ otherwise.} \end{cases}$$

Her findings show that Russian inflation increases by 0.2%, when ruble depreciates by 1%; and inflation decreases by only 0.1%, when ruble appreciates by 1%. Thus, she finds that the response of the inflation on changes in the exchange rate is asymmetric. The response is twice stronger for the depreciation of the domestic currency.

Similar to Kataranova (2010) and Benlialper et al (2015) for the asymmetric exchange rate pass through model, I define two separate variables for the exchange rate depreciation and appreciation:

ERA = max (ER, zero), for appreciation;

ERD = min (ER, zero), for depreciation.

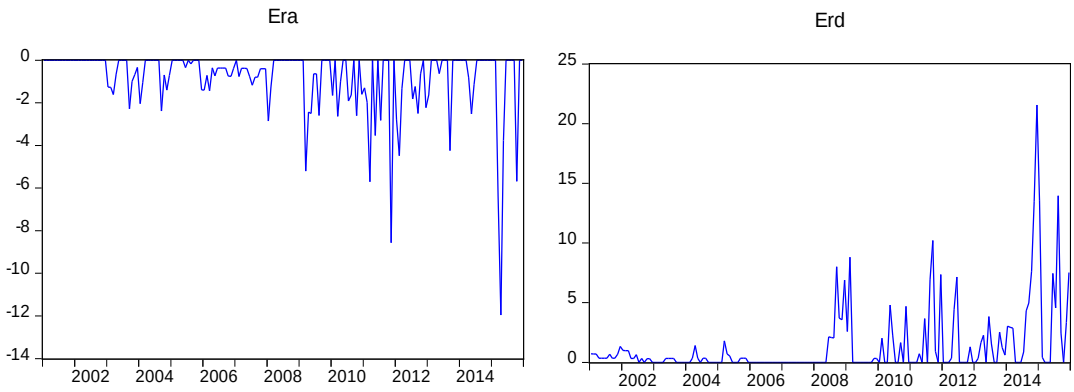

Figure 5.4. Individual graphs for the exchange rate appreciation and depreciation.

Figure 5.4 shows the individual graphs of the variables. Stationarity tests revealed that the variables do not have a unit root, and the results of the ADF test are presented in table A.2 in the Appendıx A (Descriptive statistics are presented in Table A.1, in Appendix A).

The expanded VAR model for the Russian inflation factors has a following ordering: WPI_t, $YgapSA_t$, ERA_t, ERD_t, $InflCPI_t$, and IR_t. Granger Causality test results are presented in Table A.9 in the Appendıx A. According to the Lag length Criteria (see Table A.10, Appendix A) I estimate the model with four lags. The model is stationary and free from autocorrelation (see Table A.11 and Figure A.3, Appendix A). Estimation results of the Model 2 are presented in Table A.12 (Appendix A).

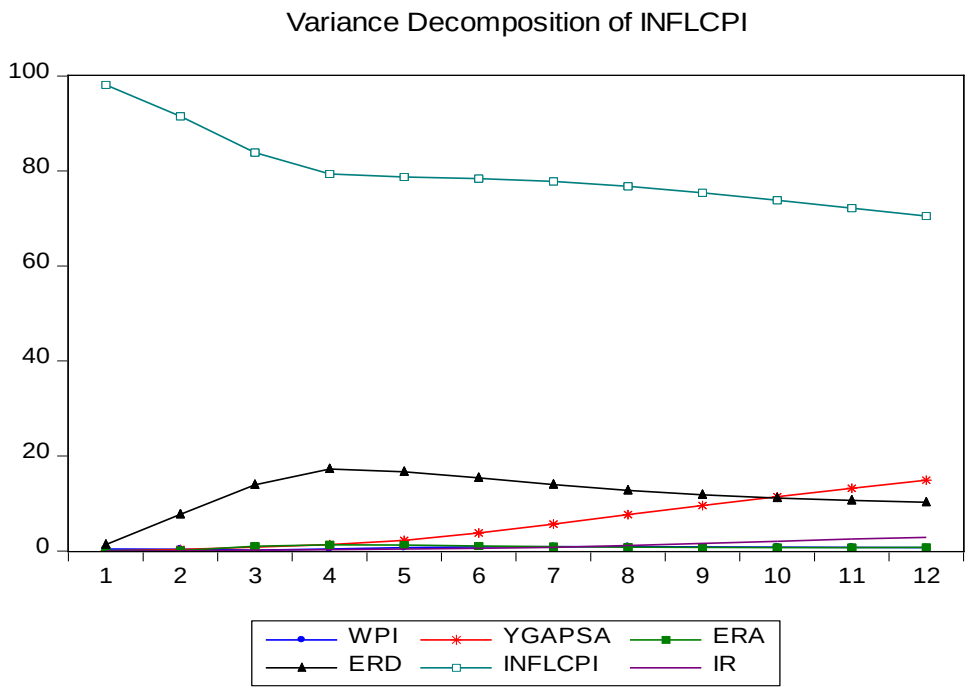

Figure 5.5. Variance decomposition of inflation for the Model 2.

The results of the Variance decomposition analysis (see Figure 5.5) indicate that a shock or an innovation of the exchange rate depreciation is a leading factor behind Russian inflation. At the same time, one may notice that the appreciation of domestic currency plays almost no role in the emergence of inflation in Russia (see Table A.13, Appendix A).

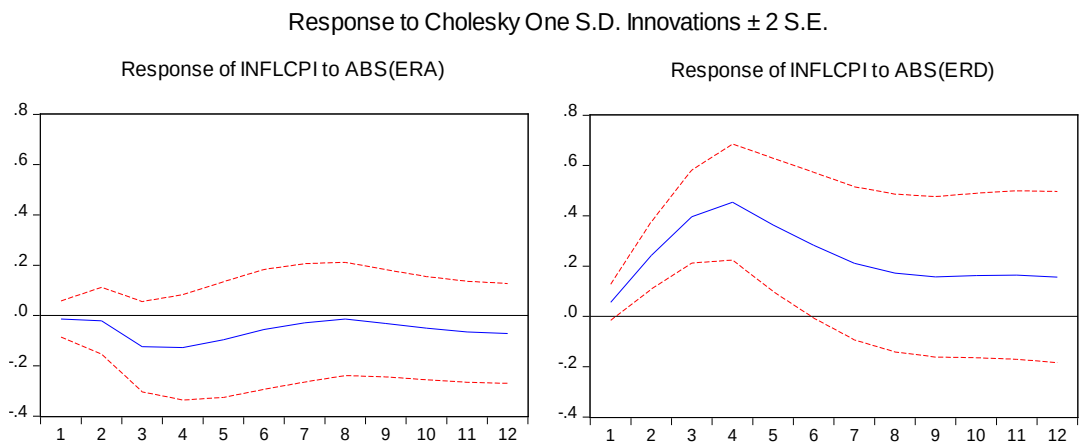

Figure 5.6. Impulse response function analysis of the inflation for the Model 2[17].

[17] For the clear results of the impulse response function analysis, I take absolute values of ERD and ERA (W^{minus}, W^{plus}) variables.

According to the results of the IRF analysis, Russian inflation has a significant response to the changes in the exchange rate depreciation and is insignificant to the currency appreciation (see Figure 5.6 and Table A.14, Appendix A).

These findings support the hypothesis of the asymmetric nature of the exchange rate pass-through in Russia, also they support the results concluded by Kataranova, (2010). However, the time period observed by Kataranova is different from mine. For the sake of the robustness of the results, I will estimate inflation determinants using two separate models in the next subsection. The Model 3 of the study will be run for the period before the Global Financial crisis of 2008, and Model 4 will be run for the period after the Crisis.

5.4.1 Asymmetric exchange rate pass-through analysis of the first period

In the third model, I estimate inflation factors for the period between January 2001 – December 2007. The model includes the same variables as the model 2: WPI_t, $YgapSA_t$, ERA_t, ERD_t, $InflCPI_t$, and IR_t. Individual graphs for the variables are presented in Figure 5.7.

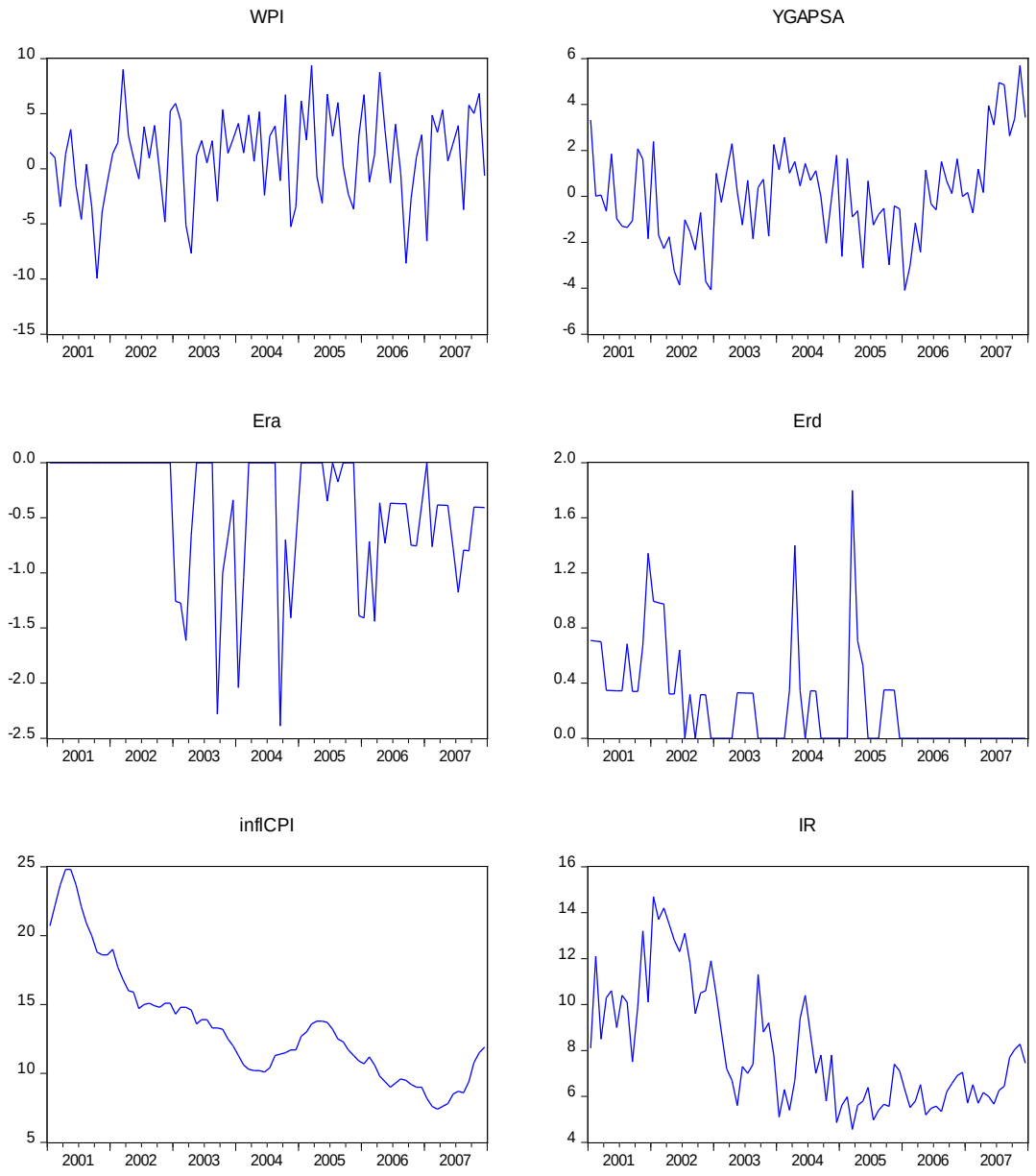

Figure 5.7. Individual graphs for the variables of the model 3.

The stationarity properties of the variables were tested. The ADF test shows that all the variables are stationary, except the seasonally adjusted output gap variable. Thus, I take the first difference of the YgapSA variable (see Table A.2, Appendix A). CPI inflation variable is stationary under the 10% significance level.

The results of the Granger causality test are presented in Table A.15 in the Appendix A. The Cholesky ordering of the variables for the Model 3 is as follows: WPI_t, D_YgapSA_t, ERA_t, ERD_t, $InflCPI_t$, and IR_t. According to the lag length criteria I estimate the model with one lag (See Table A.16, Appendix A). The model

is stationary and free from autocorrelation (see Table A.17 and Figure A.4, Appendix A). Estimation results of the model are presented in the Table A.18 in the Appendix A.

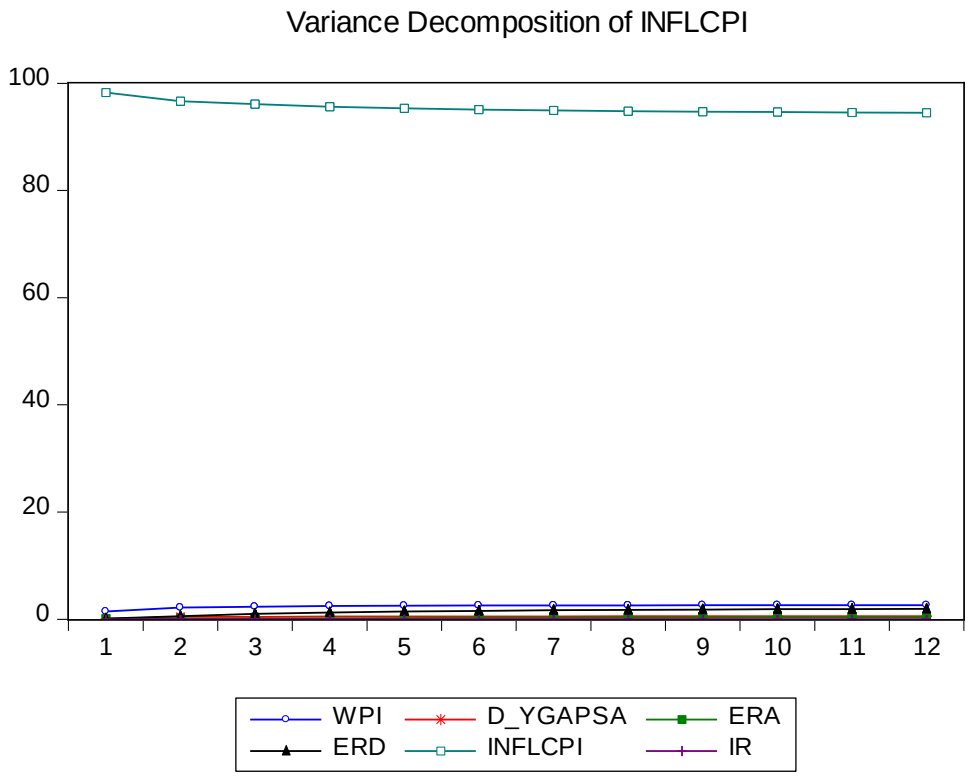

Figure 5.8. Variance decomposition analysis for the model 3.

Variance decomposition analysis (see Figure 5.8) reveals that variations in the inflation variable were mostly explained with its own dynamics in the previous periods. 1.9 percent of the fluctuations in inflation were explained with the exchange rate depreciation dynamics, and 0.4% of them were explained with the dynamics in the exchange rate appreciation (see Table A.19, Appendix A).

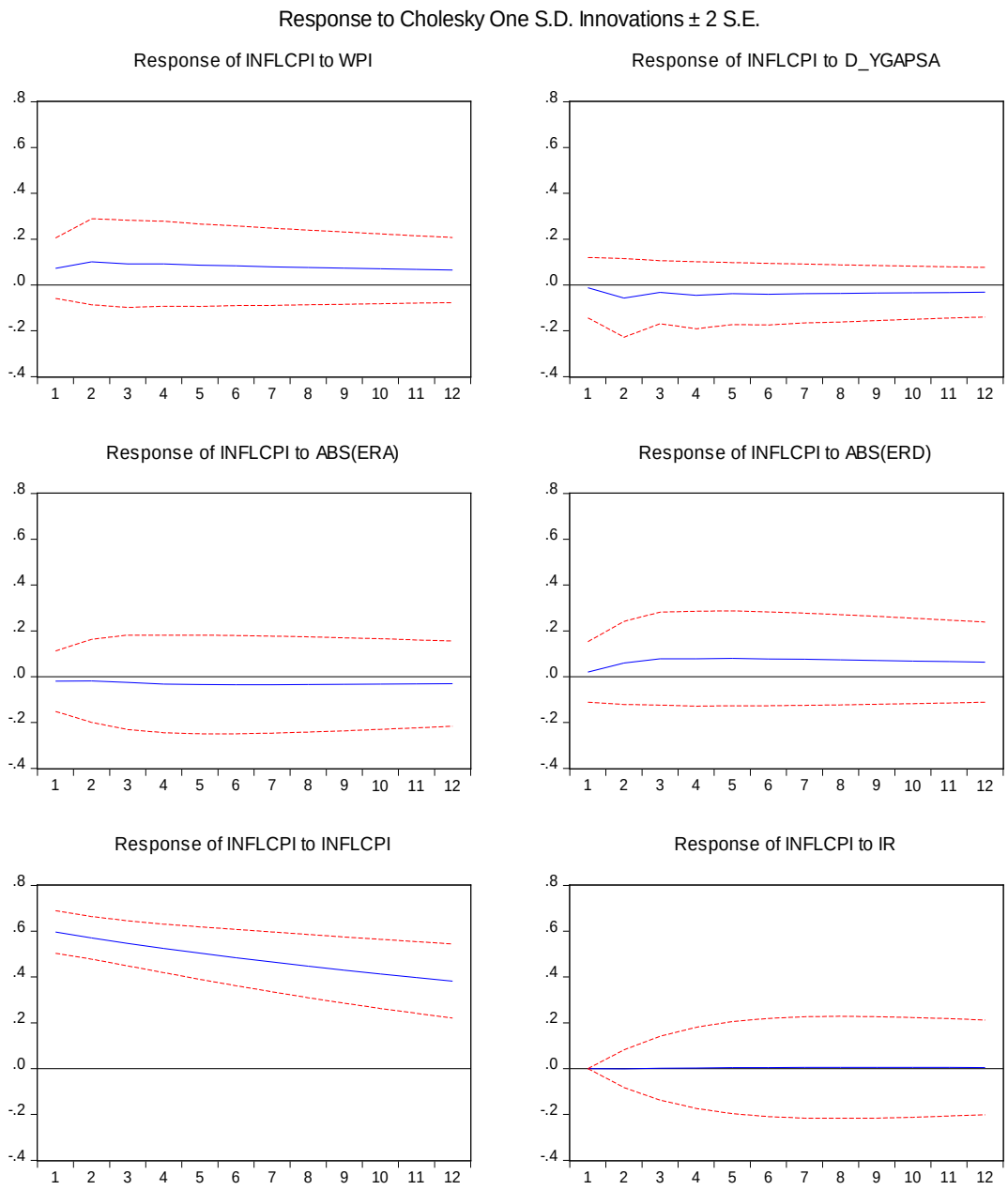

Figure 5.9. IRF analysis of the model 3.

The impulse response function analysis demonstrates that Russian inflation during the first period had insignificant response to both ERA and ERD variables. More specifically, inflation rate decreases by 0.04% when the domestic currency appreciates, and increases by 0.08% when the domestic currency depreciates (see Table A.20, Appendix A).

The findings of the first period analysis are more or less in line with the findings of Kataranova (2010). Inflation is indeed more sensitive to the changes in exchange

rate depreciation, but the response is insignificant. Thus, I cannot say that there is an asymmetric exchange rate pass-through in Russia in the first period.

5.4.2 Asymmetric exchange rate pass-through analysis of the second period

Second period estimates the causes of Russian inflation during September 2009 – December 2015. I omit the period affected by the Global Financial crisis in order to avoid the influence of the external economic shocks. Figure 5.10 shows the individual graphs of the variables used in the model.

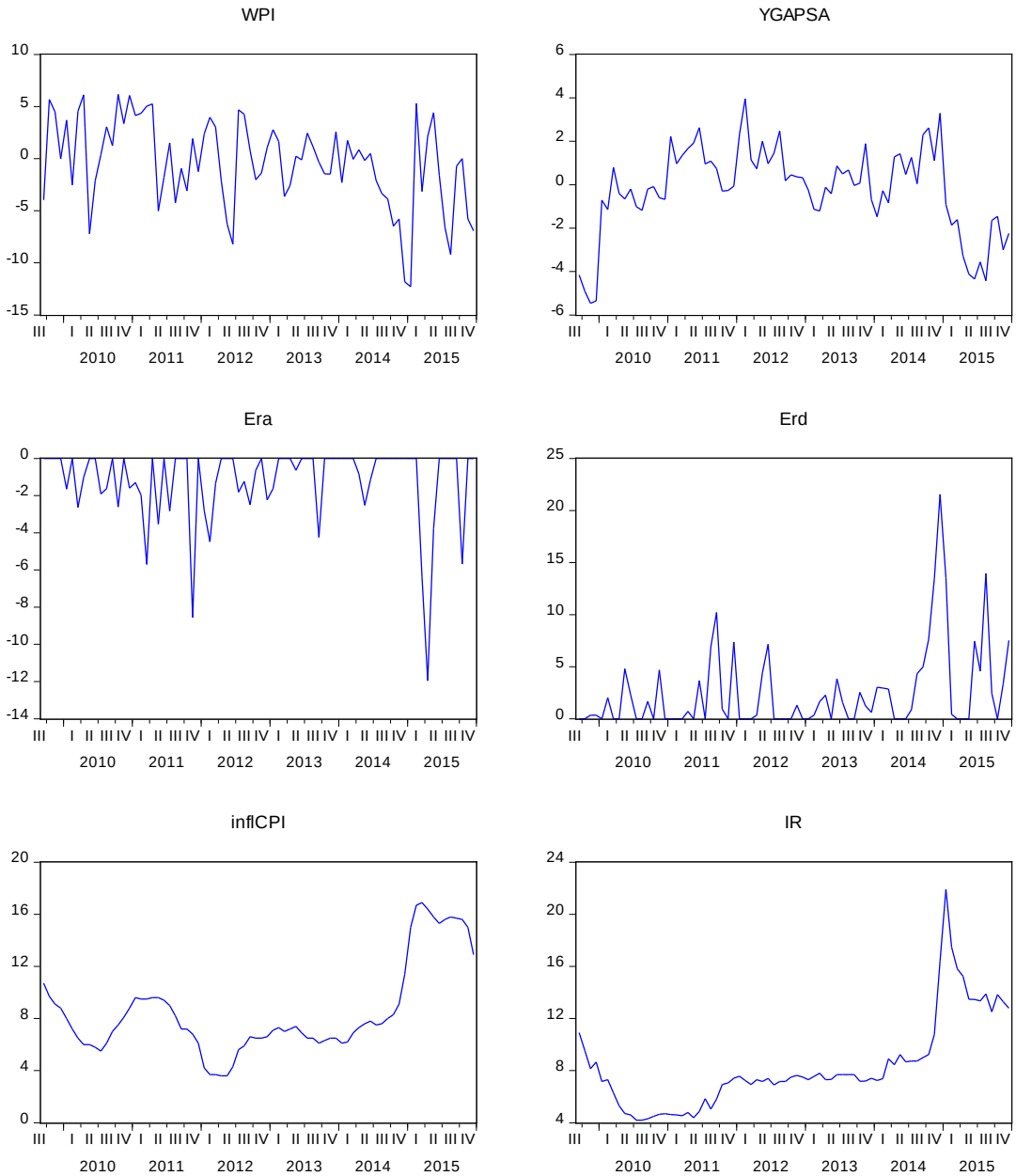

Figure 5.10. Individual graphs of the variables of the model 4.

According to the ADF test results, all the variables in the model are stationary except the CPI inflation variable. Thus, for the model I use first order differentiation of the InflCPI variable (see Table A.2, Appendix A). Granger causality test is presented in the Table A.21 of the Appendix A. The Cholesky ordering of the variables for the model is as follows: WPI_t, $YgapSA_t$, ERA_t, ERD_t, $D\_InflCPI_t$, and IR_t.

According to the lag length criteria (see Table A.22, Appendix A), I estimate the model with one lag. The model does not suffer from autocorrelation and is stationary (see Table A.23 and Figure A.5, Appendix A). Estimation results for the model 4 are presented in Table A24. in the Appendix A).

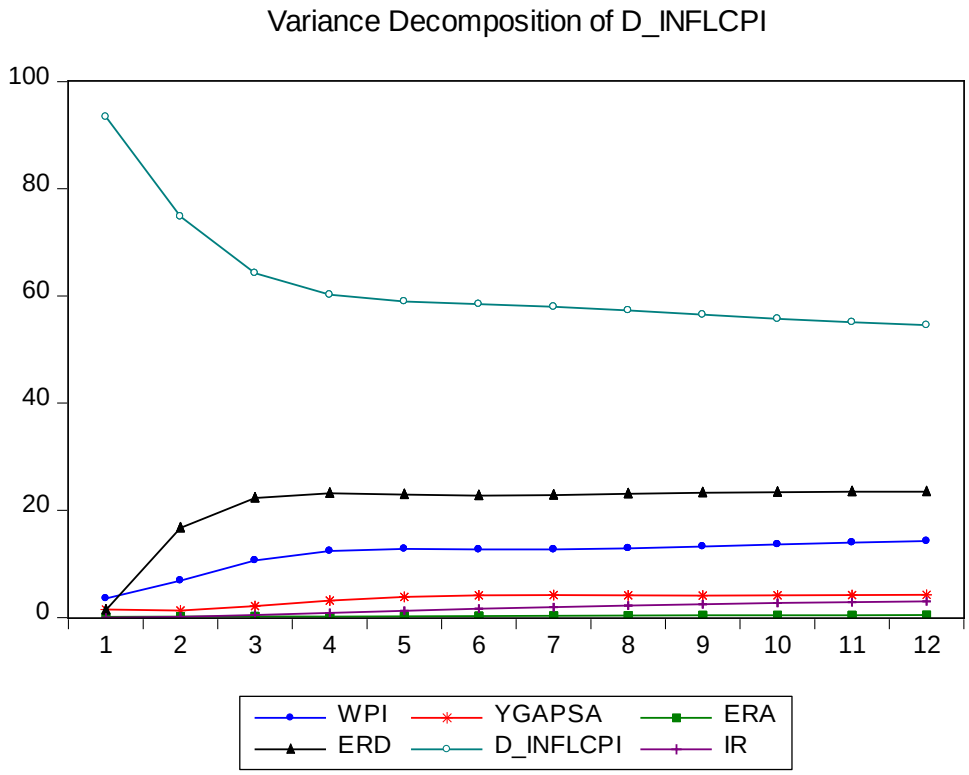

Figure 5.11. Variance decomposition of inflation, model 4.

Figure 5.11 presents the results of the variance decomposition of Russian inflation after the crisis of 2008. As one can see, the influence of the exchange rate depreciation on the inflation dynamics significantly increased, compared to the previous period. A shock to the ERD variable explains 23% of the fluctuations in CPI inflation variable. At the same time, a shock to the exchange rate appreciation variable accounts for only 0.4% of the fluctuation in inflation (see Table A.25,

Appendix A). More than that, one can see the increased effect of the world price index on Russian inflation. This result may be related to the transition to the floating exchange rate regime.

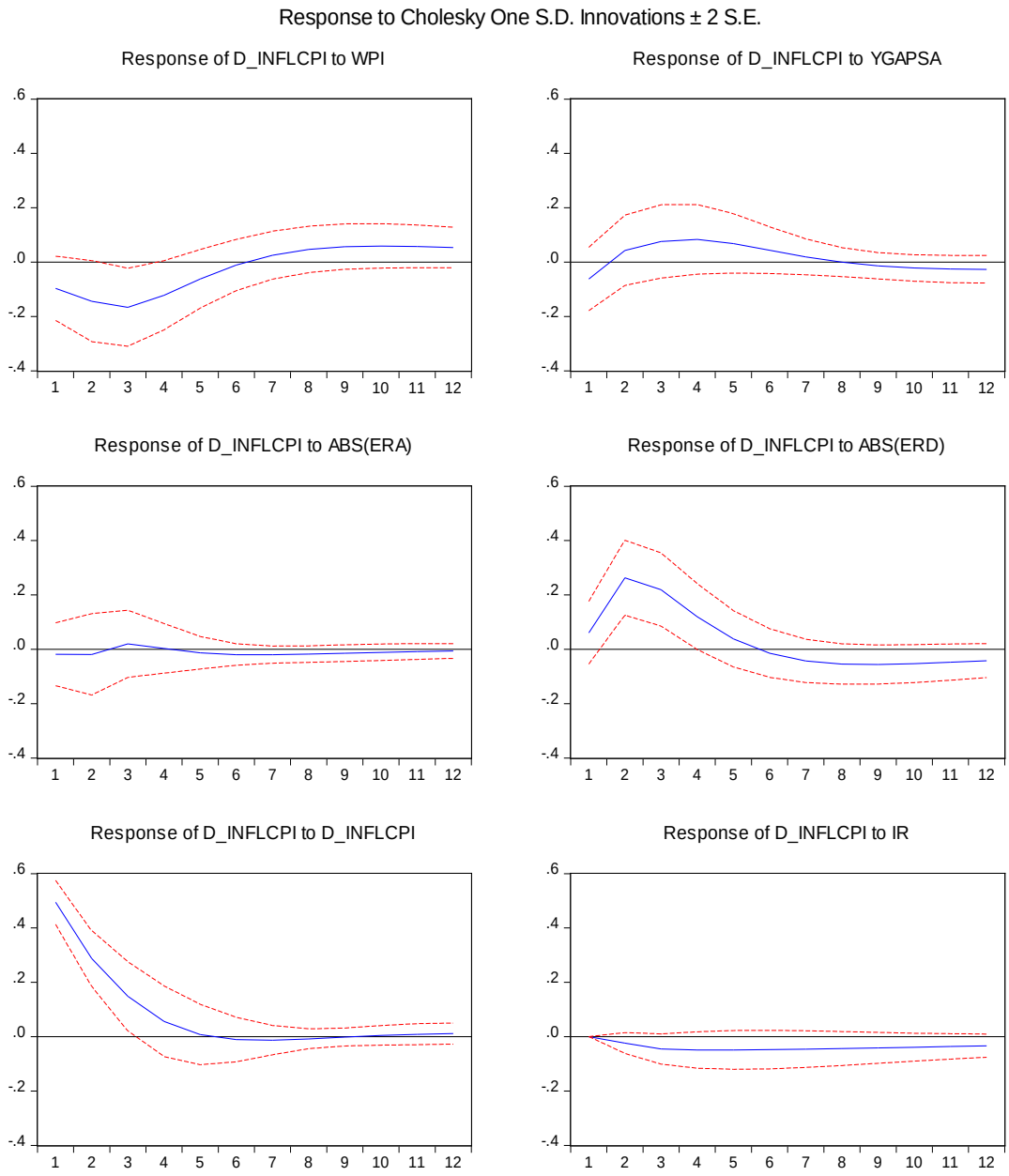

Figure 5.12. IRF analysis for the model 4.

Impulse response function analysis for inflation indicates that during the second period Russian inflation had significant positive response to the changes in the exchange rate depreciation, while it was insignificant to the changes in the exchange rate appreciation (see Figure 5.12 and Table A.26, Appendix A). Thus,

currency depreciation will cause a strong and fast increase in inflation within the first two periods.

Estimations for the second period reveal that exchange rate depreciation was the most important factor in Russian inflation after the Crisis, while during the first period the asymmetric nature of the exchange rate pass-through was not so critical.

5.5 Conclusion

In this chapter, I analyzed the reasons for inflation in Russia. Both the variance decomposition and impulse response function analyses indicate that Russian inflation is mostly caused by the changes in the dynamics of itself, and by the dynamics of exchange rate.

The importance of the exchange rate dynamics as an inflation factor can be explained with several factors. First, exchange rate has a huge effect on inflation through direct and indirect channels. Second, as I discussed in chapter four, exchange rate swings may have negative affect on the balance sheets of firms and competitiveness of domestically produced goods, which later may form upward pressure on inflation. These facts make monetary policy authorities highly concerned with exchange rate dynamics.

My results are similar to those reached by Benlialper et al (2015). They derive two main conclusions from it. The first one is that, the importance of the exchange rate does not coincide with the main tenets of the inflation targeting regime. However, Russia is in the transition period to the IT regime, thus, this kind of effect would be premature. The second conclusion considered by the authors is that, it may indicate that the central bank may have asymmetric monetary policy response to appreciation or depreciation of the domestic currency. In order to find whether the CBR tolerates the appreciation of the domestic currency I continue with the analysis of the interest rate setting behavior.

Managed floating exchange rate regime of the CBR was aiming to control exchange rate fluctuations. It had pre-announced foreign exchange intervention volumes. In theory, managed floating exchange rate regime was supposed to protect inflation dynamics from the external shocks, thus the effect of the exchange rate depreciation

or appreciation on inflation should have been symmetrical. However, the analysis of the two separate periods reveals that inflation dynamics in the second period were mostly determined by the exchange rate depreciation; while in the first period the response of inflation to changes in the exchange rate variables was mostly insignificant. The result can be explained with the huge amounts of foreign exchange interventions, actively pursued by the CBR. Supporting the currency value, it imposed a pressure on domestic inflation. However, the analysis of the second period reveals that after the gradual transition to the free floating exchange rate regime, the influence of the exchange rate depreciation on inflation increased.

Given the fact that exchange rates have been very influential on inflation, the CBR might have taken very active stance towards exchange rates dynamics. In the next chapter, utilizing VAR technique, I estimate interest rate factors, as one of the most important tool of the monetary policy.

CHAPTER 6

ASYMMETRIC MONETARY POLICY STANCE WITH RESPECT TO THE EXCHANGE RATE

Exchange rate is a crucial factor for many of the developing countries. As we know, Russian Central Bank pays huge attention to the value of the domestic currency. It follows managed floating exchange rate regime as spending huge amounts of its reserves for the foreign exchange interventions, which are supposed to keep the value of ruble within the limits. This kind of policy can affect the repercussions of monetary policy.

According to the official announcements of the Bank of Russia, monetary policy response to the currency appreciation or depreciation is supposed to be symmetric. In this chapter I analyze this hypothesis using vector autoregressive models. For the whole period overall the results of the analyses suggest that monetary authorities were tolerating currency appreciation and strongly responding depreciation. The chapter also includes the analyses of the two separate time periods as before the crisis of 2008, and as after the crisis. According to the official sources, the CBR was taking into attention the dynamics of the exchange rate while constructing monetary policy before the crisis; and shifted to free floating exchange rate regime after the crisis. However, the analyses reveals that after the Global Financial crisis of 2008 dynamics of the exchange rate had bigger effect on monetary policy instrument than before the crisis.

In the first section I examine the literature on Russian monetary policy rules and theoretical background for the asymmetric monetary policy stance. Second section includes the results of the analysis of the first and second model, which estimate the

response of the interest rate to the dynamics of the exchange rate depreciation and appreciation separately. The third section focuses on asymmetric monetary policy stance in two separate periods.

6.1 Theoretical background for the asymmetric monetary policy stance VAR model

After the Asian crisis 1998, Russian monetary authorities became concerned about hyperinflation and the impact of exchange rate on Russian economy. As being discussed in chapter three, the CBR changed its exchange rate policy several times: from fixed exchange rate, to managed floating exchange rate in 1999 and to free floating exchange rate regime in 2014 ("The history of the Bank of Russia foreign exchange policy", 2013). A shift to the free-floating exchange rate regime started after the Global Financial crisis of 2008. The main aim of the adoption of the new policy regime was to increase the effectiveness of interest rate policy and decrease the impact of exchange rate fluctuations on domestic inflation (II, Q., 2011).

Dobrynskaya et al (2008) claim that exchange rate pass-through effect in Russia should be higher than in developed economies, since it is highly dependent on world markets. Estimating the relation between Russian monetary policy and the exchange rate pass-through effect, the authors find that monetary policy in Russia does not achieve its primary goals. Thus, it cannot smooth the effect of exchange rate fluctuations on the economy.

Graniville et al (2010) test whether Russian real interest rate is reacting to policy driven exchange rate shocks. Using Vector Error Correction Model, authors find that exchange rate channel played an important role applying of monetary policy in Russia during 1995-2009. They find significant response of inflation to the changes in exchange rate, while an increase in inflation is responded by changes in interest rate. Thus, authors conclude that Russian monetary policy was not designed to maintain price stability in the observed period.

Korhonen et al (2016) estimate several monetary policy rules for Russia using data for the period 2003-2015. Using Generalized Method of Moments estimator for the Taylor monetary policy rule reaction function, authors find that Russian interest

rate, as the main instrument of monetary policy, significantly responds to changes in inflation and output gap. At the same time, they also find that appreciation of the currency does not result with a loose monetary policy, as it is expected to be in theory. However, adding the oil prices into estimation equation did not produce clear results, because exchange rate and oil prices are highly interrelated.

For my analysis of the asymmetric monetary policy stance with respect to the exchange rate in Russia, I choose the same classic Taylor's monetary policy rule reaction function with Korhonen et al (2016). The function has a following form (Taylor, 2001):

$$r = \pi + g*y + h*(\pi - \pi^*) + r, \qquad (2)$$

In the equation (2), r – is a short-run interest rate; y – is a percentage deviation of real output; $(\pi - \pi^*)$ – is a deviation from the price level.

Benlialper et al (2015) use VAR model for the estimation of the asymmetric effect of the exchange rate changes on monetary policy in Turkey. Their model (equation (3)) is based on the extended Taylor rule, which captures the impact of the exchange rate on monetary policy decisions:

$$i_t = \alpha_0 + \alpha_{1*}\, i_{t-1} + \alpha_1*(\pi_t - \pi_t^*) + \alpha_2\,(y_t - y^*) + \alpha_3 \Delta e_t \qquad (3)$$

Their model includes change in the nominal exchange rate (e_t), output gap $(y_t - y^*)$, interest rate (i_t) and inflation gap $(\pi_t - \pi_t^*)$. They define two variables for the exchange rate depreciation and appreciation in order to find the asymmetric response of the interest rate, as the main important monetary policy variable. Analyzing impulse response function, they find greater response of the monetary policy to the exchange rate depreciation, than to the appreciation.

Similar to the previous studies, I define two separate variables for the exchange rate depreciation and appreciation in the same way as in the previous chapter:

ERA = max (ER, zero), for appreciation;

ERD = min (ER, zero), for depreciation.

For the model five, I take the same seasonally adjusted output gap variable $YgapSA_t$, monthly short term interest rate (IR_t). In order to find inflation gap variable ($Inflgap_t$) I take the difference between the actual realized CPI inflation and targeted monthly inflation.

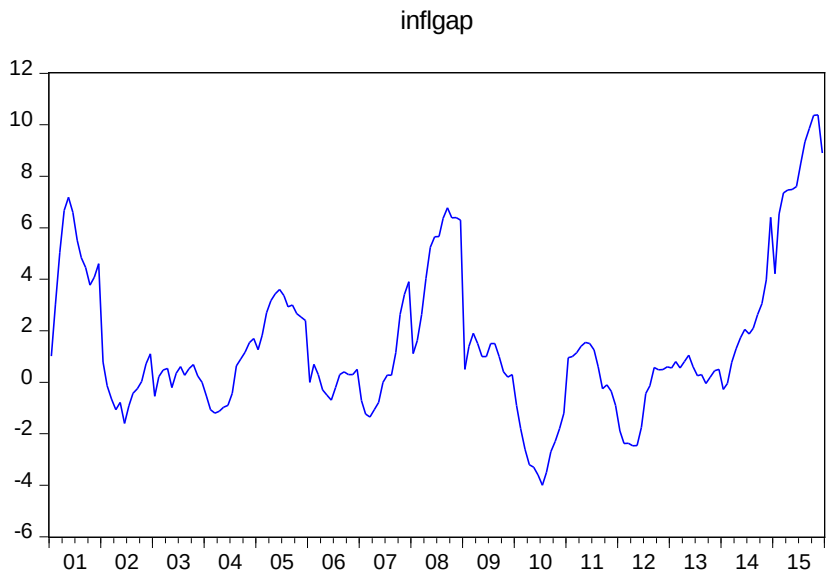

Figure 6.1. Inflation Gap variable graph.

Figure 6.1 shows the graph for the new variable Inflation Gap, which will be used in the model 5. In the next section, where estimation results are discussed, I consider stationary properties of the variables as well.

6.2 Estimation results

In this section, I analyze the repercussions of the monetary policy decisions of the CBR with a specific attention to the exchange rate depreciation and appreciation. First, I need to check the stationary properties of the variables (see Appendix A, Table A.2). Stationary properties of the exchange rate depreciation and appreciation variables were discussed in the previous chapter. According to the ADF test results, the new variable, inflation gap, is not stationary. Thus, I use the first difference of the InflGap variable (d_InflGap) and construct the model. The descriptive statistics of all variables are presented in Table A.1 in the Appendix A.

Since I will analyze the IRF, I need to carefully order the variables for the VAR model. The Pairwise Granger causality test is presented in the Table A.27 in the

Appendix A. Similar to the previous models, I order the variables as follows: $YgapSA_t$, ERA_t, ERD_t, $d\_InflGap_t$, and IR_t[18]. I also impose a Dummy variable, with the same characteristics as in the previous model. According to the lag length criteria (Table A.28, Appendix A), I estimate VAR model with five lags. The system is stationary and free from autocorrelation (Figure A.6 and Table A.29, Appendix A). Estimation output of the system is presented in Table A.30 in the Appendix A.

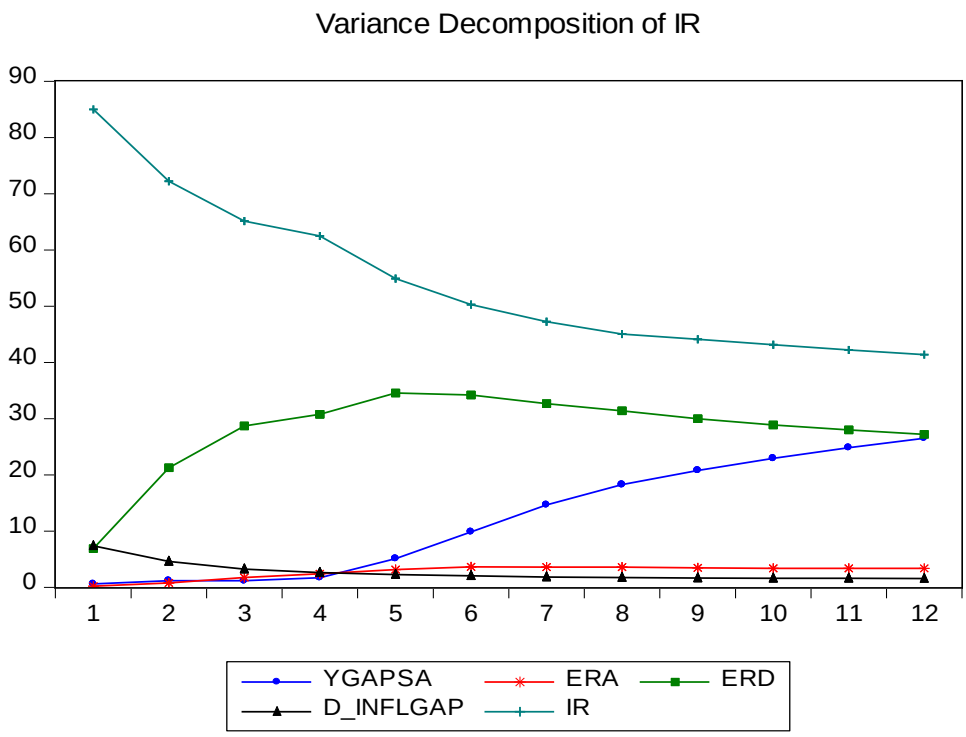

Figure 6.2. Variance decomposition for the model 5.

The variance decomposition analysis demonstrates that 34% of the dynamics of interest rate are explained with the dynamics of the exchange rate depreciation, while the appreciation explains only 3.5% of the fluctuations occur for the interest rate**.** A shock to the output gap variable will account for 25% of the fluctuations in interest rate in later periods, when the effect of depreciation decreases. The dynamics of other variables are not significant (see Table A.31, Appendix A).

[18] Other orderings of the variables do not change the results significantly.

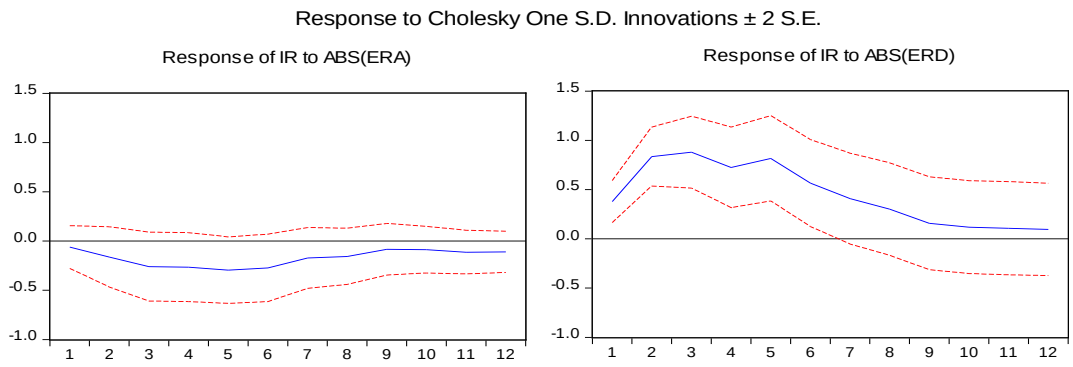

Figure 6.3. The response of the Interest rate to absolute values of ERD and ERA variables'

The results of the IRF prove that, following the shock to the ERD variable, the interest rate significantly increases within the first 5 months. However, the response of the interest rate to the shock in appreciation variable is much smaller and insignificant. Thus, a shock to the depreciation variable has a significant impact on the interest rate decisions of the CBR (see Figure 6.3).

These findings allow us to assume that monetary authorities adjust interest rates in response to changes in the nominal exchange rate in a relatively asymmetric way (see Table A.32, Appendix A). The obtained results are robust to all other specifications: the variance decomposition and the impulse response function of the interest rate do not change significantly with all other Cholesky orderings.

In order to further increase the robustness of the analysis, I run the model imposing new variables W^{minus} and W^{plus}. The variables defined as follows:

W^{minus}_t = $ERchange_t$ if $ERchange_t < -2\%$,

0 otherwise

W^{plus}_t = $ERchange_t$ if $ERchange_t > 2\%$,

0 otherwise

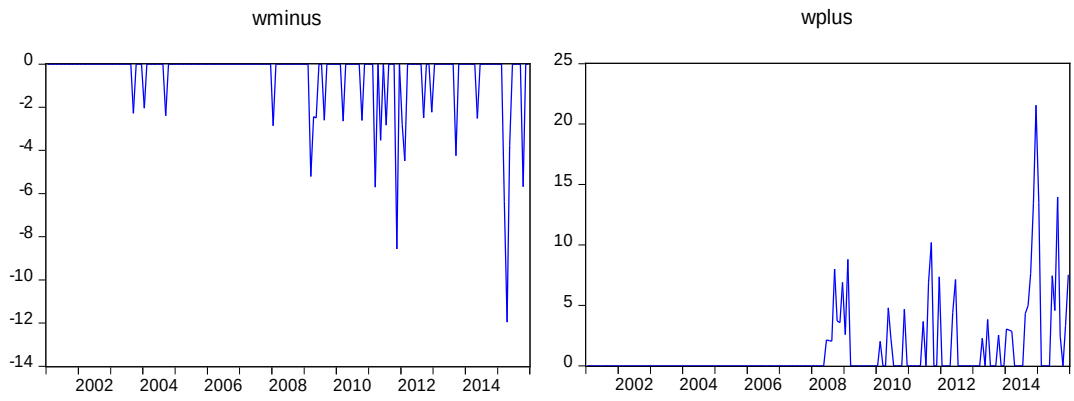

Figure 6.4. Individual graphs for the variables Wminus and Wplus.

Figure 6.4 represents the individual graphs of the new variables. Descriptive statistics and stationary tests results are presented in tables A.1 and A.2 in the Appendix A, respectively. The ADF test results show that W^{minus} and W^{plus} are stationary under the hypothesis of random walk (table A.2, Appendix A).

Running the model with new variables, I assume that monetary authorities take only changes higher than 2% of the existing exchange rate into account. The reason I chose to consider the changes higher than 2% is that, the allowed fluctuations of the exchange rate were relatively small during the Dual-currency basket exchange rate policy. As I discussed earlier, the CBR was allowed to implement foreign exchange interventions not only on the borders of the Dual-currency basket exchange rate corridor, but also within the borders.

The results of the pairwise Granger causality test are presented in Table A.33 available in the Appendix A. As in the previous models, I take the ordering of variables as follows: $YgapSA_t$, W^{minus}_t, W^{plus}_t, $D\_InflGAP_t$, and IR_t. According to the lag length criteria, I estimate VAR model with 5 lags (Table A.34, Appendix A). Estimated model is stationary and free from autocorrelation (Figure A.7, and Table A.35, Appendix A). Estimation outputs of the model are presented in Table A.36 in the Appendix A.

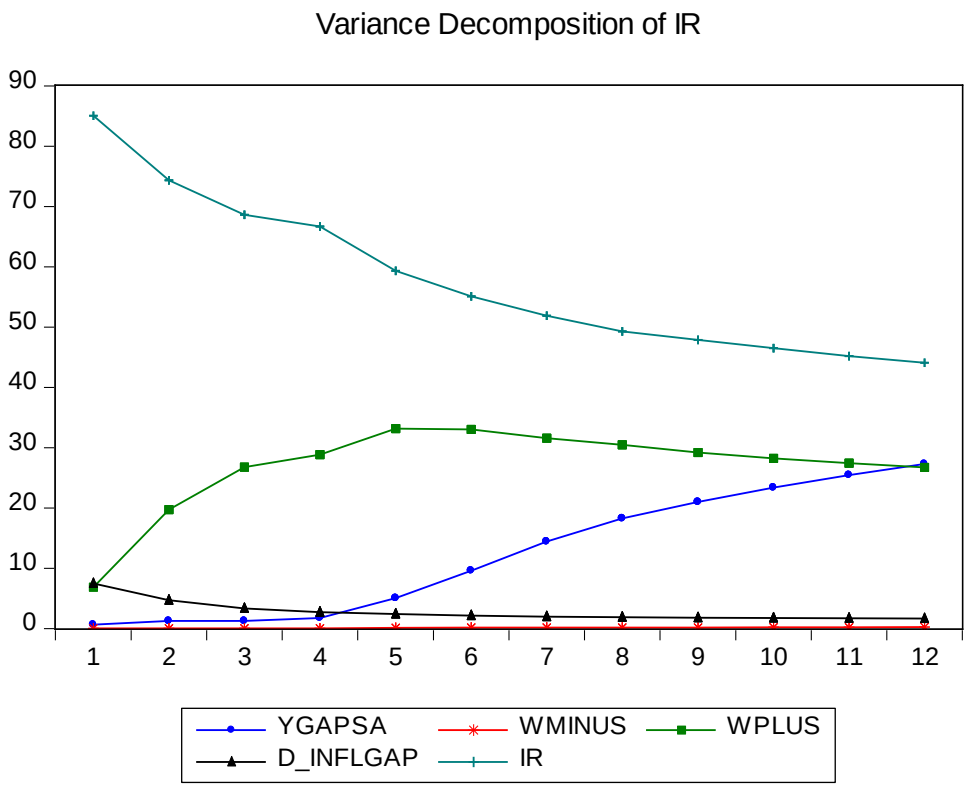

Figure 6.5. Variance decomposition of interest rate for the model 6.

As presented in Figure 6.5 of variance decomposition for the interest rate, Russian monetary policy is more affected by the dynamics of the exchange rate depreciation. A shock or innovation of the W^{plus} variable will account for 33% (see Table A.37, Appendix A) of the fluctuation in the interest rate. W^{plus} variable indicates the depreciation of ruble by higher than 2%. Another important variable in determining interest rate dynamics is output gap. A shock to the YgapSA variable will account for 26% of the fluctuation in interest rates.

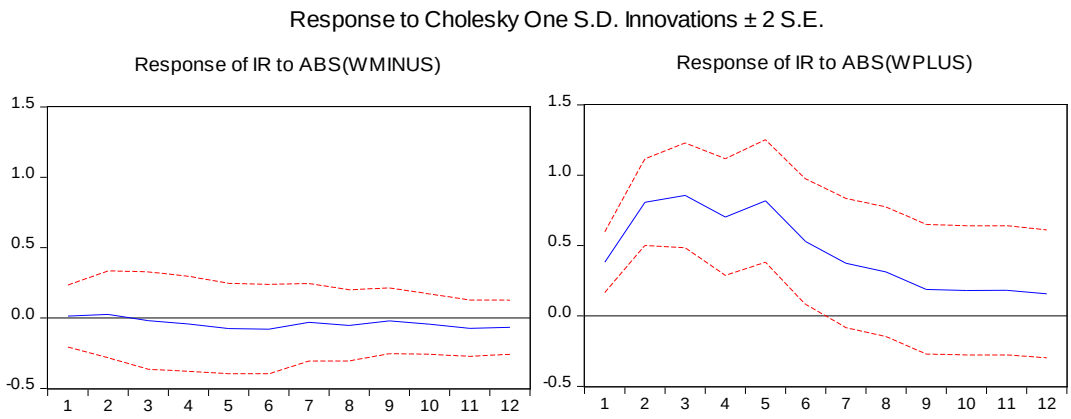

Figure 6.6. IRF for the interest rate. Model 6[14].

The results of the IRF analysis state that depreciation of the domestic currency for more than 2% is followed by a sharp increase in the interest rates within the first 5 months. A shock to the W^{minus} variable will get insignificant response from the interest rate (see Table A.38, Appendix A).

According to the models 5 and 6, the CBR has constantly tolerated exchange rate appreciation, and strongly responded exchange rate depreciation. However, since Russia had greatly suffered from the Global Financial crisis of 2008, it would be better to estimate two separate periods. In order to see how the monetary policy stance with respect to the exchange rate dynamics developed before and after the crisis. In the next section, I estimate model for the 2001-2007 and 2009-2015 periods.

6.3 Monetary policy response function for the two different periods

Monetary policy stance is a variable that can change over time. Monetary policy development depends on many internal and external factors and their dynamics. In order to have a detailed analysis of the monetary policy behavior of the CBR, I run the monetary policy response analysis for two separate periods: January 2001 – December 2007 and September 2009 – December 2015[19].

[19] In order to see the general activity of the CBR I omit the period of the Global Financial crisis of 2008.

6.3.1 Model 7: Analysis of the first period

The seventh model focuses on the behavior of monetary policy during the pre-crisis period. As I discussed in chapter three, during the period 2001-2007 the CBR was paying attention to the dynamics of the exchange rate when making decisions on monetary policy. The model includes the same variables as I took in the previous sections: IR, Ygap, InflGap, ERA, and ERD.

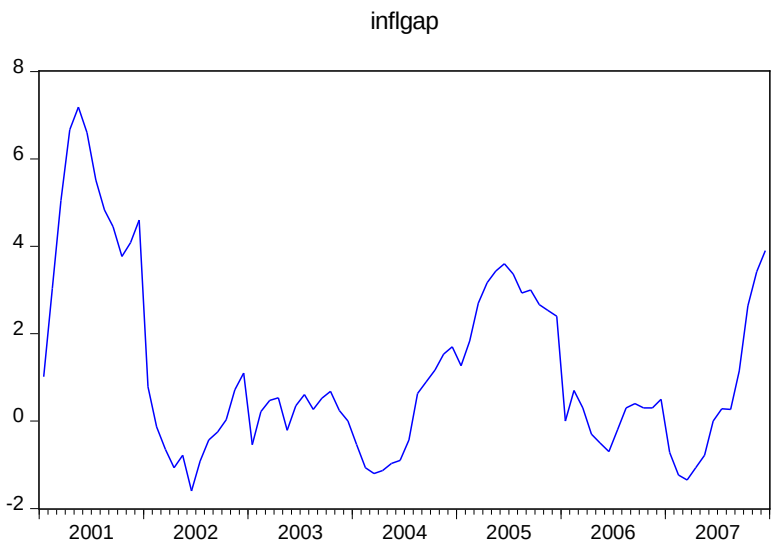

Figure 6.7. The graph of the output gap variable.

Individual graphs of the variables are presented in Figure 5.7. Figure 6.7 shows the graph of the inflation gap variable. Considering that output gap variable suffers from seasonality, I take seasonally adjusted YgapSA. Stationary properties of the variables were tested. The ADF test implies that all of the variables are stationary, except YgapSA. Thus, I take the first difference of the seasonally adjusted output gap for the period 2001-2007. ADF test results are presented in Table A.2 in the Appendix A. The descriptive statistics of the variables are presented in Table A.1 (Appendix A).

The ordering for the model 7 is as follows: D_YgapSA_t, ERA_t, ERD_t, $InflGap_t$, IR_t (results of the Granger causality test are presented in Table A.39, Appendix A). According to Schwarz information criterion I estimate the model with one lag (see Table A.40, Appendix A). The model is stationary and free from autocorrelation (see Figure A.8 and Table A.41 accordingly). Estimation outputs of the model are presented in Figure A.42 (Appendix A).

I start the analysis with the Variance Decomposition.

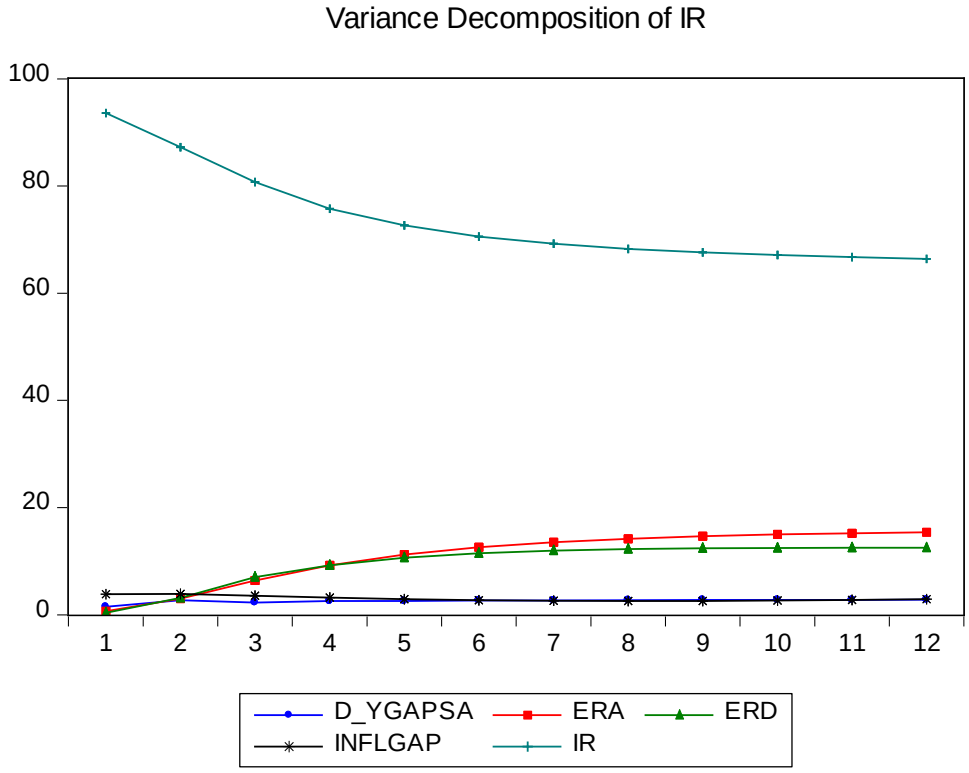

Figure 6.8. Variance decomposition graph of the interest rate.

Figures 6.8 shows the results of the Variance decomposition. As one can see, the dynamics of the interest rate were mostly explained by the dynamics of interest rate variable itself. There is no such a big difference between the importance of the ERD and ERA variables. A shock to the ERD variable will explain 12.5% of the fluctuations in interest rate, and a shock to the ERA variable will explain 15% of the fluctuations in interest rate. Shocks to the output gap and inflation gap variables have almost same effect on interest rate dynamics. The variance decomposition analysis' results are presented in Table A.43 in the Appendix A.

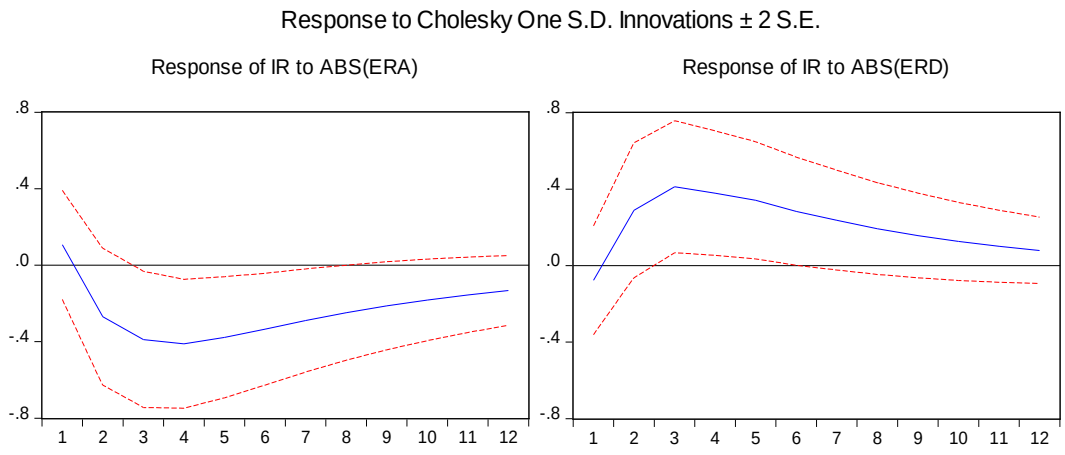

Figure 6.9. Impulse response function of the interest rate for the model 7.

The results of the impulse response function put that the highest response the IR variable will have highest response to the dynamics of itself (see Table A.44, Appendix A). It has insignificant response to changes in the output gap and inflation gap variables. Most importantly, one can see that short-term interest rate dynamics have symmetric response to the shock to ERA and ERD variables (See Figure 6.9).

In order to increase the robustness of the analysis results, I estimate the first period using W^{plus} and W^{minus} variables, same as in the previous section. The model 8, will estimate the response of the interest rate variable to the changes in the exchange rate variable only higher than 2%. Individual graphs for the new variables are presented in the figure 6.10.

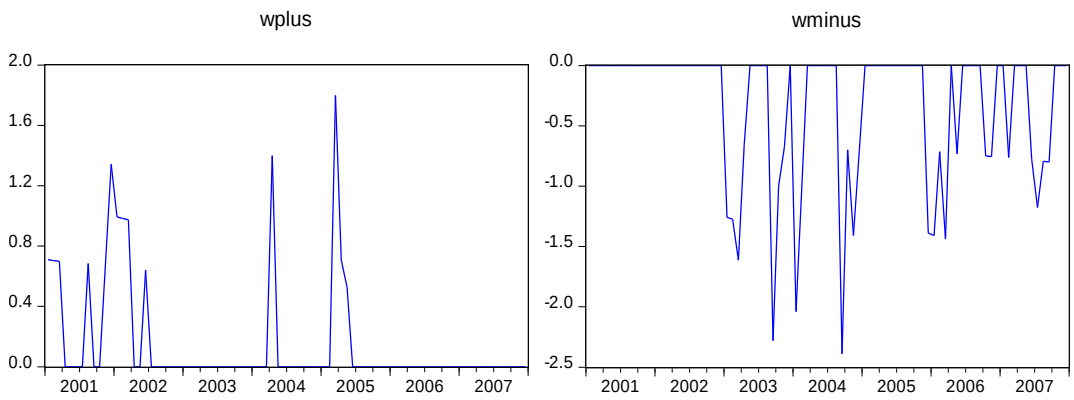

Figure 6.10. Individual graphs for the variables Wplus and Wminus.

According to the ADF test, new variables are stationary (see Table A.2, Appendix A). As in the previous model, the Cholesky ordering for the model 8 is as follows:

D_YgapSA_t, W^{minus}_t, W^{plus}_t, $InflGap_t$, IR_t (see Granger Causality test results in Table A.45, Appendix A). According to the Lag Length criteria (see Table A.46, Appendix A) I estimate the model with one lag. The model is stationary and free from autocorrelation (see Figure A.9 and Table A.47, Appendix A). Estimation outputs are presented in Table A.48 in the Appendix A.

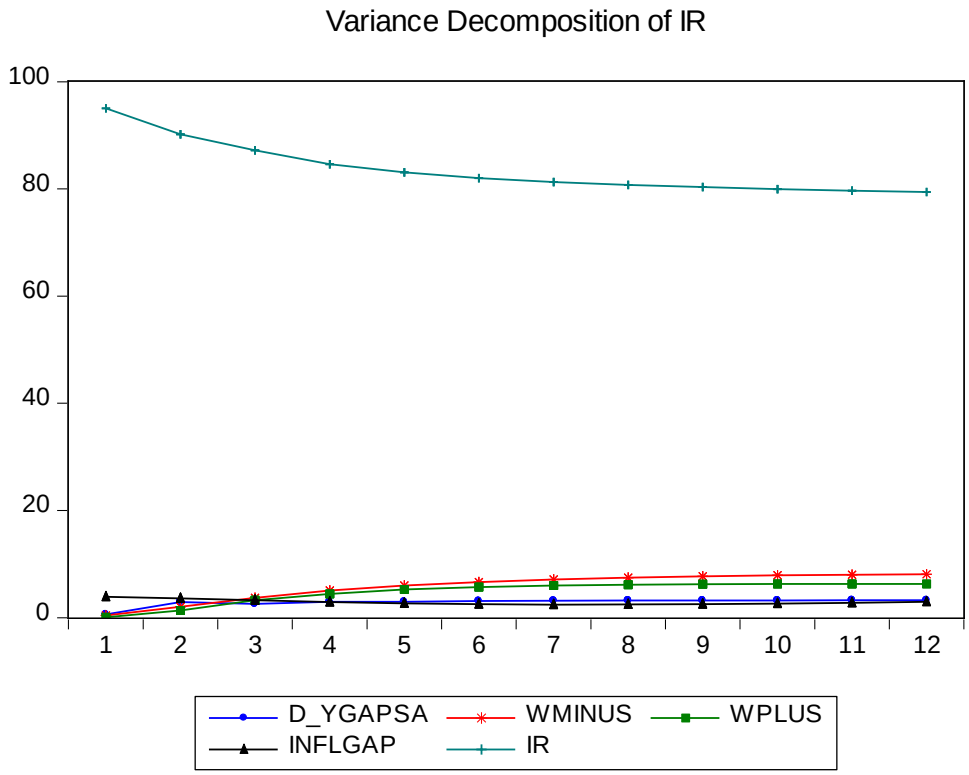

Figure 6.11. Variance decomposition of the interest rate for the model 8.

Variance decomposition for the model 8 indicates that changes in the exchange rate greater than 2% have low impact on Russian monetary policy instrument – short-term interest rate. More importantly, exchange rate depreciation and appreciation affect dynamics of the IR_t variable almost in the same way (see Table A.49, Appendix A).

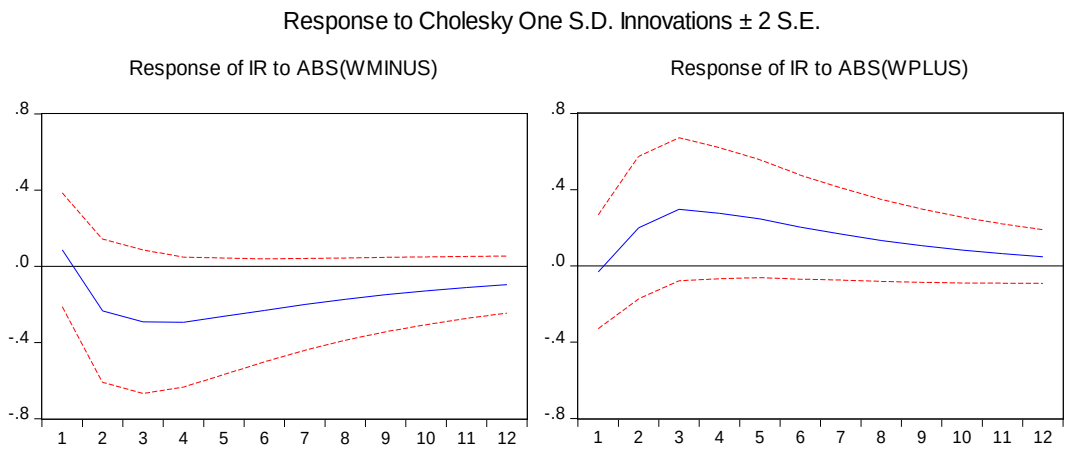

Figure 6.12. IRF of the interest rate for the model 8.

The results of the impulse response function analysis of the interest rate indicate that Russian monetary policy instrument had insignificant response to the changes in the exchange rate higher than 2% (see Figure 6.12, Table A.50, Appendix A)

The analysis of the period January 2001 – December 2007 reveals that the dynamics of the exchange rate depreciation and exchange rate appreciation had almost the same effect on the interest rate. One may remember that similar results I arrived in estimating the response of Russian inflation in first period in the previous chapter. It means that the CBR was responding to the changes in the exchange rate more or less symmetrically. Thus, I conclude that there was no asymmetric monetary policy stance during the pre-crisis period.

Next, I will study the behavior of monetary policy in Russia in the period after the Global Financial crisis.

6.3.2 Model 9: Analysis of the second period

Second period observes the time segment from September 2009 to December 2015. For the model 9 I use the same variables, as in the previous period. The individual graphs for most of the variables are presented in Figure 5.10.

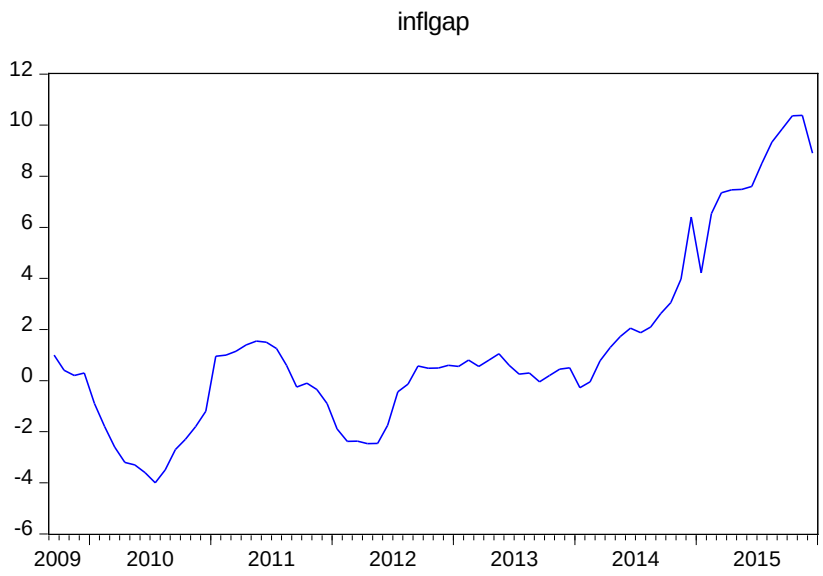

Figure 6.13. The graph of the inflation gap variable.

Figure 6.13 shows the dynamics of the inflation gap variable for the second time period. I take seasonally adjusted output gap: YgapSA in order to deal with the seasonality problem. With the help of Augmented Dickey-Fuller test, I tested stationary properties of the variables. The results are presented in Table A.2 in the Appendix A.

Stationary test reveals that all of the variables are stationary, except for the inflation gap. Thus, I take first order differentiation of InflGap variable. Furthermore, interest rate variable is stationary under the 10% significance level. The descriptive statistics of the data are presented in Table A.2 in the Appendix A.

The ordering of the variables is as follows: $YgapSA_t$, ERA_t, ERD_t, $D\_InflGap_t$, IR_t (Granger causality test results are presented in Table A.51 in the Appendix A). According to Schwartz information criteria (see Table A.52 in the Appendix A), I estimate the model with one lag. The model is stationary and free from autocorrelation (see Figure A.10 and Table A.53 in the Appendix A). Estimation output of the model is presented in Table A.54 in the Appendix A.

The results of the Variance decomposition analysis are presented below.

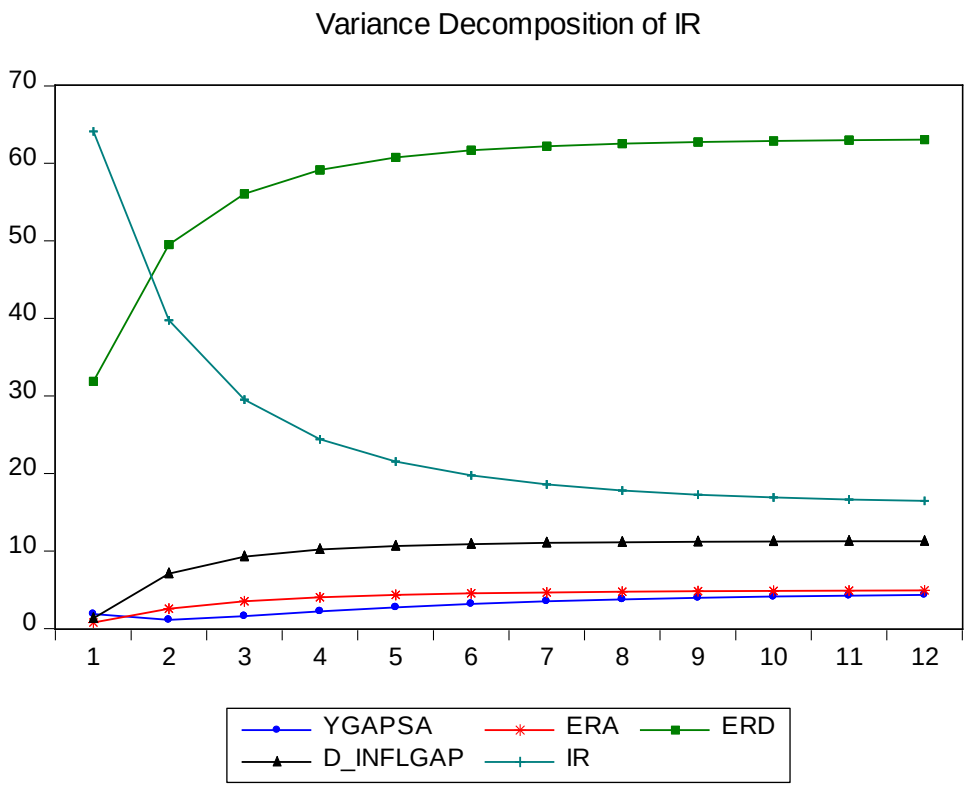

Figure 6.14. Variance decomposition graph of interest rate for the model 9.

The results of the Variance decomposition show that the importance of the exchange rate depreciation in determining the dynamics of interest rate increased dramatically. Almost 64% of the fluctuations in the interest rate are explained with the shock to the ERD variable. Furthermore, the role of the inflation gap also increased. Thus, shock to the inflation gap will explain 11% of the fluctuations in the interest rate. Also, I notice that the role of the ERA variable decreased to only 5%. Variance decomposition analysis results for the model 9 are presented in Table A.55 in the Appendix A.

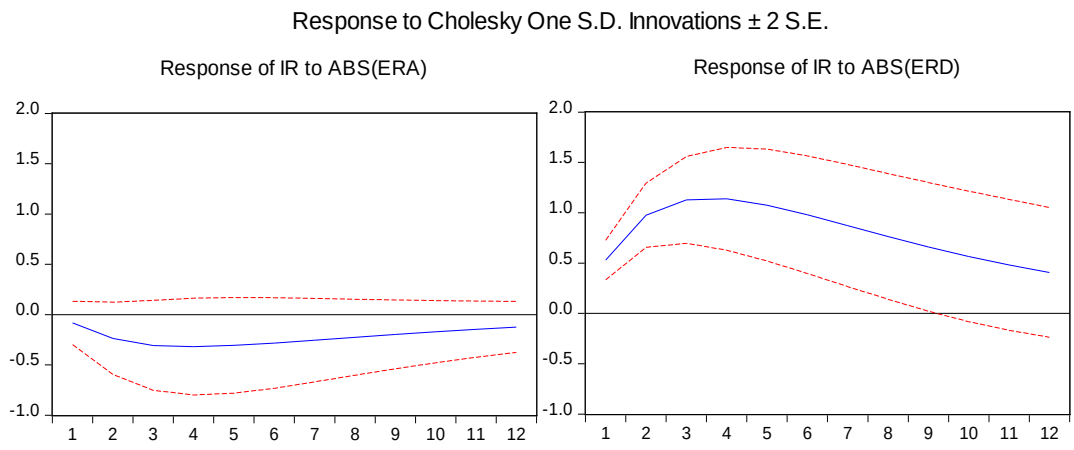

Figure 6.15. Impulse response function analysis results of the interest rate variable for the model 9.

Figure 6.15 and Table A.56 (Appendix A) show the results of the Impulse response function analysis. As expected, while interest rate has significant response to the dynamics of itself and to the dynamics of the exchange rate depreciation; a shock to the ERA variable faces an insignificant response from the interest rate.

In the next model, I estimate the impact of the changes in the exchange rate greater than 2% on Russian monetary policy instrument after the Global Financial crisis. Individual graphs for the new variables W^{plus} for depreciation (the rise in ruble price for $1 US) and W^{minus} for depreciation are presented in Figure 6.16.

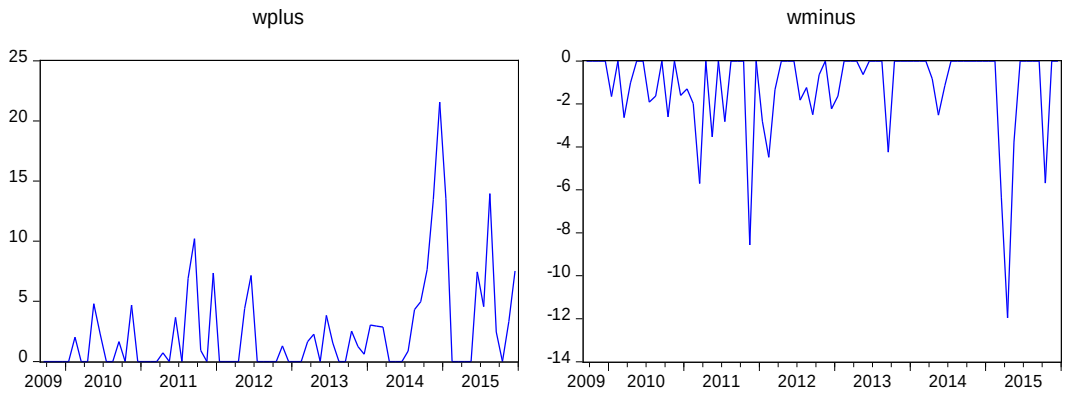

Figure 6.16. Individual graphs for the new variables of the model 10.

Stationary properties of the variables are tested using ADF test. The results are presented in Table A.2 in the Appendix A. Variables are stationary. The Results of the Granger Causality test are presented in Table A.57 in the Appendix A. The

Cholesky ordering of the variables is as follows: $YgapSA_t$, W^{minus}_t, W^{plus}_t, $D\_InflGap_t$, IR_t. According to the Lag length criteria, (see Table A.58, Appendix A) I estimate the model with one lag. The model 10 is stationary and free from autocorrelation (see Figure A11 and Table A.59, Appendix A). Estimation results are presented in Table A.60 in the Appendix A.

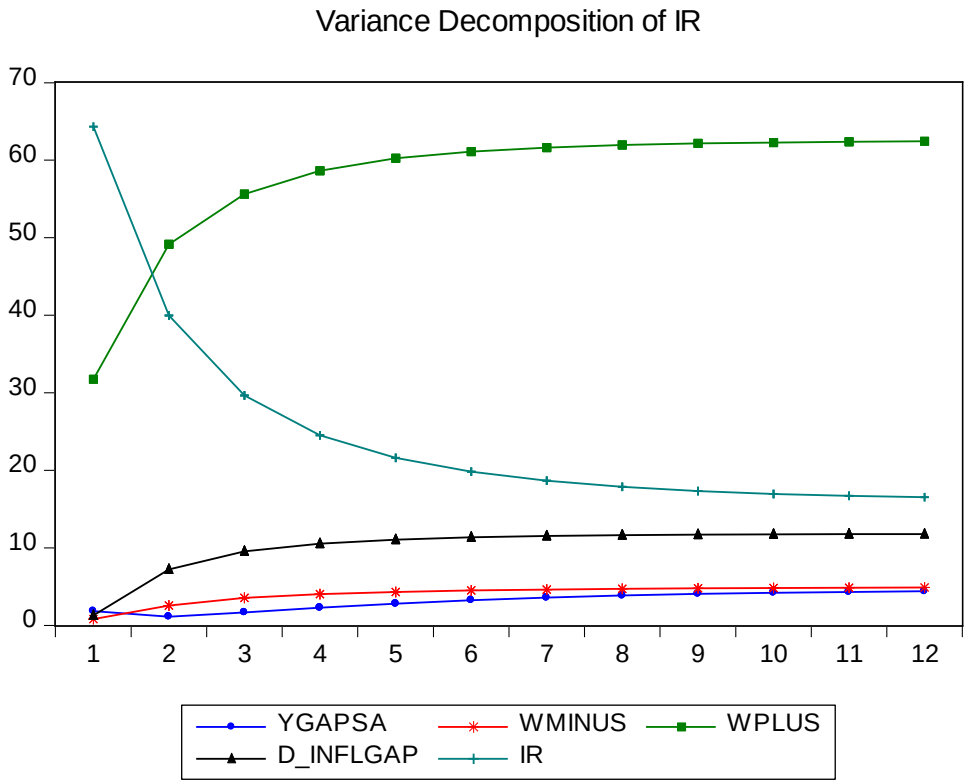

Figure 6.17. Variance decomposition of the interest rate variable for the model 10.

Variance decomposition analysis demonstrates that exchange rate depreciation greater than 2% has the strongest impact on the dynamics of the Russian short-term interest rate dynamics for the second period (see Figure 6.17). At the same time, appreciation of the exchange rate has no significant impact on the interest rate dynamics (see Table A.61, Appendix A).

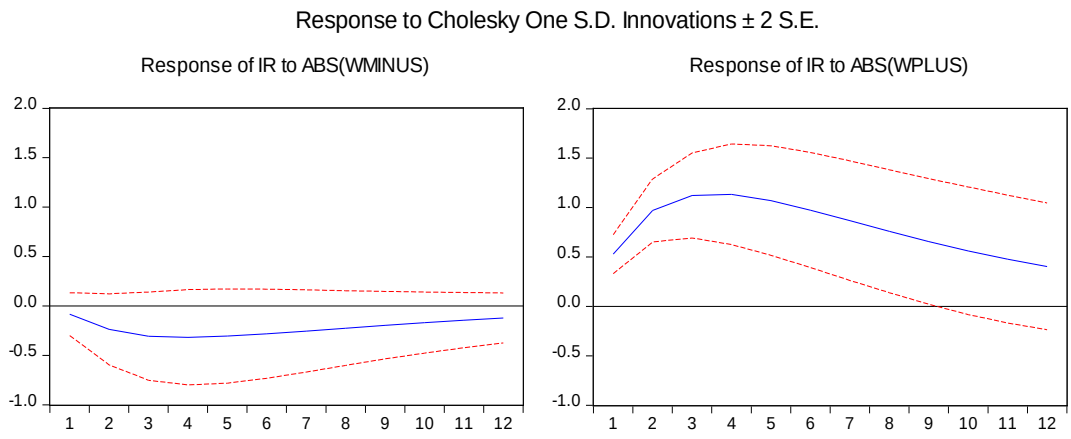

Figure 6.18. Impulse response function analysis of the IR_t variable for the model 10.

A shock to the exchange rate appreciation variable does not get any significant response from the interest rate (see Figure 6.18). Depreciation of the domestic currency greater than 2% will get strong and significant response from the short-term interest rate variable for the next 10 periods. The results of the IRF analysis are presented in Table A.62 in the Appendix A.

The analyses of the two separate periods reveal that the monetary policy of the CBR has changed significantly after the Global Financial crisis. According to the results of the analyses, the CBR followed managed floating exchange rate regime with symmetric response to the changes in the exchange rate dynamics before the crisis. Afterwards, one can see that the CBR tolerates the appreciation of the domestic currency, and fights its depreciation.

6.4 Conclusion

In this chapter, I analyzed the asymmetric monetary policy stance of the Central Bank of Russia. Constructed models were based on the Taylor's monetary policy reaction function. For the whole period, the results of the analyses confirm the hypothesis of the asymmetric monetary policy stance with respect to the exchange rate depreciation in Russia. Interest rate relatively quick and significantly responds to changes in the exchange rate depreciation. However, in chapter three I point that the exchange rate policy of the CBR was formed in a symmetric way, i. e. same amounts of foreign exchange interventions can be implemented in the case of depreciation or appreciation of the exchange rate.

In section 6.3, I repeated the analysis for two separate periods: 2001-2007 and 2009-2015, which revealed interesting results. According to them, before the Global Financial crisis of 2008 the CBR was mainly following symmetric responses to the changes in the exchange rate. After the Crisis, the CBR became concerned about the exchange rate depreciation. Exchange rate depreciation variable explains more than 60% of the fluctuation in the interest rate.

After the Global financial crisis of 2008, the CBR decided to shift to the free floating exchange rate regime. However, external developments imposed negative pressure to the exchange rate, leading to sharp currency depreciation. Taking currency depreciation into consideration, and keeping the fact that the exchange rate puts a high pressure on inflation in mind, we can understand the behavior of monetary policy. Although monetary authorities try to adopt free-floating exchange rate regime, large swings may negatively affect the financial stability of the economy. Thus, the CBR takes measures in order to smooth the depreciation and minimize its effect on inflation.

CHAPTER 7

CONCLUSION

In this thesis, I study the role of the exchange rate in Russian economy with the help of VAR models. I consider that this methodology has not been previously used for analyzing inflation factors and asymmetric monetary policy stance with respect to the exchange rate fluctuations in Russia. According to my findings, the exchange rate and its dynamics have a huge role in the formation of the price level in Russia. Furthermore, Russian monetary policy decisions are strongly responsive to the changes in the exchange rate. The findings of the thesis are very meaningful for the Russian monetary authorities, especially during the period of transition to free-floating exchange rate policy and inflation targeting regime.

The analysis of the causes of Russian inflation reveals that supply side factors has more effect on inflation. In particular, exchange rate dynamics appear to be the most important factor affecting inflation. Furthermore the findings indicate that Russian inflation is mostly caused by exchange rate depreciation for the period between 2001-2015. The analysis of the two separate periods, however, shows that the influence of the exchange rate depreciation on inflation significantly increased only after the Global financial crisis of 2008. Variance decomposition and impulse response function of inflation for the period 2001-2007 demonstrate that the effect of exchange rate depreciation or appreciation on inflation was mostly insignificant. Thus, I consider it as a symmetrical response of inflation to the depreciation or appreciation of the domestic currency during the first period, and asymmetric response of inflation to the exchange rate depreciation in the second period.

Dobrynskaya et al (2008) claim that, Russia, as a country with the developing economy, has high exchange rate pass through effect to domestic prices.

Dependence of Russian economy on oil revenues and world markets leads to high responsive inflation rates to the currency depreciation. In order to eliminate or decrease a pass through effect the CBR may use its monetary policy. However, the results of the analyses indicate that Russian monetary policy was not very successful in achieving this goal.

Estimation of the monetary policy stance in Russia for the period 2001-2015 proves that Russian monetary authorities had asymmetric response to the dynamics of the exchange rate. The appreciation of the currency was mostly tolerated, while the depreciation of ruble relative to US dollar was generally met with a strong response. Russian Central Bank's short term interest rates, used in the analysis as a proxy for the official monetary policy instrument – refinancing rate, are highly responsive to the currency depreciation and almost indifferent to currency appreciation.

The analyses of the two separate periods, 2001-2007 and 2009-2015, show more specific results. Accordingly, it states that before the Global Financial crisis of 2008, when economic growth was strong and oil prices were increasing, monetary authorities were implementing more or less symmetric monetary policy stance with respect to the changes in nominal exchange rate. The CBR let domestic currency gradually appreciate under the managed floating exchange rate regime.

After the crisis, the CBR decided to adopt free-floating exchange rate regime. The new regime was supposed to make domestic monetary policy less affected by the world economic shocks. However, the findings indicate that Russian monetary policy was affected more by the dynamics of the exchange rate depreciation in the second period than before the crisis. A fall in oil prices, economic slowdown and current political developments in Russia caused sharp ruble devaluation. Therefore, the CBR had to respond currency devaluation. Thus, exchange rate depreciation during the period 2009-2015 had bigger effect on monetary policy instruments than during the first period.

The asymmetry of the monetary policy of the CBR is represented with large foreign exchange interventions and increased interest rates, as a response to exchange rate depreciation. There can be many different reasons for the asymmetric behavior of the monetary policy. Ponomarev et al (2014) claim that ruble depreciation has a

very high level of the exchange rate pass through to the domestic price level, while the appreciation of the domestic currency almost has no effect. Thus, controlling exchange rate fluctuations help to prevent external shocks, which can be very harmful for the financial system.

Second reason is that depreciation of domestic currency will increase payments on foreign debts of domestic banks and firms. Thus, deteriorate their balance sheets.

Another reason why the CBR tolerates appreciation and fights depreciation of the domestic currency can be related to the importance of the ruble exchange rate in Russian economy. Russia is one of the biggest oil-exporters. Since oil prices are expressed in US dollars worldwide, thus, the dynamics of ruble-dollar exchange rate are extremely important for the Russian economy. Large shifts of the exchange rate will deteriorate trade balance and the balance of payments.

After the Crisis of 2008, the CBR officially announced that it aims to adopt inflation targeting regime, which means a transition to free-floating exchange rate. The aim of this development is to decrease the impact of exchange rate fluctuations on inflation. Yet, the CBR cannot let ruble to float freely. Monetary authorities monitor the development of foreign exchange markets and prevent large shifts of the domestic currency value in order to maintain financial stability and smooth the effect of exchange rate fluctuations on inflation coming through direct and indirect channels.

Interpreting the results, one should keep in mind limitations of the study. I assume that short-term interest rate is the most important monetary policy instrument of the CBR for the observed period. As one remembers, Russia was not fully inflation targeting country during the observed period, thus, in its annual reports, the CBR considers interest rate only as one of its monetary policy tool. However, it also points that monetary authorities try to increase its importance, and make it the only monetary policy tool as for the inflation targeting regime.

Regarding future works, it will be interesting to analyze the subsequent development of the Russian monetary policy. At the present time, the CBR tries to reduce the effect of the exchange rate dynamics on the economy, by letting the

currency flow and decreasing the amount of foreign exchange interventions. When Russian economy will recover from the current crisis in a few years, it is possible to decrease the amounts of foreign exchange interventions. This may cause changes in responses of the CBR to exchange rates by using interest rates too.

There are other fruitful areas of studies regarding this problem. New researches can investigate the expanded number of the economic variables affected by the dynamics of the exchange rate. Another area is the analysis of the parameters of foreign exchange interventions and how they are conducted as a monetary policy instrument. The findings of new researches may help to improve monetary policies or to form an economic and financial reforms package.

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APPENDICES

APPENDİX A. TABLES AND ILLUSTRATIONS OF THE ANALYSES

Table A.1. Descriptive statistics of the data.

2001-2015	Mean	Median	Maximum	Minimum	Std. Dev.	Skewness
InfCPI	11.31	10.85	24.8	3.6	4.4	0.7
WPI	0.35	1.06	11.6	-21	5.06	-0.98
IR	8.64	7.51	27.8	4.2	3.73	1.91
ERchange	0.572	0	21.55	-11.96	3.69	1.75
YgapSA	-0.02	0.036	7.705	-10.402	3.199	-0.31
D_InflGap	0.044	0.117	2.415	-5.8	0.901	-1.959
ERA	-0.8	0	0	-12	1.57	-3.6
ERD	1.38	0	21.5	0	2.98	3.49
W^{minus}	-0.53	0	0	-11.9	1.59	-3.97
W^{plus}	1.19	0	21.5	0	3.03	3.48
2001-2007						
IR	8.01	7.25	14.7	4.56	2.58	0.86
D_YgapSA	0.0012	-0.25	5.07	-4.41	2.12	0.25
InflGap	1.15	0.48	7.18	-1.6	2.06	1.046
ERA	-0.405	0	0	-2.389	0.57	-1.58
ERD	0.24	0	1.79	0	3.65	1.95
WPI	1.21	1.39	9.36	-9.94	4.08	-0.41
InflCPI	13.34	12.5	24.8	7.4	4.24	1.015
W^{minus}	-0.34	0	0	-2.39	0.59	-1.69
W^{plus}	0.15	0	1.79	0	0.37	2.49
2009-2015						
IR	8.51	8.13	12.64	6.94	1.28	1.74
YgapSA	-0.23	-0.077	3.96	-5.47	2.03	-0.72
D_InflGap	0.11	0.11	2.43	-2.18	0.74	0.41
ERA	-1.22	0	0	-11.96	2.16	-2.63
ERD	2.47	0	21.55	0	4.03	2.41
WPI	-0.409	-0.03	6.16	-12.27	4.25	-0.59

Table A.1 (continued)

D_InflCPI	0.029	0	3.6	-2.1	0.78	1.23
W^{minus}	-1.22	0	0	-11.96	2.16	-2.62
W^{plus}	2.44	0	21.55	0	4.04	2.39

Table A.2. ADF test

2001-2015	**InflCPI**	**WPI**	**IR**	**ERchange**	**YgapSA**	**D_InflGap**	**ERA**	**ERD**	**W^{minus}**	**W^{plus}**
t value	-2.643	-8.68	-2.7	-7.596	-3.907	-11.84	-10.8	-7.7	-11.2	-7.8
5% significance level critical t value	-2.576	-1.94	-2.6	-3.436	-1.943	-1.94	-3.4	-3.4	-3.43	-3.43
2001-2007	**InflCPI**	**WPI**	**IR**		**D_YgapSA**	**InflGap**	**ERA**	**ERD**	**W^{minus}**	**W^{plus}**
t value	-2.66	-7.53	-4.18		-6.091	-3.34	-5.81	-5.05	-6.11	-5.78
5% significance level critical t value	-2.58	-1.94	-3.46		-1.95	-1.944	-2.89	-2.89	-2.58	-2.58
2009-2015	**D_InflCPI**	**WPI**	**IR**		**YgapSA**	**D_InflGap**	**ERA**	**ERD**	**W^{minus}**	**W^{plus}**
t value	-3.92	-6.88	1.78		-4.2	-3.08	-7.13	-4.78	-7.13	-4.8
5% significance level critical t value	-1.945	-3.47	-1.61		-3.47	-1.94	-2.9	-2.9	-2.9	-2.9

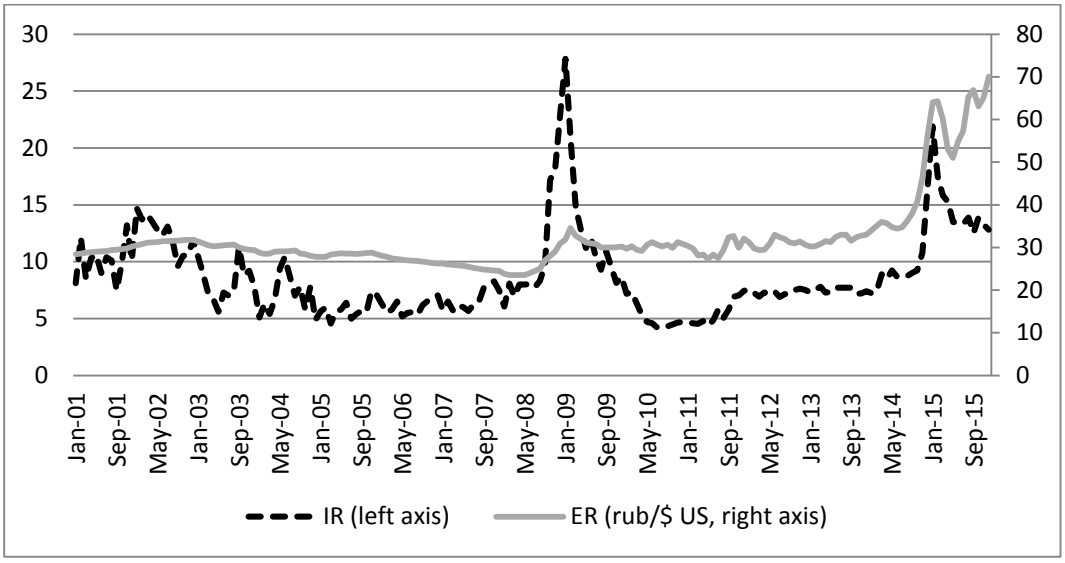

Figure A.1. Dynamics of the nominal exchange rate and short-term interest rate.

Table A.3. Pairwise Granger causality test. Model 1. (6 lags).

Null Hypothesis	Number of observations	F-Statistic	p-value
YgapSA DNGC WPI	174	0.644	0.695
WPI DNGC YgapSA	174	3.64	0.002
ERchange DNGC WPI	174	1.212	0.302
WPI DNGC ERchange	174	1.851	0.092
InflCPI DNGC WPI	174	1.015	0.417
WPI DNCG InflCPI	174	0.557	0.763
IR DNGC WPI	174	0.925	0.478
WPI DNGC IR	174	6.002	0
ERchange DNGC YgapSA	174	2.006	0.068
YgapSA DNGC ERchange	174	0.493	0.813
InflCPI DNGC YgapSA	174	0.573	0.751
YgapSA DNGC InflCPI	174	0.773	0.592
IR DNGC YgapSA	174	4.609	0
YgapSA DNGC IR	174	3.957	0.001
InflCPI DNGC ERchange	174	1.081	0.375
ERchange DNGC InflCPI	174	4.911	0
IR DNGC ERchange	174	2.238	0.042
ERchange DNGC IR	174	3.046	0.007
IR DNGC InflCPI	174	1.809	0.1
InflCPI DNGC IR	174	0.689	0.658

Table A.4. Lag length criteria for the Model 1.

Endogenous variables	WPI, YgapSA, ERchange, InflCPI, IR			
Exogenous variables	C, Dummy			
Included observations	168			
Lag	**Final Prediction Error**	**Akaike Information Criterion**	**Schwarz Information Criterion**	**Hannan-Quinn Information Criterion**
0	173746	26.25	26.44	26.33
1	638.15	20.65	21.29*	20.91
2	439.68*	20.27*	21.38	20.72*
3	482.73	20.36	21.94	21
4	481.78	20.35	22.4	21.19
5	544.74	20.47	22.98	21.49
6	558.26	20.49	23.47	21.69
7	593.41	20.53	23.98	21.93
8	677.72	20.65	24.55	22.23
9	658.17	20.6	24.97	22.37
10	749.15	20.7	25.53	22.66
11	898.95	20.85	26.15	23
12	743.53	20.62	26.38	22.95

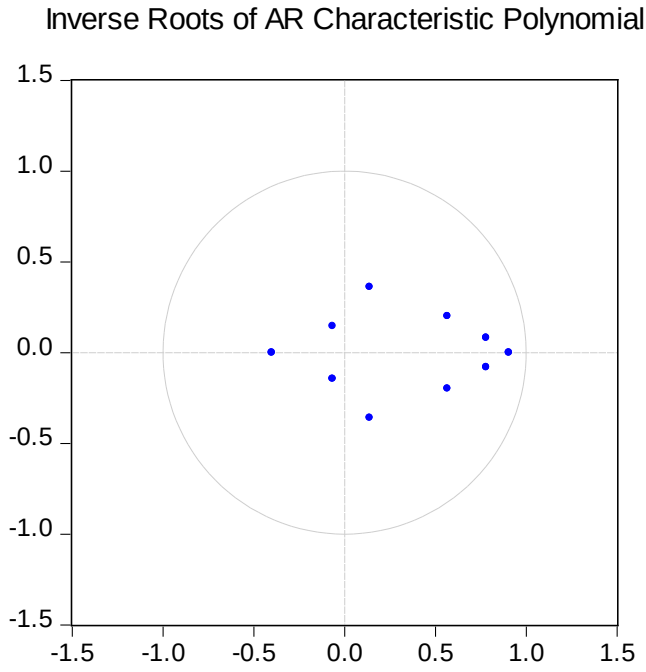

Figure A.2. Inverse roots of AR Characteristic Polynomial for the Model 1.

Table A.5. Autocorrelation test for the Model 1

(Probs from Chi-square with 25 df; 178 observations included).

Null Hypothesis	no serial correlation at lag order h	
Lags	**LM-Statistic**	**p-value**
1	47.677	0.004
2	24.933	0.466
3	28.999	0.263
4	49.654	0.002
5	23.44	0.551
6	43.999	0.011
7	18.174	0.834
8	24.693	0.479
9	21.061	0.689
10	34.711	0.093
11	15.128	0.9383
12	86.196	0

Table A.6. Estimation output for the Model 1.

Vector Autoregression estimates for the Model 1.					
Included observations 173					
T-statistics in [ ]					
	WPI	**YgapSA**	**ERchange**	**InflCPI**	**IR**
WPI(-1)	0.239 [2.76]	0.077 [2.18]	-0.041 [-0.67]	0.012 [1.31]	-0.054 [-1.99]
WPI (-2)	0.078 [0.89]	-0.023 [-0.64]	-0.093 [-1.49]	0.003 [0.38]	-0.095 [-3.48]
YgapSA (-1)	-0.086 [-0.46]	0.553 [7.3]	0.165 [1.26]	0.014 [0.72]	0.017 [0.30]
YgapSA (-2)	-0.231 [-1.31]	0.124 [1.71]	0.023 [0.18]	0.008 [0.46]	0.099 [1.81]
ERchange (-1)	-0.259 [-2.18]	0.042 [0.85]	0.387 [4.57]	0.036 [2.79]	0.112 [3.02]
ERchange (-2)	0.019 [0.15]	-0.028 [-0.56]	-0.157 [-1.76]	0.017 [1.26]	-0.024 [-0.62]
InflCPI (-1)	0.7 [1.14]	0.306 [1.22]	-0.439 [-1]	1.481 [22.24]	-0.231 [-1.21]
InflCPI (-2)	-0.751 [-1.25]	-0.31 [-1.26]	0.389 [0.91]	-0.512 [-7.85]	0.287 [1.53]
IR (-1)	-0.013 [-0.057]	-0.282 [-2.84]	0.339 [1.97]	0.031 [1.19]	0.692 [9.17]
IR (-2)	-0.022 [-0.09]	0.16 [1.65]	-0.224 [-1.34]	-0.023 [-0.92]	0.089 [1.22]
C	1.35 [1.09]	1.127 [2.22]	0.06 [0.07]	0.217 [1.61]	1.194 [3.1]
Dummy	-2 [-1.19]	-1.486 [-2.16]	0.216 [0.18]	-0.039 [-0.21]	1.173 [2.24]

Table A.6 (continued)

R-squared	0.218	0.664	0.256	0.987	0.86
Adj. R-squared	0.166	0.642	0.207	0.986	0.85
SSR	3584.631	603.456	1812.573	42.378	348.02
S.E. equation	4.646	1.906	3.304	0.505	1.447
F-statistic	4.211	29.905	5.217	1147.08	92.732
Log Likelihood	-519.8	-361.23	-459.115	-124.84	-312.24
Akaike AIC	5.975	4.193	5.293	1.537	3.643
Schwarz SC	6.189	4.408	5.507	1.752	3.857
Mean Dependent	0.342	-0.157	0.571	11.204	8.619
S.D. dependent	5.089	3.188	3.712	4.294	3.748
Determinant Resid Covariance (dof adj)			334.14		
Determinant Resid Covariance			235.7		
Log Likelihood			-1749.1		
Akaike Information criterion			20.32		
Schwarz criterion			21.39		

Table A.7. Variance decomposition table for the Model 1.

Period	**WPI**	**YgapSA**	**ERchange**	**InflCPI**	**IR**
1	0.465	0.042	4.175	95.315	0
2	0.437	0.311	9.414	89.623	0.21
3	0.282	0.964	15.51	82.844	0.39
4	0.178	1.896	19.751	77.622	0.55
5	0.177	2.982	22.276	73.932	0.63
6	0.227	4.149	23.717	71.254	0.652
7	0.272	5.315	24.534	69.238	0.639
8	0.292	6.415	24.985	67.695	0.61
9	0.291	7.403	25.219	66.509	0.575
10	0.278	8.258	25.324	65.697	0.541
11	0.261	8.974	25.358	64.895	0.51
12	0.246	9.562	25.353	64.354	0.48

Table A.8. Impulse response function for the Model 1.

Period	WPI	YgapSA	ERchange	InflCPI	IR
1	0.034	0.01	0.103	0.493	0
2	0.051	0.051	0.268	0.738	0.043
3	0.035	0.121	0.442	0.836	0.072
4	-0.006	0.192	0.535	0.857	0.092
5	-0.044	0.252	0.561	0.836	0.095
6	-0.065	0.298	0.551	0.797	0.087
7	-0.069	0.331	0.526	0.753	0.074
8	-0.061	0.349	0.495	0.708	0.06
9	-0.046	0.354	0.462	0.664	0.046
10	-0.03	0.35	0.429	0.622	0.033
11	-0.014	0.338	0.397	0.582	0.023
12	0	0.321	0.366	0.542	0.014

Table A.9. Pairwise Granger Causality test for the variables of the model 2.

Null Hypothesis	Number of observations	F-Statistic	p-value
ERA DNGC YgapSA	174	0.671	0.673
YgapSA DNGC ERA	174	1.408	0.214
ERD DNGC YgapSA	174	1.505	0.179
YgapSA DNGC ERD	174	0.533	0.782
InflCPI DNGC YgapSA	174	0.573	0.751
YgapSA DNCG InflCPI	174	0.773	0.592
IR DNGC YgapSA	174	4.609	0
YgapSA DNGC IR	174	3.957	0.001
ERD DNGC ERA	174	11.912	0
ERA DNGC ERD	174	1.358	0.235
InflCPI DNGC ERA	174	4.026	0.0002
ERA DNGC InflCPI	174	3.975	0.001
IR DNGC ERA	174	6.034	0
ERA DNGC IR	174	0.276	0.947
InflCPI DNGC ERD	174	0.982	0.439
ERD DNGC InflCPI	174	5.086	8.3
IR DNGC ERD	174	0.631	0.705
ERD DNGC IR	174	3.548	0.002
IR DNGC InflCPI	174	1.809	0.1
InflCPI DNGC IR	174	0.689	0.658
YgapSA DNGC WPI	174	0.644	0.694
WPI DNGC YgapSA	174	3.64	0.002
ERA DNGC WPI	174	0.57	0.753
WPI DNGC ERA	174	2.913	0.01
ERD DNGC WPI	174	1.12	0.352
WPI DNGC ERD	174	0.87	0.51
InfCPI DNGC WPI	174	1.015	0.41
WPI DNGC InflCPI	174	0.557	0.764
IR DNGC WPI	174	0.925	0.478
WPI DNGC IR	174	6	1.096

Table A.10. Lag length criteria for the model 2.

Endogenous variables	WPI, YgapSA, ERA, ERD, InflCPI, IR			
Exogenous variables	C, Dummy			
Included observations	168			
Lag	**Final Prediction Error**	**Akaike Information Criterion**	**Schwarz Information Criterion**	**Hannan-Quinn Information Criterion**
0	238282.9	29.4	29.63	29.4
1	807.562	23.72	24.61*	24.08
2	489.06	23.21	24.77	23.85*
3	509.57	23.25	25.48	24.159
4	427.04*	23.06*	24.61	24.25
5	478.272	23.17	27.44	24.92
6	507.369	23.208	27.45	24.61
7	540.94	23.245	28.15	25.23
8	651.62	23.395	28.97	25.65
9	644.023	23.336	29.58	25.87
10	768.8	23.452	30.37	26.26
11	914.79	23.551	31.13	26.63
12	925.1	23.469	31.72	26.81

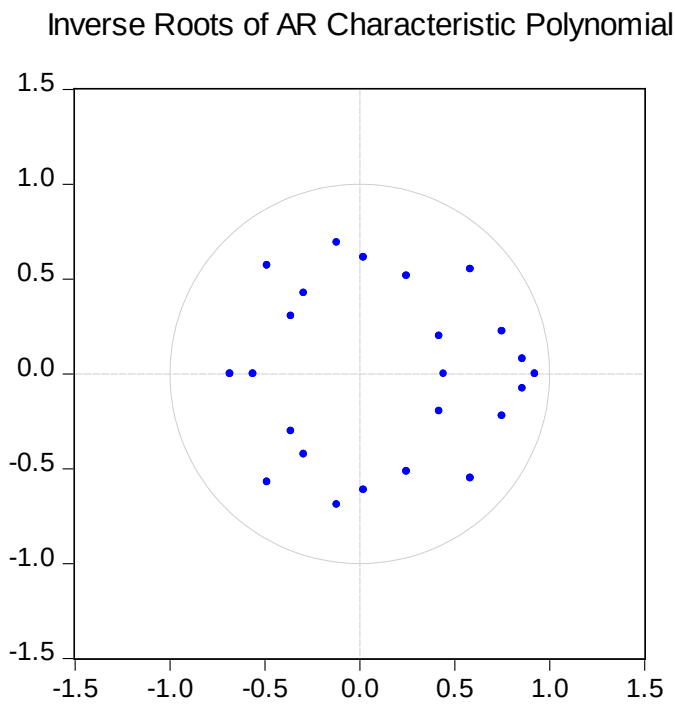

Figure A.3. Inverse Roots of AR Characteristic Polynomial for the model 2.

Table A.11. Autocorrelation LM-test for the Model 2

(Probs from Chi-square with 36 df; 176 observations included).

Null Hypothesis	no serial correlation at lag order h	
Lags	**LM-Statistic**	**p-value**
1	41.02	0.259
2	35.37	0.498
3	45.61	0.1309
4	51.82	0.042
5	36.45	0.447
6	56.48	0.015
7	28.97	0.79
8	25.42	0.91
9	29	0.79
10	21.22	0.976
11	27.67	0.838
12	72.76	0.0003

Table A.12. Estimation output of the model 2.

Vector Autoregression estimates for the Model 2.						
Included observations 176						
T-statistics in [ ]						
	WPI	**YgapSA**	**ERA**	**ERD**	**InflCPI**	**IR**
WPI(-1)	0.23 [2.47]	0.073 [1.96]	0.0354 [1.48]	-0.039 [-0.81]	0.015 [1.6]	-0.021 [-0.8]
WPI(-2)	0.084 [0.88]	-0.044 [-1.12]	-0.052 [-2.11]	-0.046 [-0.91]	0.004 [0.47]	-0.091 [-3.27]
WPI(-3)	-0.053 [-0.537]	0.023 [0.53]	0.014 [-0.81	-0.042 [-0.81]	-0.017 [-1.77]	-0.006 [-0.23]
WPI(-4)	0.004 [0.049]	0.024 [0.63]	-0.024 [-1]	-0.062 [-1.24]	0.006 [0.64]	0.021 [0.73]
YgapSA (-1)	-0.122 [-0.609]	0.564 [6.92]	-0.0569 [-1.27]	0.145 [1.37]	0.003 [0.162]	-0.046 [-0.801]
YgapSA (-2)	-0.123 [-0.55]	0.083 [0.917]	0.069 [1.2]	-0.065 [-0.55]	-0.0001 [-0.007]	0.047 [0.726]
YgapSA (-3)	-0.227 [-1.02]	0.138 [1.54]	0.121 [2.122]	0.159 [1.37]	0.011 [0.51]	0.196 [3.04]
YgapSA (-4)	0.075 [0.38]	-0.087 [-1.09]	-0.067 [-1.32]	-0.036 [-0.353]	0.016 [0.81]	-0.018 [-0.32]

Table A.12 (continued)

ERA (-1)	-0.159 [-0.52]	0.043 [0.035]	-0.091 [-1.17]	-0.248 [-1.56]	-0.042 [-1.38]	-0.013 [-0.14]
ERA (-2)	0.127 [0.44]	0.058 [0.5]	0.049 [0.67]	0.041 [0.27]	0.084 [2.9]	0.075 0.905
ERA (-3)	0.222 [0.79]	-0.154 [-1.37]	-0.006 [-0.08]	-0.152 [-1.04]	-0.031 [-1.1]	-0.029 [-0.35]
ERA (-4)	0.113 [0.41]	0.166 [1.59]	0.065 [0.93]	-0.271 [-1.89]	0.009 [0.36]	-0.005 [-0.06]
ERD (-1)	-0.267 [-1.47]	0.058 [0.8]	0.16 [3.43]	0.503 [5.26]	0.074 [4.057]	0.209 [3.96]
ERD (-2)	0.015 [0.07]	-0.103 [-0.23]	-0.196 [-3.738]	-0.065 [-0.06]	0.002 [0.1]	-0.085 [-1.43]
ERD (-3)	-0.18 [-0.85]	0.55 [1.65]	-0.116 [-2.197]	0.018 [0.17]	-0.031 [-1.51]	-0.02 [-0.34]
ERD (-4)	-0.043 [-0.21]	-0.884 [-1.47]	-0.179 [-3.4]	-0.085 [-0.78]	-0.037 [-1.82]	0.114 [1.91]
InflCPI (-1)	0.114 [0.14]	0.551 [1.65]	0.12 [0.56]	-0.224 [-0.52]	1.49 [17.97]	-0.17 [-0.74]
InflCPI (-2)	0.899 [0.6]	-0.884 [-1.47]	0.238 [0.627]	0.103 [0.13]	-0.613 [-4.1]	0.38 [0.88]
InflCPI (-3)	-0.75 [-0.52]	0.347 [0.59]	-1.015 [-2.73]	0.077 [0.102]	0.02 [1.37]	-0.531 [-1.26]
InflCPI (-4)	-0.389 [-0.51]	-0.031 [-0.099]	0.691 [3.40]	0.008 [0.02]	-0.122 [-1.58]	0.409 [1.83]
IR (-1)	0.091 [0.31]	-0.282 [-2.42]	0.244 [3.17]	0.076 [0.51]	0.01 [0.41]	0.679 [8.146]
IR (-2)	-0.027 [-0.08]	0.137 [1]	-0.169 [-1.95]	0.036 [0.2]	0.018 [0.54]	-0.014 [-0.15]
IR (-3)	-0.305 [-0.95]	0.229 [1.76]	-0.11 [-1.33]	-0.221 [-1.31]	-0.042 [-1.31]	0.126 [1.35]
IR (-4)	0.297 [1.13]	-0.145 [-1.36]	0.106 [1.568]	0.224 [1.61]	0.046 [1.7]	-0.031 [-0.4]
C	2.252 [1.54]	0.909 [1.54]	-1.342 [-3.58]	-0.122 [-0.15]	0.186 [1.26]	0.872 [2.05]
Dummy	-2.179 [-1.23]	-1.57 [-2.2]	-0.279 [-0.62]	0.03 [0.03]	-0.124 [-0.7]	1.223 [2.38]
R-squared	0.26	0.69	0.494	0.413	0.988	0.884
Adj. R-squared	0.136	0.64	0.411	0.315	0.986	0.865
SSR	3381.3	554.37	223.35	934.25	34.46	286.23
S.E. equation	4.747	1.922	1.22	2.495	0.479	1.381
F-statistic	2.108	13.451	5.88	4.227	502.1	46.063

Table A.12 (continued)

Log Likelihood	-509	-350.7	-270.07	-396.63	-106.24	-292.53
Akaike AIC	6.088	4.28	3.371	4.8	1.5	3.619
Schwarz SC	6.557	4.794	3.839	5.27	1.971	4.088
Mean Dependent	0.358	-0.167	-0.823	1.395	11.055	8.61
S.D. dependent	5.11	3.205	1.589	3.016	4.083	3.767
Determinant Resid Covariance (dof adj)				193.45		
Determinant Resid Covariance				74.139		
Log Likelihood				-1877.1		
Akaike Information criterion				23.105		
Schwarz criterion				25.916		

Table A.13. Variance Decomposition table for the model 2.

Period	**WPI**	**YgapSA**	**ERA**	**ERD**	**InflCPI**	**IR**
1	0.436	0.018	0.084	1.357	98.1	0
2	0.35	0.336	0.078	7.695	91.508	0.03
3	0.178	0.823	1.018	13.904	83.888	0.187
4	0.411	1.349	1.307	17.273	79,365	0.292
5	0.71	2.245	1.24	16.686	78.719	0.397
6	0.837	3.801	1.074	15.369	78.374	0.542
7	0.903	5.667	0.929	13.95	77.779	0.769
8	0.906	7.641	0.817	12.746	76.753	1.135
9	0.862	9.592	0.748	11.814	75.407	1.575
10	0.81	11.445	0.719	11.148	73.823	2.053
11	0.766	13.203	0.721	10.657	72.149	2.502
12	0.729	14.896	0.738	10.27	70.495	2.869

Table A.14. Impulse response function table results for the model 2.

Period	WPI	YgapSA	ABS(ERA)	ABS(ERD)	InflCPI	IR
1	0.031	0.006	-0.013	0.055	0.474	0
2	0.042	0.051	-0.02	0.241	0.711	0.015
3	0.003	0.101	-0.124	0.369	0.767	0.052
4	-0.085	0.142	-0.127	0.454	1	0.065
5	-0.116	0.204	-0.096	0.363	0.822	0.077
6	-0.105	0.287	-0.055	0.283	0.788	0.096
7	-0.097	0.345	-0.029	0.21	0.742	0.122
8	-0.08	0.386	-0.013	0.172	0.694	0.16
9	-0.055	0.413	-0.031	0.157	0.643	0.186
10	-0.041	0.43	-0.051	0.162	0.592	0.205
11	-0.036	0.441	-0.065	0.163	0.543	0.211
12	-0.032	0.449	-0.071	0.156	0.491	0.205

Table A.15. Pairwise Granger Causality test for the model 3.

Null Hypothesis	Number of observations	F-Statistic	p-value
D_YgapSA DNGC WPI	77	0.283	0.942
WPI DNGC D_YgapSA	77	0.659	0.682
ERA DNGC WPI	78	1.927	0.089
WPI DNGC ERA	78	0.608	0.722
ERD DNGC WPI	78	0.782	0.586
WPI DNGC ERD	78	1.215	0.309
InfCPI DNGC WPI	78	1.674	0.141
WPI DNGC InflCPI	78	0.384	0.886
IR DNGC WPI	78	1.3	0.269
WPI DNGC IR	78	1.551	0.175
ERA DNGC D_YgapSA	77	1.531	0.182
D_ YgapSA DNGC ERA	77	0.52	0.79
ERD DNGC D_YgapSA	77	1.551	0.175
D_YgapSA DNGC ERD	77	2.115	0.063
InflCPI DNGC D_YgapSA	77	0.891	0.506
D_YgapSA DNCG InflCPI	77	0.532	0.781
IR DNGC D_YgapSA	77	2.133	0.061
D_YgapSA DNGC IR	77	1.357	0.245
ERD DNGC ERA	78	2.217	0.052
ERA DNGC ERD	78	2.734	0.019
InflCPI DNGC ERA	78	1.567	0.171
ERA DNGC InflCPI	78	0.462	0.833

Table A.15 (continued)

IR DNGC ERA	78	1.339	0.252
ERA DNGC IR	78	1.644	0.149
InflCPI DNGC ERD	78	1.967	0.083
ERD DNGC InflCPI	78	0.454	0.839
IR DNGC ERD	78	1.786	0.115
ERD DNGC IR	78	3.17	0.008
IR DNGC InflCPI	78	2.311	0.044
InflCPI DNGC IR	78	2.749	0.019

Table A.16. Lag length criteria for the model 3.

Endogenous variables	WPI, D_YgapSA, ERA, ERD, InflCPI, IR			
Exogenous variables	C, Dummy			
Included observations	77			
Lag	**Final Prediction Error**	**Akaike Information Criterion**	**Schwarz Information Criterion**	**Hannan-Quinn Information Criterion**
0	77.512	21.377	21.56	21.45
1	0.777*	16.772*	18.051*	17.283*
2	1.002	17.01	19.384	17.959
3	1.56	17.409	20.879	18.797
4	1.859	17.501	22.067	19.327
5	1.799	17.324	22.986	19.589
6	1.922	17.163	23.92	19.866

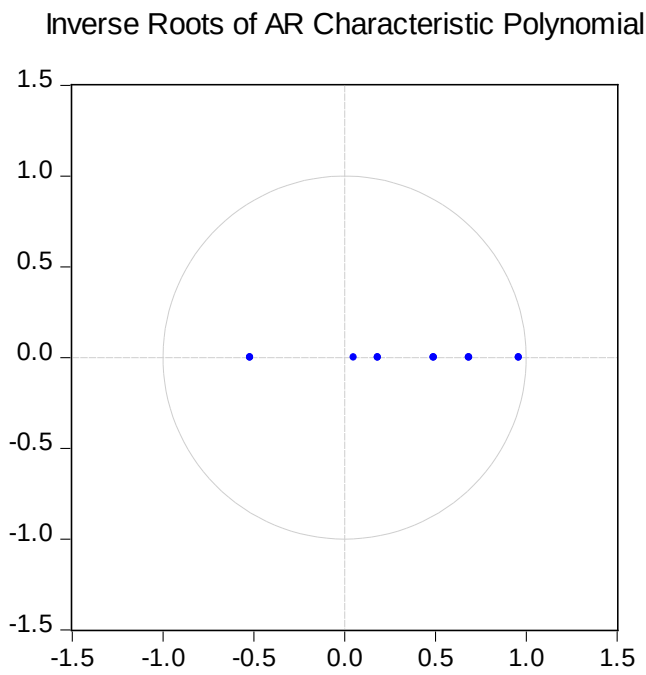

Figure A.4. Inverse roots of AR Characteristic Polynomial for the model 3.

Table A.17. Autocorrelation LM-test for the Model 3

(Probs from Chi-square with 36 df; 82 observations included).

Null Hypothesis	no serial correlation at lag order h	
Lags	**LM-Statistic**	**p-value**
1	55.989	0.018
2	25.455	0.908
3	52.816	0.034
4	39.096	0.332
5	27.928	0.829
6	42.764	0.203
7	28.242	0.818
8	32.876	0.618
9	42.076	0.224
10	39.624	0.311
11	32.214	0.649
12	44.747	0.1504

Table A.18. Estimation output of the model 3.

Vector Autoregression estimates for the Model 3.						
Included observations 82						
T-statistics in [ ]						
	WPI	**D_YgapSA**	**ERA**	**ERD**	**InflCPI**	**IR**
WPI(-1)	0.056 [0.49]	**0.056** **[1.12]**	**-0.01** **[-0.071]**	**-0.002** **[-0.28]**	**0.005** **[0.34]**	**-0.057** **[-1.6]**
D_YgapSA (-1)	**0.074** **[0.32]**	**-0.542** **[-5.43]**	-0.008 [-0.3]	0.021 [1.25]	-0.021 [-0.63]	-0.128 [-1.8]
ERA (-1)	**-0.435** **[-0.48]**	0.21 [0.52]	0.291 [2.5]	-0.118 [1.78]	-0.02 [-0.15]	0.478 1.674
ERD (-1)	**0.808** **[0.52]**	-1.118 [-0.1.62]	0.194 [0.972]	0.36 [3.15]	0.142 [0.62]	1.167 [2.37]
InflCPI (-1)	**-0.34** **[-2.26]**	0.002 [0.032]	0.021 [1.1]	0.018 [1.64]	0.957 [43.38]	0.0006 [0.01]
IR (-1)	**0.364** **[1.64]**	-0.006 [-0.07]	0.0015 [0.05]	0.0016 [0.1]	-0.0007 [-0.02]	0.733 [10.5]
C	**2.366** **[1.23]**	0.367 [0.43]	-0.623 [-2.52]	-0.059 [-0.42]	0.393 [1.38]	2.065 [3.39]
R-squared	0.09	0.311	0.228	0.366	0.979	0.767
Adj. R-squared	0.017	0.255	0.166	0.315	0.978	0.748
SSR	1255.67	245.79	20.641	6.755	27.112	124.89
S.E. equation	4.091	1.81	0.524	0.3	0.601	1.29
F-statistic	1.24	5.631	3.705	7.236	611.68	41.153
Log Likelihood	-228.2	-161.36	-59.797	-14.001	-70.976	-133.6
Akaike AIC	5.377	4.106	1.629	0.512	1.901	3.429
Schwarz SC	5.94	4.311	1.834	0.717	2.107	3.634
Mean Dependent	1.211	0.041	-0.414	0.229	13.143	7.969
S.D. dependent	4.128	2.098	0.574	0.363	4.088	2.572
Determinant Resid Covariance (dof adj)				0.648		
Determinant Resid Covariance				0.379		
Log Likelihood				-658.43		
Akaike Information criterion				17.083		
Schwarz criterion				18.316		

Table A.19. Variance decomposition of inflation for the model 3.

Period	WPI	D_YgapSA	ERA	ERD	InflCPI	IR
1	1.468	0.041	0.109	0.116	98.26	0
2	2.195	0.478	0.106	0.569	96.65	0.0001
3	2.344	0.413	0.134	0.994	96.093	0.0003
4	2.47	0.491	0.182	1.241	95.613	0.0008
5	2.515	0.498	0.224	1.432	95.326	0.0017
6	2.551	0.52	0.262	1.564	95.098	0.0026
7	2.571	0.53	0.292	1.668	94.934	0.0035
8	2.585	0.541	0.317	1.746	94.803	0.0043
9	2.595	0.548	0.338	1.81	94.702	0.005
10	2.603	0.555	0.355	1.861	94.619	0.0057
11	2.609	0.561	0.369	1.903	94.551	0,0062
12	2.614	0.565	0.38	1.937	94.494	0.0067

Table A.20. IRF of inflation for the model 3.

Period	WPI	D_YgapSA	ABS(ERA)	ABS(ERD)	InflCPI	IR
1	0.072	-0.012	-0.019	0.021	0.596	0
2	0.1	-0.056	-0.018	0.059	0.57	-0.0009
3	0.091	-0.32	-0.025	0.078	0.546	0.001
4	0.092	-0.045	-0.032	0.078	0.524	0.002
5	0.085	-0.037	-0.034	0.079	0.503	0.004
6	0.083	-0.04	-0.035	0.077	0.484	0.0045
7	0.079	-0.0375	-0.035	0.075	0.465	0.0049
8	0.076	-0.0372	-0.034	0.073	0.447	0.005
9	0.073	-0.035	-0.033	0.07	0.429	0.0051
10	0.07	-0.034	-0.032	0.068	0.413	0.0051
11	0.067	-0.032	-0.031	0.065	0.397	0.005
12	0.064	-0.031	-0.03	0.063	0.382	0.0048

Table A.21. Pairwise Granger causality test for the variables of the model 4.

Null Hypothesis	Number of observations	F-Statistic	p-value
YgapSA DNGC WPI	70	1.988	0.0823
WPI DNGC YgapSA	70	1.709	0.135
ERA DNGC WPI	70	1.255	0.292
WPI DNGC ERA	70	1.812	0.11
ERD DNGC WPI	70	1.087	0.38
WPI DNGC ERD	70	1.02	0.416
D_InfCPI DNGC WPI	69	1.83	0.109
WPI DNGC D_InflCPI	69	0.487	0.815
IR DNGC WPI	70	1.279	0.281
WPI DNGC IR	70	1	0.433
ERA DNGC YgapSA	70	2.096	0.067
DYgapSA DNGC ERA	70	1.08	0.385
ERD DNGC YgapSA	70	1.839	0.107
YgapSA DNGC ERD	70	0.413	0.867
D_InflCPI DNGC YgapSA	69	1.108	0.369
YgapSA DNCG D_InflCPI	69	1.465	0.206
IR DNGC YgapSA	70	2.355	0.042
YgapSA DNGC IR	70	4.291	0.0012
ERD DNGC ERA	70	6.044	0
ERA DNGC ERD	70	0.6525	0.687
D_InflCPI DNGC ERA	69	3.013	0.012
ERA DNGC D_InflCPI	69	1.686	0.141
IR DNGC ERA	70	6.766	0
ERA DNGC IR	70	0.512	0.796
D_InflCPI DNGC ERD	69	0.523	0.788
ERD DNGC D_InflCPI	69	3.763	0.003
IR DNGC ERD	70	1.234	0.302
ERD DNGC IR	70	3.119	0.01
IR DNGC D_InflCPI	69	1.676	0.143
D_InflCPI DNGC IR	69	0.227	0.965

Table A. 22. Lag length Criteria for the model 4.

Endogenous variables	WPI, YgapSA, ERA, ERD, D_InflCPI, IR			
Exogenous variables	C			
Included observations	69			
Lag	**Final Prediction Error**	**Akaike Information Criterion**	**Schwarz Information Criterion**	**Hannan-Quinn Information Criterion**
0	6789.2	25.85	26.044	25.927
1	139.59*	21.961	23.321*	22.501*
2	170.79	21.14	24.665	23.142
3	161.68	22.025	25.71	23.489
4	175.27	21.986	26.843	23.913
5	169.14	21.743*	27.766	24.133
6	239.33	21.753	28.941	21.605

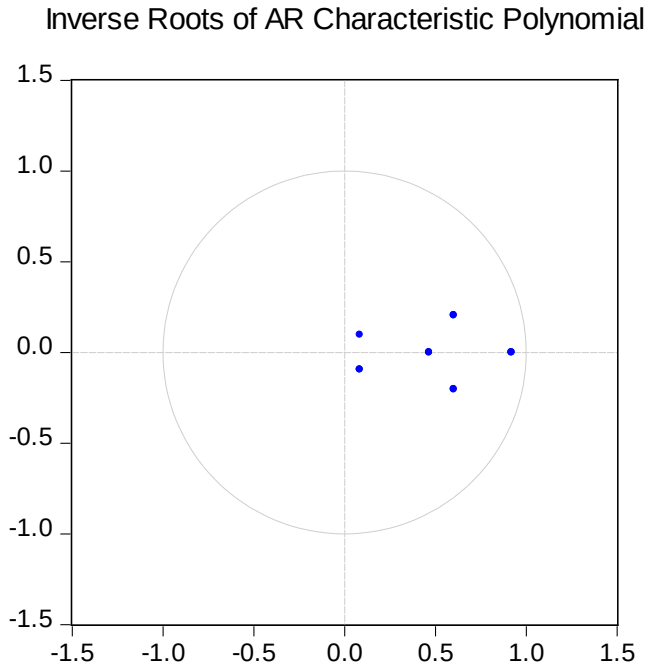

Figure A.5. Inverse roots of AR characteristic Polynomial for the model 4.

Table A.23. Autocorrelation test for the model 4.

(Probs from Chi-square with 36 df; 74 observations included).

Null Hypothesis	no serial correlation at lag order h	
Lags	**LM-Statistic**	**p-value**
1	49.826	0.062
2	52.83	0.034
3	27.351	0.849
4	67.144	0.001
5	31.409	0.68
6	35.887	0.47
7	23.353	0.94
8	33.25	0.6
9	33.504	0.49
10	27.706	0.83
11	33.941	0.56
12	48.862	0.07

Table A.24. Estimation results of the model 4.

Vector Autoregression estimates for the Model 4.						
Included observations 74						
T-statistics in [ ]						
	WPI	**YgapSA**	**ERA**	**ERD**	**D_InflCPI**	**IR**
WPI(-1)	0.148 [0.93]	**-0.052** **[-1.02]**	**-0.009** **[-0.11]**	**-0.135** **[-0.91]**	**0.031** **[1.43]**	**0.059** **[1.37]**
YgapSA (-1)	**-0.442** **[-1.6]**	**0.601** **[6.83]**	-0.191 [-1.25]	0.159 [0.625]	0.054 [1.48]	1.17 [2.27]
ERA (-1)	**-0.381** **[-1.57]**	0.061 [0.79]	0.003 [0.024]	-0.188 [-0.84]	-0.0185 [-0.57]	-0.002 [-0.03]
ERD (-1)	**-0.134** **[-0.76]**	-0.007 [-0,12]	0.187 [1.91]	0.477 [2.92]	0.095 [4.05]	0.199 [4.14]
D_InflCPI (-1)	**1.435** **[1.98]**	0.081 [0.35]	0.061 [0.15]	-0.833 [-1.24]	0.599 [6.217]	-0.198 [-1]
IR (-1)	**-0.435** **[-2.27]**	-0.164 [-2.68]	-0.239 [-2.26]	0.062 [0.354]	-0.032 [-1.26]	0.934 [17.92]
C	**2.874** **[1.95]**	1.398 [2.99]	0.227 [0.28]	0.657 [0.48]	0.033 [0.17]	0.146 [0.365]
R-squared	0.243	0.628	0.13	0.298	0.606	0.92
Adj. R-squared	0.175	0.595	0.052	0.235	0.571	0.912

Table A.24 (continued)

SSR	990.2	100.4	302.4	847.6	17.52	73.27
S.E. equation	3.844	1.224	2.124	3.556	0.511	1.045
F-statistic	3.59	18.878	1.676	4.749	17.221	128.5
Log Likelihood	-200.97	-116.29	-157.08	-195.22	-51.69	-104.63
Akaike AIC	5.62	3.332	4.434	5.465	1.586	3.017
Schwarz SC	5.838	3.55	4.652	5.683	1.804	3.235
Mean Dependent	-0.443	-0.117	-1.254	2.539	0.043	8.267
S.D. dependent	4.233	1.923	2.182	4.068	0.781	3.543
Determinant Resid Covariance (dof adj)				72.459		
Determinant Resid Covariance				39.916		
Log Likelihood				-766.42		
Akaike Information criterion				21.849		
Schwarz criterion				23.156		

Table A.25. Variance decomposition of inflation for the model 4.

Period	**WPI**	**YgapSA**	**ERA**	**ERD**	**D_InflCPI**	**IR**
1	3.569	1.481	0.135	1.417	93.396	0
2	6.878	1.314	0.164	16.7	74.809	0.13
3	10.648	2.117	0.202	22.293	64.251	0.486
4	12.428	3.151	0.189	23.153	60.207	0.869
5	12.808	3.864	0.214	22.909	58.948	1.254
6	12.721	4.148	0.276	22.753	58.477	1.622
7	12.709	4.17	0.342	22.847	57.973	1.956
8	12.905	4.12	0.39	23.055	57.282	2.245
9	13.242	4.095	0.418	23.25	56.502	2.49
10	13.621	4.116	0.432	23.383	55.749	2.696
11	13.976	4.17	0.438	23.456	55.09	2.868
12	14.28	4.23	0.44	23.486	54.541	3.012

Table A.26. IRF for inflation for the model 4.

Period	WPI	YgapSA	ABS(ERA)	ABS(ERD)	D_InflCPI	IR
1	-0.09	-0.062	-0.018	0.06	0.494	0
2	-0.143	0.043	-0.019	0.26	0.287	-0.023
3	-0.166	0.075	0.019	0.219	0.148	-0.045
4	-0.121	0.083	0.002	0.119	0.056	-0.0494
5	-0.061	0.068	-0.012	0.038	0.007	-0.049
6	-0.01	0.043	-0.019	-0.014	-0.011	-0.047
7	0.025	0.019	-0.02	-0.042	-0.013	-0.046
8	0.046	-0.0004	-0.017	-0.054	-0.008	-0.043
9	0.056	-0.013	-0.014	-0.056	-0.001	-0.041
10	0.059	-0.021	-0.011	-0.053	0.004	-0.038
11	0.057	-0.025	-0.008	-0.047	0.008	-0.036
12	0.053	-0.026	-0.006	-0.041	0.011	-0.033

Table A.27. Pairwise Granger causality test for the variables of the model 5.(Lags: 6).

Null Hypothesis	Number of observations	F-Statistic	p-value
ERA DNGC YgapSA	174	0.671	0.673
YgapSA DNGC ERA	174	1.408	0.214
ERD DNGC YgapSA	174	1.505	0.179
YgapSA DNGC ERD	174	0.533	0.782
D_InflGAP DNGC YgapSA	173	0.291	0.94
YgapSA DNCG D_InflGAP	173	1.5	0.181
IR DNGC YgapSA	174	4.609	0
YgapSA DNGC IR	174	3.957	0.001
ERD DNGC ERA	174	11.912	0
ERA DNGC ERD	174	1.358	0.235
D_InflGAP DNGC ERA	173	1.096	0.366
ERA DNGC D_InflGAP	173	0.712	0.64
IR DNGC ERA	174	6.034	0
ERA DNGC IR	174	0.276	0.947
D_InflGAP DNGC ERD	173	0.977	0.443
ERD DNGC D_InflGAP	173	1.459	0.195
IR DNGC ERD	174	0.631	0.705
ERD DNGC IR	174	3.548	0.002
IR DNGC D_InflGAP	173	0.879	0.511
D_InflGAP DNGC IR	173	2.244	0.041

Table A.28. Lag length criteria for the Model 5.

Endogenous variables	YgapSA, ERA, ERD, D_InflGap, IR			
Exogenous variables	C, Dummy			
Included observations	167			
Lag	**Final Prediction Error**	**Akaike Information Criterion**	**Schwarz Information Criterion**	**Hannan-Quinn Information Criterion**
0	1016.31	21.11	21.3	21.18
1	79.95	18.5	19.22*	18.83*
2	71.69	18.46	19.58	18.91
3	72.40	18.46	20.05	19.11
4	71.47	18.45	20.5	19.28
5	70.046*	18.42*	20.94	19.44
6	78.74	18.53	21.51	19.74
7	85.27	18.59	22.05	19.99
8	97.55	18.71	22.63	20.3
9	104.78	18.76	23.15	20.54
10	119.58	18.86	23.72	20.83
11	115.25	18.79	24.11	20.95
12	115.94	18.75	24.54	21.1

Table A.29. Autocorrelation LM-test for the Model 5

(Probs from Chi-square with 25 df; 174 observations included).

Null Hypothesis	no serial correlation at lag order h	
Lags	**LM-Statistic**	**p-value**
1	37.032	0.057
2	29.061	0.261
3	43.666	0.011
4	17.167	0,875
5	28.507	0.285
6	26.144	0.399
7	17.962	0.844
8	26.456	0.383
9	24,447	0.493
10	21.708	0.652
11	21.662	0.655
12	50.985	0.001

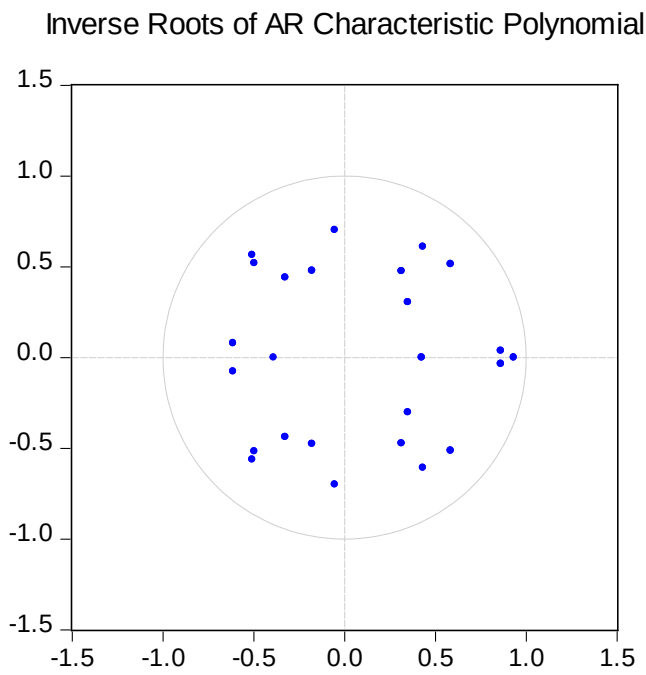

Figure A.6. Inverse roots of AR characteristic polynomial of the model 5.

Table A.30. Estimation output for the Model 5

Vector Autoregression estimates for the Model 5.					
Included observations 174					
T-statistics in [ ]					
	YgapSA	**ERA**	**ERD**	**D_InlfGap**	**IR**
YgapSA (-1)	0.605 [7.34]	-0.066 [-1.308]	0.095 [0.88]	0.063 [1.75]	-0.09 [-1.48]
YgapSA (-2)	0.051 [0.54]	0.053 [0.92]	-0.086 [-0.07]	0.014 [0.34]	0.014 [0.21]
YgapSA (-3)	0.116 [1.26]	0.108 [1.91]	0.139 [1.15]	-0.053 [-1.33]	0.192 [2.83]
YgapSA (-4)	-0.191 [-2]	0.012 [0.21]	-0.038 [-0.3]	-0.001 [-0.01]	0.048 [0.68]
YgapSA (-5)	0.161 [1.88]	-0.061 [-1.16]	0.021 [0.18]	0.064 [1.69]	-0.005 [-0.07]
ERA (-1)	0.102 [0.76]	-0.215 [-2.61]	-0.298 [-1.69]	0.064 [1.09]	-0.081 [-0.82]
ERA (-2)	0.068 [0.53]	-0.014 [-0.17]	0.03 [0.18]	0.023 [0.04]	0.079 [0.83]
ERA (-3)	-0.136 [-1.16]	0.022 [0.3]	-0.155 [-1]	-0.061 [-1.17]	0.064 [0.73]
ERA (-4)	0.168 [1.47]	0.088 [1.25]	-0.273 [-1.82]	-0.004 [-0.08]	0.004 [0.06]
ERA (-5)	-0.101 [-0.89]	0.055 [0.78]	0.078 [0.53]	-0.049 [-1]	0.156 [1.86]
ERD (-1)	0.003 [0.03]	0.144 [3.34]	0.565 [6.15]	-0.042 [-1.36]	0.225 [4.36]
ERD (-2)	-0.055 [-0.68]	-0.115 [-2.35]	-0.057 [-0.54]	0.064 [1.82]	-0.025 [-0.42]
ERD (-3)	0.038 [0.47]	-0.147 [-2.94]	0.046 [0.43]	0.066 [1.84]	-0.067 [-1.12]

Table A.30 (continued)

ERD (-4)	-0.054 [-0.06]	-0.154 [-3.06]	-0.043 [-0.4]	-0.03 [-0.84]	0.079 [1.31]
ERD (-5)	0.046 [0.49]	-0.158 [-2.71]	-0.058 [-0.47]	0.011 [0.27]	-0.066 [-0.95]
D_InlfGap (-1)	-0.069 [-0.36]	-0.171 [-1.43]	-0.079 [-0.31]	-0.018 [-0.21]	0.157 [1.1]
D_InlfGap (-2)	0.096 [0.49]	0.064 [0.53]	0.177 [0.69]	0.004 [0.05]	0.224 [1.57]
D_InlfGap (-3)	0.194 [1.01]	-0.036 [-0.3]	-0.048 [-0.19	0.034 [0.39]	-0.031 [-0.21]
D_InlfGap (-4)	-0.122 [-0.64]	-0.166 [-1.42]	0.192 [0.77]	0.022 [0.25]	-0.041 [-0.29]
D_InlfGap (-5)	0.116 [0.63]	0.039 [0.35]	-0.042 [-0.17]	0.035 [0.44]	-0.037 [-0.27]
IR (-1)	-0.344 [-2.969]	0.247 [3.45]	0.128 [0.84]	-0.042 [-0.837]	0.787 [9.21]
IR (-2)	0.141 [0.95]	-0.017 [-0.18]	0.081 [0.42]	-0.021 [-0.33]	0.025 [0.23]
IR (-3)	0.221 [1.52]	-0.192 [-2.15]	-0.33 [-1.73]	-0.057 [-0.89]	0.026 [0.24]
IR (-4)	-0.203 [-1.37]	-0.755 [-0.83]	0.256 [1.33]	0.101 [1.56]	-0.165 [-1.52]
IR (-5)	0.085 [0.75]	0.197 [2.8]	-0.025 [-0.16]	0.026 [0.52]	0.217 [2.57]
C	1.036 [1.78]	-1.644 [-4.58]	-0.679 [-0.89]	-0.116 [-0.45]	0.875 [2.04]
Dummy	-1.768 [-2.46]	-0.497 [-1.12]	0.444 [0.47]	-0.299 [-0.947]	1.098 [2.07]
R-squared	0.687	0.517	0.395	0.187	0.877
Adj. R-squared	0.632	0.432	0.288	0.043	0.855
SSR	559.75	212.81	961.73	108.61	304.16
S.E. equation	1.96	1.203	2.557	0.859	1.438
F-statistic	12.467	6.059	3.695	1.3	40.438
Log Likelihood	-348.55	-246.41	-395.63	-205.89	-295.48
Akaike AIC	4.316	3.349	4.857	2.676	3.706
Schwarz SC	4.806	3.839	5.348	3.167	4.196
Mean Dependent	-0.169	-0.833	1.408	0.013	8.597
S.D. dependent	3.22	1.596	3.031	0.878	3.785
Determinant Resid Covariance (dof adj)			39.977		
Determinant Resid Covariance			17.204		
Log Likelihood			-1482.008		
Akaike Information criterion			18.586		
Schwarz criterion			21.037		

Table A.31. Variance decomposition table for the interest rate of the Model 5.

Period	YgapSA	ERA	ERD	D_InlfGap	IR
1	0.587	0.18	6.88	7.35	84.98
2	1.17	0.76	21.25	4.61	72.20
3	1.15	1.73	28.7	3.25	65.14
4	1.69	2.42	30.77	2.63	62.46
5	5.09	3.15	34.56	2.28	54.9
6	9.83	3.61	34.21	2.03	50.29
7	14.64	3.57	32.67	1.84	47.26
8	18.24	3.56	31.39	1.73	45.06
9	20.76	3.44	29.99	1.66	44.12
10	22.94	3.37	28.88	1.62	43.17
11	24.8	3.36	28.01	1.59	42.22
12	26.48	3.35	27.19	1.56	41.40

Table A.32. IRF for the interest rate of the Model 5.

Period	YgapSA	ABS(ERA)	ABS(ERD)	D_InlfGap	IR
1	-0.11	-0.06	0.37	-0.39	1.33
2	-0.18	-0.16	0.83	-0.17	1.04
3	-0.13	-0.26	0.88	0.03	0.9
4	0.23	-0.27	0.72	-0.016	0.82
5	0.54	-0.29	0.81	0.04	0.34
6	0.69	-0.27	0.56	0.02	0.37
7	0.75	-0.17	0.407	-0.01	0.407
8	0.7	-0.16	0.3	0.02	0.31
9	0.63	-0.08	0.15	0.047	0.39
10	0.59	-0.09	0.12	0.053	0.32
11	0.56	-0.11	0.1	0.06	0.25
12	0.55	-0.1	0.095	0.044	0.254

Table A.33. Granger causality test for variables of the Model 6.

Null Hypothesis	Number of observations	F-Statistic	p-value
W^{minus} DNGC YgapSA	174	0.676	0.668
YgapSA DNGC W^{minus}	174	1.568	0.159
W^{plus} DNGC YgapSA	174	1.231	0.292
YgapSA DNGC W^{plus}	174	0.462	0.835
D_InflGAP DNGC YgapSA	173	0.292	0.94
YgapSA DNCG D_InflGAP	173	1.5	0.181
IR DNGC YgapSA	174	4.609	0
YgapSA DNGC IR	174	3.957	0.001
W^{plus} DNGC W^{minus}	174	16.154	0
W^{minus} DNGC W^{plus}	174	1.641	0.139
D_InflGAP DNGC W^{minus}	173	1.115	0.356
W^{minus} DNGC D_InflGAP	173	0.514	0.797
IR DNGC W^{minus}	174	6.981	0
W^{minus} DNGC IR	174	0.133	0.992
D_InflGAP DNGC W^{plus}	173	0.985	0.436
W^{plus} DNGC D_InflGAP	173	1.65	0.136
IR DNGC W^{plus}	174	0.507	0.802
W^{plus} DNGC IR	174	3.312	0.004
IR DNGC D_InflGAP	173	0.879	0.511
D_InflGAP DNGC IR	173	2.244	0.041

Table A.34. Lag length criteria for the Model 6.

Endogenous variables	YgapSA, W^{minus}, W^{plus}, D_InflGap, IR			
Exogenous variables	C, Dummy			
Included observations	167			
Lag	**Final Prediction Error**	**Akaike Information Criterion**	**Schwarz Information Criterion**	**Hannan-Quinn Information Criterion**
0	1105.67	21.19	21.38	21.27
1	89.92	18.68	19.34*	18.95*
2	83.06	18.60	19.72	19.06
3	83.81	18.61	20.2	19.25
4	81.48	18.58	20.63	19.41
5	78.57*	18.53*	21.05	19.56
6	87.61	18.63	21.62	19.85
7	96.23	18.71	22.17	20.12
8	110.26	18.83	22.75	20.42
9	116.33	18.86	23.25	20.64
10	130.93	18.95	23.81	20.92
11	128.81	18.91	24.23	21.06
12	134.44	18.90	24.69	21.25

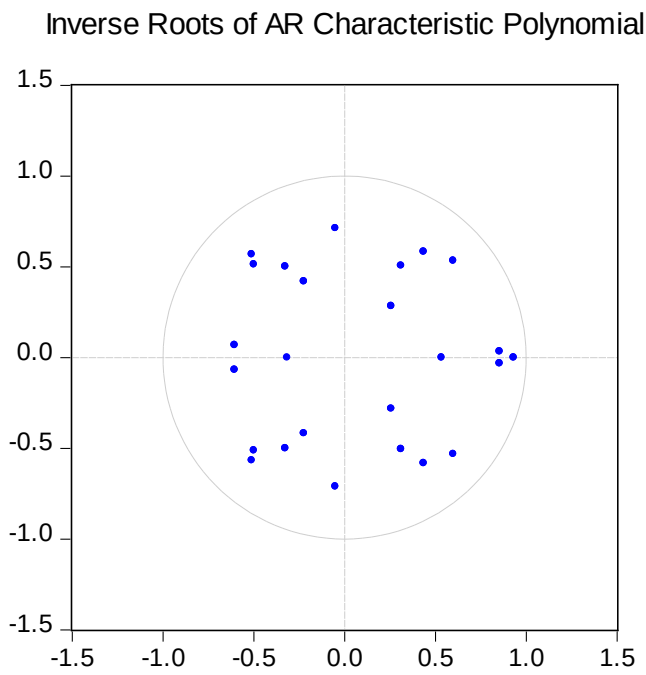

Figure A.7. Inverse roots of AR Characteristic polynomial for the model 6.

Table A.35. Autocorrelation LM-test for the model 6

(Probs from Chi-square with 25 df; 174 observations included).

Null Hypothesis	no serial correlation at lag order h	
Lags	**LM-Statistic**	**p-value**
1	34.25	0.103
2	31.29	0.179
3	44.28	0.01
4	19.51	0.771
5	33.34	0.123
6	31.67	0.1676
7	18.61	0.8151
8	23.76	0.533
9	22.45	0.609
10	25.12	0.455
11	23.85	0.527
12	53.81	0

Table A.36. Estimation output for the Model 6.

Vector Autoregression estimates for the Model 6.					
Included observations 174					
T-statistics in [ ]					
	YgapSA	**W^{minus}**	**W^{plus}**	**D_InlfGap**	**IR**
YgapSA (-1)	0.599 [7.27]	-0.041 [-0.831]	0.108 [0.99]	0.06 [1.66]	-0.087 [-1.43]
YgapSA (-2)	0.043 [0.46]	0.054 [0.96]	-0.082 [-0.67]	0.012 [0.305]	0.014 [0.21]
YgapSA (-3)	0.123 [1.35]	0.073 [1.3]	0.095 [0.79]	-0.052 [-1.29]	0.186 [2.74]
YgapSA (-4)	-0.177 [-1.87]	-0.005 [-0.09]	-0.035 [-0.27]	0.003 [0.08]	0.051 [0.73]
YgapSA (-5)	0.154 [1.81]	-0.085 [-1.62]	0.041 [0.36]	0.065 [1.73]	-0.004 [-0.07]
W^{minus} (-1)	0.07 [0.54]	-0.263 [-3.32]	-0.319 [-1.87]	0.067 [1.18]	-0.111 [-1.16]
W^{minus} (-2)	0.084 [0.68]	-0.057 [-0.76]	-0.048 [-0.29]	0.045 [0.85]	0.014 [0.16]
W^{minus} (-3)	-0.077 [-0.69]	0.045 [0.65]	-0.183 [-1.24]	-0.041 [-0.85]	0.038 [0.46]
W^{minus} (-4)	0.156 [1.43]	0.082 [1.23]	-0.272 [-1.89]	-0.009 [-0.2]	0.006 [0.07]
W^{minus} (-5)	-0.082 [-0.76]	0.048 [0.73]	0.033 [0.23]	-0.033 [-0.7]	0.131 [1.64]
W^{plus} (-1)	0.013 [0.19]	0.117 [2.83]	0.53 [5.94]	-0.03 [-1.02]	0.197 [3.92]
W^{plus} (-2)	-0.026 [-0.34]	-0.085 [-1.83]	-0.045 [-0.44]	0.065 [1.94]	-0.015 [-0.26]
W^{plus} (-3)	0.011 [0.14]	-0.132 [-2.76]	0.071 [0.69]	0.056 [1.65]	-0.061 [-1.05]
W^{plus} (-4)	-0.043 [-0.56]	-0.175 [-3.67]	-0.076 [-0.75]	-0.032 [-0.94]	0.072 [1.25]
W^{plus} (-5)	0.049 [0.55]	-0.183 [-3.32]	-0.076 [-0.64]	0.022 [0.56]	-0.098 [-1.46]
D_InlfGap (-1)	-0.074 [-0.38]	-0.128 [-1.08]	-0.035 [-0.14]	-0.023 [-0.26]	0.171 [1.18]
D_InlfGap (-2)	0.069 [0.36]	0.073 [0.5361]	0.251 [0.98]	0.001 [0.01]	0.221 [1.52]
D_InlfGap (-3)	0.194 [1.01]	0.011 [0.09]	-0.055 [-0.21]	0.034 [0.41]	-0.047 [-0.32]
D_InlfGap (-4)	-0.109 [-0.57]	-0.095 [-0.82]	0.192 [0.77]	0.024 [0.29]	-0.053 [-0.37]
D_InlfGap (-5)	0.109 [0.6]	-0.007 [-0.06]	-0.002 [-0.11]	0.028 [0.35]	-0.035 [-0.26]
IR (-1)	-0.358 [-3.12]	0.237 [3.37]	0.111 [0.73]	-0.049 [-0.99]	0.817 [9.57]
IR (-2)	0.144 [0.97]	-0.024 [-0.26]	0.087 [0.44]	-0.021 [-0.34]	0.026 [0.24]
IR (-3)	0.216 [1.48]	-0.183 [-2.06]	-0.301 [-1.57]	-0.058 [-0.91]	0.031 [0.28]
IR (-4)	-0.205 [-1.39]	-0.096 [-1.07]	0.21 [1.08]	0.106 [1.64]	-0.184 [-1.68]

Table A.36 (continued)

IR (-5)	0.106 [0.92]	0.166 [2.35]	-0.032 [-0.21]	0.03 [0.61]	0.215 [2.51]
C	0.991 [1.78]	-0.95 [-2.79]	-0.349 [-0.47]	-0.082 [-0.34]	0.686 [1.66]
Dummy	-1.801 [-2.49]	-0.115 [-0.26]	0.701 [0.73]	-0.351 [-1.11]	1.086 [2.02]
R-squared	0.686	0.532	0.404	0.188	0.874
Adj. R-squared	0.631	0.449	0.298	0.044	0.852
SSR	562.95	211.24	977.27	108.45	311.54
S.E. equation	1.96	1.198	2.578	0.859	1.455
F-statistic	12.364	6.430	3.831	1.311	39.345
Log Likelihood	-349.05	-263.77	-397.03	-205.76	-297.57
Akaike AIC	4.322	3.342	4.873	2.675	3.731
Schwarz SC	4.812	3.832	5.364	3.166	4.221
Mean Dependent	-0.169	-0.544	1.238	0.013	8.597
S.D. dependent	3.22	1.615	3.078	0.878	3.786
Determinant Resid Covariance (dof adj)			45.084		
Determinant Resid Covariance			19.402		
Log Likelihood			-1492.468		
Akaike Information criterion			18.7		
Schwarz criterion			21.157		

Table A.37. Variance decomposition table for the interest rate of the Model 6.

Period	**YgapSA**	**W^{minus}**	**W^{plus}**	**D_InlfGap**	**IR**
1	0.622	0.008	6.871	7.452	85.045
2	1.244	0.019	19.717	4.696	74.321
3	1.245	0.021	26.767	3.342	68.624
4	1.722	0.042	28.825	2.723	66.687
5	5.022	0.104	33.152	2.383	59.336
6	9.592	0.164	33.007	2.155	55.079
7	14.432	0.159	31.564	1.969	51.873
8	18.254	0.175	30.454	1.853	49.262
9	20.979	0.17	29.187	1.781	47.881
10	23.389	0.179	28.194	1.735	46.501
11	25445	0.216	27.44	1.708	45.188
12	27.312	0.245	26.714	1.637	44.054

Table A.38. IRF table for the interest rate of the Model 6.

Period	YgapSA	ABS(W^{minus})	ABS(W^{plus})	D_InlfGap	IR
1	-0.115	0.013	0.381	-0.397	1.342
2	-0.192	0.025	0.807	-0.179	1.097
3	-0.144	-0.019	0.856	0.032	0.957
4	0.222	-0.042	0.701	-0.007	0.869
5	0.535	-0.074	0.817	0.048	0.368
6	0.674	-0.079	0.527	0.019	0.371
7	0.747	-0.03	0.374	0.008	0.394
8	0.707	-0.052	0.312	0.035	0.279
9	0.639	-0.02	0.188	0.051	0.362
10	0.621	-0.043	0.181	0.061	0.287
11	0.592	-0.073	0.181	0.066	0.214
12	0.582	-0.066	0.156	0.053	0.219

Table A.39. Pairwise granger causality test for the variables of the Model 7 (Lags: 6).

Null Hypothesis	Number of observations	F-Statistic	p-value
ERA DNGC D_YgapSA	77	1.531	0.18
D_YgapSA DNGC ERA	77	0.52	0.79
ERD DNGC D_YgapSA	77	1.552	0.17
D_YgapSA DNGC ERD	77	2.115	0.06
IR DNGC D_YgapSA	77	2.133	0.06
D_YgapSA DNCG IR	77	1.357	0.24
InflGAP DNGC D_YgapSA	77	0.512	0.79
D_YgapSA DNGC InflGAP	77	0.263	0.95
ERD DNGC ERA	78	2.217	0.05
ERA DNGC ERD	78	2.734	0.02
IR DNGC ERA	78	1.339	0.25
ERA DNGC IR	78	1.644	0.15
InflGAP DNGC ERA	78	1.093	0.37
ERA DNGC InflGAP	78	0.479	0.82
IR DNGC ERD	78	1.787	0.12
ERD DNGC IR	78	3.17	0.008
InflGAP DNGC ERD	78	1.967	0.08
ERD DNGC InflGAP	78	0.319	0.924
IR DNGC InflGAP	78	1.583	0.16
InflGAP DNGC IR	78	1.142	0.35

Table A.40. Lag length criteria for the Model 7.

Endogenous variables	D_YgapSA, ERA, ERD, InflGap, IR			
Exogenous variables	C			
Included observations	71			
Lag	**Final Prediction Error**	**Akaike Information Criterion**	**Schwarz Information Criterion**	**Hannan-Quinn Information Criterion**
0	1.43	14.547	14.706	14.610
1	0.036	10.885	11.841*	11.266
2	0.047	11.138	12.981	11.835
3	0.066	11.442	13.992	12.456
4	0.085	11.636	14.982	12.967
5	0.084	11.541	15.684	13.188
6	0.072	11.250	16.189	13.214
7	0.107	11.44	17.177	13.721
8	0.164	11.572	18.105	14.17
9	0.144	11.017	18.346	13.93
10	0.101	10.047	18.174	13.27
11	0.044	8.292	17.217	11.84
12	0.019	5.925*	15.645	9.79*

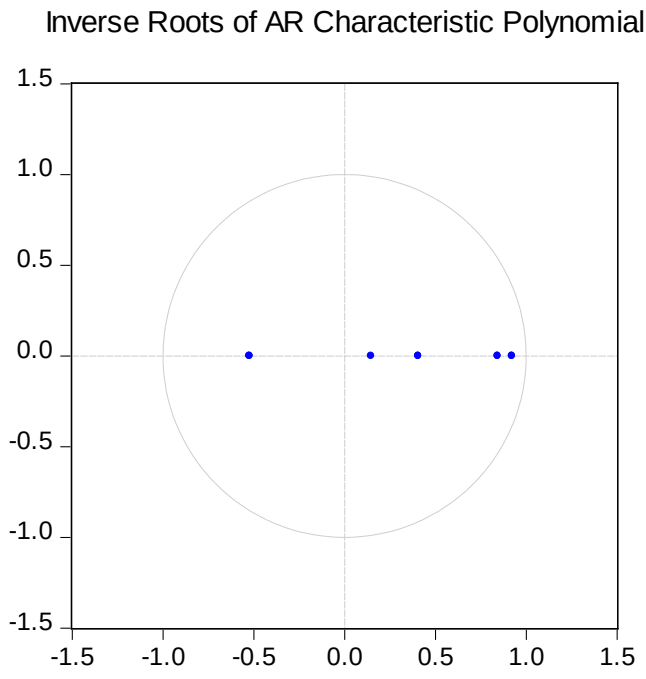

Figure A.8. AR roots graph for the model 7.

Table A.41. Autocorrelation LM-test for the model 7

(Probs from Chi-square with 25 df; 82 observations included).

Null Hypothesis	no serial correlation at lag order h	
Lags	**LM-Statistic**	**p-value**
1	28.67	0.27
2	26.34	0.38
3	36.75	0.06
4	23.24	0.56
5	13.48	0.97
6	38.21	0.04
7	24.89	0.46
8	24.64	0.48
9	33.38	0.12
10	34.61	0.095
11	16.28	0.9
12	24.77	0.47

Table A.42. Estimation output of the model 7.

Vector Autoregression estimates for the Model 7.					
Included observations 82					
T-statistics in [ ]					
	D_YgapSA	**ERA**	**ERD**	**InlfGap**	**IR**
D_YgapSA (-1)	-0.554 [-5.58]	-0.007 [-0.26]	0.02 [1.22]	0.007 [0.16]	-0.114 [-1.61]
ERA (-1)	0.219 [0.54]	0.296 [2.54]	0.123 [1.84]	0.184 [1.04]	0.499 [1.73]
ERD (-1)	-1.096 [-1.62]	0.223 [1.14]	0.387 [3.44]	-0.249 [-0.84]	1.214 [2.49]
InlfGap (-1)	-0.024 [-0.24]	0.26 [0.89]	0.019 [1.15]	0.932 [20.74]	-0.026 [-0.35]
IR (-1)	-0.008 [-0.10]	0.019 [0.82]	0.016 [1.22]	-0.011 [-0.31]	0.735 [12.3]
C	0.504 [0.68]	-0.536 [-2.52]	0.029 [0.24]	0.313 [0.97]	2.01 [3.82]
R-squared	0.299	0.214	0.351	0.861	0.758
Adj. R-squared	0.252	0.162	0.308	0.852	0.743
SSR	249.9	21.029	6.917	48.182	129.2
S.E. equation	1.813	0.526	0.301	0.796	1.303
F-statistic	6.486	4.142	8.236	94.612	47.857
Log Likelihood	-162.04	-60.56	-14.974	-94.552	-134.998
Akaike AIC	4.098	1.623	0.511	2.452	3.438
Schwarz SC	4.274	1.799	0.687	2.628	3.615

Table A.42 (continued)

Mean Dependent	0.041	-0.414	0.229	1.132	7.969
S.D. dependent	2.098	0.574	0.362	2.073	2.572
Determinant Resid Covariance (dof adj)	0.0698				
Determinant Resid Covariance	0.047				
Log Likelihood	-457.058				
Akaike Information criterion	11.879				
Schwarz criterion	12.759				

Table A.43. Variance decomposition table for the interest rate of the Model 7.

Period	D_YgapSA	ERA	ERD	InlfGap	IR
1	1.507	0.669	0.348	3.857	93.617
2	2.715	2.994	3.179	3.884	87.225
3	2.275	6.38	7.045	3.569	80.723
4	2.569	9.241	9.219	3.209	75.761
5	2.56	11.21	10.663	2.923	72.639
6	2.655	12.585	11.467	2.722	70.569
7	2.686	13.527	11.964	2.607	69.21
8	2.728	14.189	12.24	2.565	68.274
9	2.752	14.656	12.396	2.586	67.608
10	2.774	14.986	12.471	2.656	67.111
11	2.788	15.22	12.5	2.763	66.728
12	2.798	15.385	12.499	2.895	66.42

Table A.44. IRF table for the interest rate of the Model 7.

Period	D__YgapSA	ABS(ERA)	ABS(ERD)	InlfGap	IR
1	0.16	0.106	-0.076	-0.256	1.26
2	-0.225	-0.269	0.288	-0.208	0.928
3	-0.086	-0.388	0.412	-0.149	0.722
4	-0.168	-0.41	0.378	-0.093	0.581
5	-0.111	-0.377	0.341	-0.045	0.476
6	-0.119	-0.335	0.284	-0.006	0.329
7	-0.092	-0.289	0.237	0.024	0.324
8	-0.085	-0.249	0.193	0.048	0.286
9	-0.07	-0.212	0.157	0.067	0.221
10	-0.061	-0.181	0.126	0.081	0.182
11	-0.052	-0.155	0.1	0.09	0.150
12	-0.045	-0.132	0.079	0.096	0.123

Table A.45. Pairwise granger causality test for the variables of the model 8.

Null Hypothesis	Number of observations	F-Statistic	p-value
Wminus DNGC D_YgapSA	77	1.066	0.39
D_YgapSA DNGC Wminus	77	0.601	0.72
Wplus DNGC D_YgapSA	77	1.401	0.23
D_YgapSA DNGC Wplus	77	1.103	0.37
InflGAP DNGC D_YgapSA	77	0.512	0.79
D_YgapSA DNCG InflGAP	77	0.263	0.957
IR DNGC D_YgapSA	77	2.133	0.06
D_YgapSA DNGC IR	77	1.357	0.245
Wplus DNGC Wminus	78	2.411	0.03
Wminus DNGC Wplus	78	1.27	0.28
InflGAP DNGC Wminus	78	1.065	0.39
Wminus DNGC InflGAP	78	0.397	0.87
IR DNGC Wminus	78	0.908	0.49
Wminus DNGC IR	78	1.231	0.3
InflGAP DNGC Wplus	78	2.253	0.04
Wplus DNGC InflGAP	78	0.519	0.791
IR DNGC Wplus	78	1.77	0.12
Wplus DNGC IR	78	2.115	0.06
IR DNGC InflGAP	78	1.583	0.16
InflGAP DNGC IR	78	1.142	0.348

Table A.46. Lag length criteria for the model 8.

Endogenous variables	D_YgapSA, Wminus, Wplus, InflGAP, IR			
Exogenous variables	C			
Included observations	77			
Lag	**Final Prediction Error**	**Akaike Information Criterion**	**Schwarz Information Criterion**	**Hannan-Quinn Information Criterion**
0	3.483	15.437	15.589	15.498
1	0.145*	12.259*	13.172*	12.624*
2	0.188	12.509	14.183	13.179
3	0.261	12.815	15.251	13.789
4	0.31	12.974	16.144	14.226
5	0.329	12.94	16.897	14.522
6	0.308	12.773	17.491	14.661

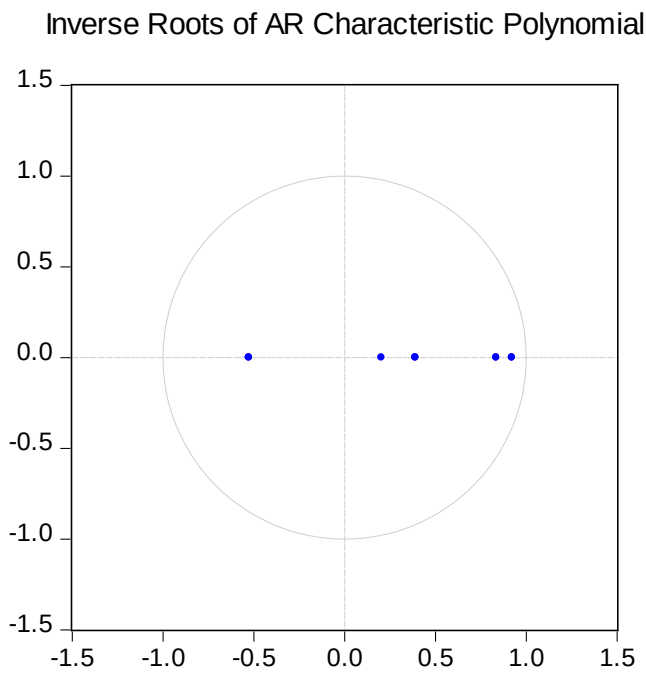

Figure A.9. Inverse roots of AR characteristic polynomial of the model 8.

Table A.47. Autocorrelation LM-test for the model 8

(Probs from Chi-square with 25 df; 82 observations included).

Null Hypothesis	no serial correlation at lag order h	
Lags	**LM-Statistic**	**p-value**
1	26.633	0.374
2	21.213	0.68
3	35.598	0.078
4	29.903	0.22
5	14.49	0.95
6	30.473	0.21
7	27.829	0.31
8	25.358	0.44
9	32.622	0.14
10	37.427	0.054
11	14.863	0.94
12	26.905	0.36

Table A.48. Estimation output of the model 8.

Vector Autoregression estimates for the Model 8.					
Included observations 82					
T-statistics in [ ]					
	D_YgapSA	**Wminus**	**Wplus**	**InflGAP**	**IR**
D_YgapSA (-1)	**-0.534** **[-5.41]**	-0.011 [-0.36]	0.011 [0.17]	0.007 [0.17]	-0.147 [-2.01]
Wminus (-1)	0.15 [0.42]	0.306 [2.78]	0.065 [1.01]	0.141 [0.908]	0.516 [1.94]
Wplus (-1)	-0.642 [-1.07]	0.203 [1.1]	0.353 [3.23]	-0.194 [-0.74]	0.683 1.54]
InflGAP (-1)	-0.047 [-0.46]	0.024 [0.77]	0.016 [0.88]	0.931 [21.03]	0.0078 [0.1]
IR (-1)	-0.029 [-0.36]	0.011 [0.47]	0.017 [1.15]	-0.011 [-0.327]	0.772 [12.77]
C	0.494 [0.69]	-0.393 [-1.8]	-0.047 [-0.36]	0.259 [0.84]	1.843 [3.51]
R-squared	0.286	0.167	0.218	0.861	0.738
Adj. R-squared	0.239	0.112	0.166	0.852	0.721
SSR	254.43	24.061	8.523	48.268	140.055
S.E. equation	1.829	0.562	0.334	0.796	1.375
F-statistic	6.099	3.053	4.245	94.418	42.978
Log Likelihood	-162.77	-66.082	-23.531	-94.625	-138.3
Akaike AIC	4.11	1.758	0.72	2.45	3.519
Schwarz SC	4.292	1.934	0.896	2.63	3.695
Mean Dependent	0.041	-0.348	0.139	1.132	7.969
S.D. dependent	2.098	0.597	0.366	2.073	2.572
Determinant Resid Covariance (dof adj)				0.121	
Determinant Resid Covariance				0.082	
Log Likelihood				-479.65	
Akaike Information criterion				12.43	
Schwarz criterion				13.311	

Table A.49. Variance decomposition of interest rate for the model 8.

Period	D_YgapSA	Wminus	Wplus	InflGAP	IR
1	0.625	0.406	0.052	3.878	95.037
2	2.89	2.01	1.323	3.598	90.176
3	2.572	3.717	3.251	3.235	87.222
4	2.963	5.066	4.442	2.899	84.627
5	2.985	5.988	5.261	2.659	83.105
6	3.1	6.641	5.724	2.509	82.019
7	3.139	7.112	6.005	2.445	81.295
8	3.185	7.452	6.158	2.454	80.748
9	3.209	7.701	6.24	2.522	80.325
10	3.229	7.885	6.275	2.635	79.973
11	3.24	8.02	6.286	2.779	79.671
12	3.249	8.12	6.281	2.944	79.404

Table A.50. IRF of interest rate for the model 8.

Period	D_YgapSA	ABS(Wminus)	ABS(Wplus)	InflGAP	IR
1	0.107	0.086	-0.031	-0.267	1.323
2	-0.279	-0.234	0.2	-0.2	1.022
3	-0.112	-0.292	0.296	-0.13	0.819
4	-0.186	-0.293	0.275	-0.073	0.664
5	-0.119	-0.262	0.246	-0.024	0.544
6	-0.124	-0.232	0.202	0.013	0.446
7	-0.093	-0.2	0.166	0.042	0.365
8	-0.085	-0.173	0.133	0.064	0.299
9	-0.069	-0.149	0.105	0.081	0.244
10	-0.06	-0.129	0.082	0.092	0.199
11	-0.049	-0.111	0.063	0.1	0.162
12	-0.042	-0.096	0.048	0.105	0.131

Table A.51. Pairwise granger causality test for the variables of the model 9 (Lags: 6).

Null Hypothesis	Number of observations	F-Statistic	p-value
ERA DNGC YgapSA	70	2.096	0.067
YgapSA DNGC ERA	70	1.08	0.358
ERD DNGC YgapSA	70	1.839	0.1
YgapSA DNGC ERD	70	0.413	0.86
IR DNGC YgapSA	70	2.355	0.042
YgapSA DNCG IR	70	4.291	0.001
D_InflGAP DNGC YgapSA	69	0.355	0.9
YgapSA DNGC D_InflGAP	69	0.880	0.51
ERD DNGC ERA	70	6.04	0
ERA DNGC ERD	70	0.65	0.68
IR DNGC ERA	70	6.76	0
ERA DNGC IR	70	0.51	0.79
D_InflGAP DNGC ERA	69	1.467	0.2
ERA DNGC D_InflGAP	69	1.126	0.35
IR DNGC ERD	70	1.234	0.3
ERD DNGC IR	70	3.119	0.01
D_InflGAP DNGC ERD	69	0.991	0.44
ERD DNGC D_InflGAP	69	1.468	0.21
IR DNGC D_InflGAP	69	0.962	0.458
D_InflGAP DNGC IR	69	4.079	0.002

Table A.52. Lag length criteria for the model 9.

Endogenous variables	YgapSA, ERA, ERD, D_InflGap, IR			
Exogenous variables	C			
Included observations	69			
Lag	**Final Prediction Error**	**Akaike Information Criterion**	**Schwarz Information Criterion**	**Hannan-Quinn Information Criterion**
0	926.51	21.02	21.18	21.085
1	28.95*	17.55	18.52*	17.93*
2	32.83	17.667	19.45	18.37
3	33.38	17.65	20.24	18.68
4	32.10	17.55	20.95	18.90
5	32.97	17.48*	21.69	19.15
6	42.59	17.59	22.61	19.58

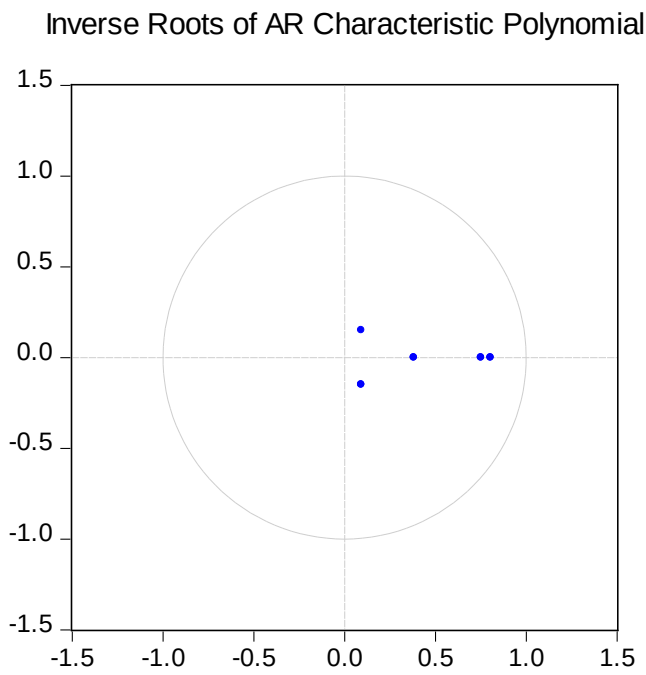

Figure A.10. Inverse roots of AR characteristic-polynomial for the model 9.

Table A.53. Autocorrelation LM-test for the model 9

(Probs from Chi-square with 25 df; 74 observations included).

Null Hypothesis	no serial correlation at lag order h	
Lags	**LM-Statistic**	**p-value**
1	36.48	0.06
2	30.05	0.22
3	25.2	0.45
4	34.19	0.1
5	32.71	0.13
6	18.52	0.81
7	17.25	0.87
8	34.54	0.09
9	40.67	0.02
10	47.88	0.004
11	24.56	0.48
12	33.54	0.12

Table A.54. Estimation output of the model 9.

Vector Autoregression estimates for the Model 9.					
Included observations 74					
T-statistics in [ ]					
	YgapSA	**ERA**	**ERD**	**D_InlfGap**	**IR**
YgapSA (-1)	0.619 [7.44]	-0.148 [-1.05]	0.038 [0.16]	0.01 [0.2]	0.093 [1.46]
ERA (-1)	0.076 [1.01]	0.018 [0.14]	-0.223 [-1.024]	0.026 [0.57]	-0.038 [-0.67]
ERD (-1)	0.026 [0.58]	0.194 [2.49]	0.546 [4.08]	0.004 [0.14]	0.158 [4.49]
D_InlfGap (-1)	0.044 [0.22]	-0.548 [-1.58]	0.712 [1.19]	0.072 [0.57]	0.677 [4.31]
IR (-1)	-0.144 [-2.62]	-0.205 [-2.2]	-0.022 [-0.14]	0.029 [0.86]	0.867 [20.62]
C	1.187 [2.95]	0.028 [0.04]	1.031 [0.88]	-0.109 [-0.44]	0.629 [2.04]
R-squared	0.622	0.161	0.286	0.034	0.934
Adj. R-squared	0.594	0.099	0.233	-0.036	0.929
SSR	102.02	291.82	862.21	38.35	59.815
S.E. equation	1.224	2.072	3.561	0.751	0.937
F-statistic	22.411	2.609	5.456	0.48	194.81
Log Likelihood	-116.88	-155.76	-195.85	-80.681	-97.127
Akaike AIC	3.321	4.372	5.455	2.342	2.787
Schwarz SC	3.508	4.558	5.642	2.529	2.974
Mean Dependent	-0.117	-1.254	2.539	0.114	8.267
S.D. dependent	1.923	2.182	4.068	0.737	3.543
Determinant Resid Covariance (dof adj)	21.161				
Determinant Resid Covariance	13.865				
Log Likelihood	-622.29				
Akaike Information criterion	17.629				
Schwarz criterion	18.563				

Table A.55. Variance decomposition table for the interest rate of the model 9.

Period	YgapSA	ERA	ERD	D_InlfGap	IR
1	1.874	0.786	31.877	1.326	64.134
2	1.098	2.538	49.518	7.072	39.771
3	1.61	3.528	56.062	9.278	29.519
4	2.207	4.038	59.155	10.182	24.416
5	2.732	4.334	60.772	10.637	21.522
6	3.162	4.525	61.681	10.891	19.74
7	3.502	4.654	62.219	11.041	18.581
8	3.767	4.745	62.552	11.132	17.802
9	3.969	4.809	62.762	11.19	17.267
10	4.122	4.855	62.898	11.227	16.895
11	4.235	4.888	62.988	11.251	16.636
12	4.319	4.911	63.046	11.267	16.454

Table A.56. IRF table for the interest rate of the model 9.

Period	YgapSA	ABS(ERA)	ABS(ERD)	D_InlfGap	IR
1	-0.128	-0.083	0.529	-0.108	0.751
2	0.104	-0.237	0.974	0.405	0.651
3	0.210	-0.307	1.126	0.487	0.572
4	0.264	-0.318	1.137	0.489	0.499
5	0.284	-0.306	1.075	0.461	0.432
6	0.283	-0.283	0.979	0.420	0.371
7	0.269	-0.255	0.871	0.374	0.316
8	0.247	-0.226	0.762	0.327	0.268
9	0.222	-0.197	0.659	0.282	0.226
10	0.196	-0.170	0.565	0.242	0.189
11	0.171	-0.145	0.481	0.205	0.158
12	0.147	-0.123	0.406	0.173	0.131

Table A.57. Pairwise Granger causality test results for the variables of the model 10.

Null Hypothesis	Number of observations	F-Statistic	p-value
Wminus DNGC YgapSA	70	2.096	0.06
YgapSA DNGC Wminus	70	1.08	0.385
Wplus DNGC YgapSA	70	1.799	0.12
YgapSA DNGC Wplus	70	0.419	0.86
D_InflGAP DNGC YgapSA	69	0.355	0.9
YgapSA DNCG D_InflGAP	69	0.88	0.51
IR DNGC YgapSA	70	2.355	0.04
YgapSA DNGC IR	70	4.291	0.001
Wplus DNGC Wminus	70	5.95	0
Wminus DNGC Wplus	70	0.649	0.69
D_InflGAP DNGC Wminus	69	1.467	0.21
Wminus DNGC D_InflGAP	69	1.126	0.36
IR DNGC Wminus	70	6.766	0
Wminus DNGC IR	70	0.512	0.796
D_InflGAP DNGC Wplus	69	1.016	0.42
Wplus DNGC D_InflGAP	69	1.437	0.216
IR DNGC Wplus	70	1.243	0.298
Wplus DNGC IR	70	3.089	0.01
IR DNGC D_InflGAP	69	0.96	0.458
D_InflGAP DNGC IR	69	4.079	0.0018

Table A.58. Lag length criteria for the model 10.

Endogenous variables	YgapSA, Wminus, Wplus, D_InflGAP, IR			
Exogenous variables	C			
Included observations	69			
Lag	**Final Prediction Error**	**Akaike Information Criterion**	**Schwarz Information Criterion**	**Hannan-Quinn Information Criterion**
0	940.567	21.035	21.197	21.2
1	29.226*	17.562	18.533*	17.947*
2	33.394	17.684	19.464	18.39
3	34.405	17.684	20.274	18.712
4	32.684	17.576	20.976	18.925
5	33.858	17.516*	21.725	19.186
6	43.403	17.614	22.633	19.605

Table A.59. Autocorrelation LM-test for the model 10.

(Probs from Chi-square with 25 df; 74 observations included).

Null Hypothesis	no serial correlation at lag order h	
Lags	**LM-Statistic**	**p-value**
1	36.241	0.06
2	29.734	0.23
3	24.953	0.46
4	34.209	0.1
5	32.5	0.14
6	18.24	0.83
7	17.197	0.87
8	34.65	0.09
9	40.898	0.02
10	47.716	0.004
11	24.798	0.47
12	33.63	0.11

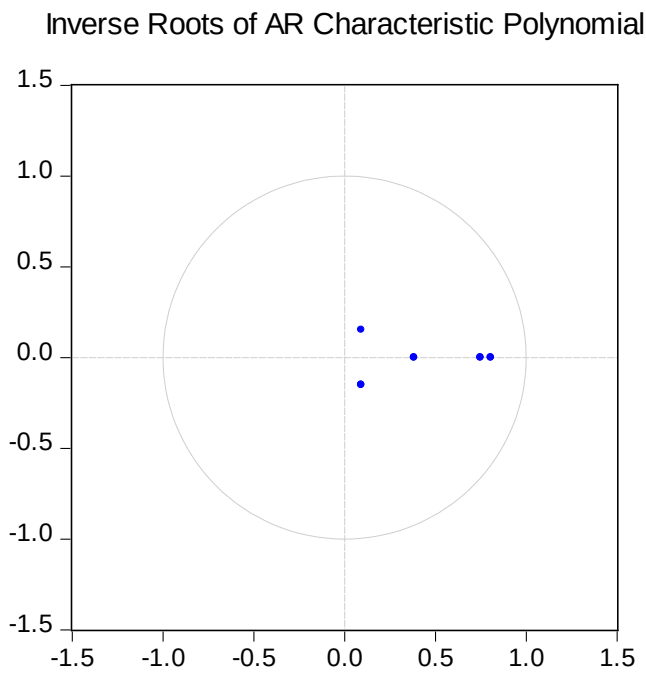

Figure A.11. Inverse roots of AR Characteristic Polynomial of the model 10.

Table A.60. Estimation output of the model 10.

Vector Autoregression estimates for the Model 10.					
Included observations 74					
T-statistics in [ ]					
	YgapSA	**Wminus**	**Wplus**	**D_InflGAP**	**IR**
YgapSA (-1)	**0.619** **[7.43]**	-0.15 [-1.06]	0.037 [0.15]	0.009 [0.19]	0.091 [1.43]
Wminus (-1)	0.077 [1.035]	0.021 [0.16]	-0.222 [-1.02]	0.025 [0.56]	-0.036 [-0.63]
Wplus (-1)	0.025 [0.56]	0.192 [2.49]	0.543 [4.07]	0.004 [0.16]	0.157 [4.49]
D_InflGAP (-1)	0.045 [0.22]	-0.543 [-1.56]	0.766 [1.282]	0.072 [0.576]	0.68 [4.34]
IR (-1)	-0.143 [-2.61]	-0.204 [-2.2]	-0.027 [-0.17]	0.028 [0.85]	0.868 [20.69]
C	1.185 [2.94]	0.029 [0.04]	1.058 [0.9]	-0.108 [-0.43]	0.631 [2.04]
R-squared	0.622	0.16	0.285	0.034	0.934
Adj. R-squared	0.594	0.099	0.233	-0.037	0.929
SSR	102.06	291.89	868.91	38.34	59.806
S.E. equation	1.225	2.071	3.574	0.75	0.937
F-statistic	22.396	2.604	5.438	0.481	194.84
Log Likelihood	-116.89	-155.77	-196.13	-80.677	-97.122
Akaike AIC	3.321	4.372	5.463	2.342	2.787
Schwarz SC	3.508	4.559	5.65	2.529	2.973
Mean Dependent	-0.117	-1.254	2.515	0.114	8.267
S.D. dependent	1.923	2.182	4.082	0.737	3.543
Determinant Resid Covariance (dof adj)				21.491	
Determinant Resid Covariance				14.081	
Log Likelihood				-622.866	
Akaike Information criterion				17.645	
Schwarz criterion				18.579	

Table A.61. Variance decomposition of interest rate for the model 10.

Period	YgapSA	Wminus	Wplus	D_InflGAP	IR
1	1.829	0.793	31.752	1.282	64.341
2	1.11	2.556	49.158	7.201	39,973
3	1.651	3.529	55.623	9.549	29.645
4	2.265	4.026	58.658	10.541	24.506
5	2.8	4.314	60.236	11.052	21.596
6	3.235	4.498	61.117	11.341	19.806
7	3.578	4.624	61.637	11.514	18.645
8	3.844	4.711	61.957	11.622	17.864
9	4.047	4.774	62.158	11.69	17.328
10	4.2	4.818	62.288	11.735	16.957
11	4.314	4.85	62.373	11.764	16.967
12	3.398	4.872	62.429	11.783	16.515

Table A.62. IRF of interest rate for the model 10.

Period	YgapSA	ABS(Wminus)	ABS(Wplus)	D_InflGAP	IR
1	-0.127	-0.083	0.528	-0.106	0.752
2	0.107	-0.237	0.97	0.409	0.653
3	0.214	-0.306	1.122	0.497	0.574
4	0.267	-0.317	1.133	0.500	0.5
5	0.287	-0.305	1.07	0.473	0.433
6	0.286	-0.282	0.974	0.431	0.371
7	0.271	-0.254	0.866	0.384	0.317
8	0.249	-0.224	0.758	0.336	0.268
9	0.223	-0.196	0.655	0.29	0.226
10	0.197	-0.169	0.561	0.248	0.189
11	0.171	-0.144	0.477	0.211	0.158
12	0.148	-0.122	0.403	0.178	0.132

APPENDIX B. TURKISH SUMMARY / TÜRKÇE ÖZET

Bu çalışmada VAR modellerine dayanarak Rus ekonomisinde döviz kurlarının rolü incelenmektedir. Çalışmanın var olan literatüre asıl katkısı CBR'nin temel para politikalarından bir tanesi olarak kısa dönemli faiz oranları üzerinde döviz kurlarının asimetrik etkisine odaklanılmasıdır. Tezde kullanılan analiz bundan önce Rusya'da enflasyonu doğruan faktörlerin araştırılmasında ne de Rusya'da para politikalarının asimetrik davranışını incelemekte kullanılmamıştır. Tezin bulguları özellikle serbest dalgalı döviz kuru politikası enflasyon hedefini merkezine alan bir rejime geçiş döneminde Rusya'da para politikalarını belirleyen otoriteler için hayli anlamlıdır.

Rusya son otuz yıl boyunca hayli meşakkatli bir siyasi ve iktisadi dönüşüm yaşamıştır. Sovyetler Birliği'nin çözülüşü 70 yılda inşa edilen ekonomik yapını dağılmasıyla sonuçlanmıştır. Dahası, ekonomi eski Sovyet Cumhuryetlerinin bağımsızlıklarını kazanmasıyla da sıkıntılar yaşamıştır. Böylesi zor koşullar altında Rusya'da para politikalarını belirleyen otoritelerin önüne zor bir görev çıkmıştı: ekonomiyi yeniden yapılandırmak ve mikro ve makroekonomik istikrarı sağlamak.

İstikrarlı bir ekonomiye kavuşmanın önündeki en önemli engeller döviz kurundaki dalgalanmalar ve yüksek enflasyon oranlarıydı. Rusya'nın ilk devlet başkanı olan Boris Yeltsin Rus ekonomisine istikrar getirmek için "şok terapisi" denen ekonomik reformları uygulamaya koymuştu. Bununla birlikte bu belirsiz reformlar Rusya'da enflasyonun yıllık %2000'e çıkmasıyla sonuçlandı ve kur seviyesi Sovyet döneminde 1 ABD dolarına 0.87 rubleden geçiş döneminde 1 ABD doları başına 5000 rubleye sıçradı. Rusya'da para politikalarını elirleyen otoriteler döviz kuru dinamiklerini yumuşatmaya odaklandılar. Ancak, böylesi müdahaleler Rusya Merkez Bankası'nın (CBR) en önemli problemlerinden birisi olarak daha da yüksek enflasyon oranlarına yol açtı.

1998'deki Asya krizinden sonra, Rus ekonomisi istikrarlı bir iktisadi büyüme dönemi yaşadı. Petrol fiyatlarındaki yükseliş CBR'nin önemli miktarda rezerv biriktirmesine, ülkedeki döviz kurunu istikrara kavuşturmasına ve enflasyon oranlarını düşürmesine yol açtı. 2008'deki küresel ekonomik kriz Rus ekonomisi üzerinde ciddi olumsuz sonuçlara neden oldu. Petrol fiyatlarındaki düşüş döviz kurlarında yüksek değişimlerle sonuçlandı. Bu da yüksek enflasyona sebebiyet verdi. CBR döviz arbitrajı müdahaleleriyle döviz kurlarındaki dalgalanmaları yumuşatmaya çalıştı, bu da enflasyon üzerinde basınca yol açtı ve döviz rezervlerini tüketti. 2008 küresel finansal krizden sonra, Banka bir kaç yıl içerisinde serbest dalgalı döviz kuru ve enflasyon hedefiyle (IT) hareket eden rejime geçildiğini açıkladı.

Günümüzde, Rusya 2010'da ekonomik yavaşlamayla başlayan bir başka ekonomik kriz yaşamaktadır. 2014'de petrol fiyatlarındaki düşüş ve Rusya'daki politik oratm yüzünden Rusya'ya uygulanan ekonomik yaptırımlar durumu daha da kötüleştirmiştir. Rusya 2014'de serbest dalgalı döviz kuru rejimine geçtiği için, CBR petrol fiyatlarındaki düşüşe yanıt olarak rublenin değer kaybetmesine müsaade etmiştir. Dolayısıyla Rus rublesi %100'den fazla değer kaybetmiştir. Ülkenin para biriminin değer kaybetmesi ekonomik büyümenin yavaşlamasına yansımıştır.

1990'dan itibaren Rus ekonomisinin geçirdiği dönüşümü incelemek ekonomik istikrarı sağlamanın Rusya'da para politikalarını belirleyen otoriteler için kolay bir görev olmadığını ortaya koyar. Bu anlamda, Merkez Bankası'nın yaptıkları Rus ekonomisi için önemli bir rol teşkil eder. Söz konusu otoritelerin temel hedefi fiyat istikrarı, enflasyon ve döviz kuru seviyesiydi. Her ne kadar CBR resmi olarak para politikalarının öncelikli hedefinin fiyat istikrarı olduğunu söylese de, pratikte CBR döviz kuru dinamiklerinin istikrara kavuşmasına daha çok dikkat ediyordu. Dahası Rusya'da Merkez Bankası politikalarının incelenmesi CBR'nin para politikasını genelde döviz kuru dinamiklerini dikkate alarak gerçekleştirdiğini ortaya koyuyordu.

Döviz kuru dünya ölçeğinde finansal açıklık kabul edildiğinden beri ekonomilerin en önemli gündemlerinden birisi oldu. Döviz kurunun ülkedeki fiyat seviyelerini ve dolayısıyla enflasyonu etkilediği doğrudan ve dolaylı yollar vardır. Doğrudan olan

ithalat üzerine fiyatları yüklemektir. Ülkenin para biriminin değer kaybetmesi ithal edilen nihai ürünlerin fiyatlarını yükselteceketir ve böylelikle tüketici fiyat seviyelerinde bir yükselişe yol açacaktır. Bu da ülkedeki enflasyonda yukarıya doğru bir basınç uygulayacak ve ülkeki para biriminin alım gücünü azaltacaktır.

Enflasyon üzerinde döviz kurunun bir diğer doğrudan etkisi ithal edilen ara mallar üzerinde görülür. Döviz kurunun değer kaybetmesi ithal edilen ara malların daha pahalı olmasına yol açar. Bu nihai malların ülke içerisindeki üretim maliyetini arttırır ve tüketici fiyat seviyelerini yükseltir. Hüfner (2012) döviz kuru değişimleri ve enflasyon oranı üzerindeki etkilerin arasındaki farkın en kısası olduğunu iddia etmektedir.

Döviz kurundaki değişimlerin enflasyon üzerindeki dolaylı etkisi toplam talepte gözlemlenebilir. Ülkenin para biriminin değer kaybetmesi ülkede üretilen malların rekabet gücünü arttırır. Bu ihracat için olan talep kadar ikame mallara ülke içindeki talebi de yükseltir. Ortaya çıkan durum emeğe olan talebi ve maaşların seviyesini yukarı çeker. Sonuç olarak, ülkede üretilen malların fiyatları da artabilir. Para biriminin değerlenmesi ile ilgili olarak ortaya çıkan süreç aynıdır, ancak bu sefer enflasyon üzerinde aşağıya doğru bir basınç oluşturur.

Ekonomik açıklık ve uluslararası ticaret hacimlerinin büyümesi döviz kuru yansımasını arttırır. Bununla birlikte döviz kurunun enflasyona yansıması seviyesi farklı döviz kurları ve para politikası rejimlerine sahip ülkeler için çeşitli şekillerde meydana gelir.

Son dönemdeki literatür serbest dalgalı döviz kuru rejmine sahip enflasyon hedefini merkeze koyan rejimlerin optimal bir çözüm sunduğunu ortaya koyar, bu durum bir ekonomi üzerinde döviz kuru dalgalanmalarının etkisini azaltır. Bununla birlikte, yükselen piyasa ekonomileri para birimlerinin serbest dalgalanması yönünde gönülsüzdürler. Döviz kuru dalgalanmalarını sınırlamak için döviz arbitrajı müdahalelerinde bulunmaya devam ederler.

Dolayısıyla, esas ekonomik faktörler üzerindeki döviz kuru dinamiklerinin etkisi bu zamanlarda dikkatleri çekmektedir. Bu çalışmada ampirik analiz bu anlamda

kurulmuştur: Rusya'daki enflasyon ve para politikaları kararları üzerinde döviz kurunun etkisinin incelenmesi.

Rus ekonomisi 1999-2014 arasında yönetimli dalgalı bir kur sistemi takip etmiştir. Her ne kadar bu enflasyon hedefiyle hareket eden rejimden farklı olsa da, fiyat seviyeleri dinamikleri Rus ekonomisi için halen önem arz etmektedir. Bundan ziyade, Rusya'da para politikalarını belirleyen otoriteler enflasyon hedefiyle hareket eden rejime geçmeyi düşündüklerinden, enflasyon CBR politikalarının ortaya çıkışında önemli bir rol oynar.

Dabrowski vd. (2001) Rusya'da enflasyonu üç ana başlık etrafında incelerler. İlk başlıkta mal pazarındaki sürtünmeler incelenir, bunun içerisinde enflasyon üzerinde üretim açığının incelenmesi de vardır. İkinci başlıkta enflasyon ve istihdam arasındaki takas incelenir. Ve son başlıkta para piyasasında sürtünmelerin etkileri üzerine vurgu yapar. Yazarlar VAR yaklaşımını kullanmışlar ve verileri 1998 krizinden önce ve sonra olmak üzere iki döneme ayırmışlardır. Para arzını esas enflasyon faktörü olarak bırakarak, bu çalışma krizden önce döviz kurunun kriz dinamiklerinin ülke içerisinde enflasyonun ortaya çıkışında hiç bir rol oynamazken, krizden sonra döviz kuru dinamiklerinin Rusya'daki enflasyon üzerinde doğrudan bir etkisi olduğuna işaret etmektedir. Yazarlar ortaya çıkan sonucu CBR tarafından uygulanan döviz kuru aralık politikası ile açıklarlar.

Ancak, However, Baranov vd.'nin (2007) ortaya koyduğu sonuçlar Dubrowski vd.'ninkinin (2011) zıttıdır. Rusya'da enflasyona yol açan faktörleri inceleyerek, yazarlar 1994-1999 ve 1999-2006 dönemleri için eşbütünleşme analizini uygularlar. İlginç bir şekilde, para arzıyla birlikte döviz kurunun dinamiklerinin krizden önce ülke içerisindeki enflasyonu etkileyen en önemli iki faktör olduğunu ortaya çıkartırlar. Ve krizden sonrası için ise, bu faktörler reel GSYİH büyüme oranı ve enflasyon beklentileri ile tamamlanır.

Kataranova (2010) Rusya'daki enflasyon üzerinde döviz kurundaki değişimlerin asimetrik bir etkisi olduğunu iddia eder. Döviz kuru yansıması modelinde etkisiz değişkenleri kullanarak Rus para biriminin %1 oranında değer kaybettiği zaman enflasyonun %0.2 oranında arttığı ve para biriminin değer kazandığı zaman enflasyonun sadece %0.1 azaldığını iddia etmektedir. Dahası, sadece ruble-dolar

döviz kurunun enflasyonun ortaya çıkmasında etkili olduğunu ve ruble-euro oranlarını önemli bir etkisi olmadığını belirtmiştir.

Önemli sayıda bilimsel çalışma Rusya'da enflasyona yol açan faktörleri ve döviz kuru yansımalarını incelemektedir. Çalışmaların çoğu para politikaları ve fiyat seviyelerinin bir parçası olarak enflasyon üzerinde döviz kurunun asimetrik etkisine dikkat çekmektedir (Ponomarev vd., 2014). Bununla birlikte, bu çalışma bir çok açıdan literatürün geri kalanından ayrılmaktadır. İlk önce, bu çalışma farklı bir döneme odaklanmaktadır. Bu analiz 2001'den başlamakta ve 2015'de sona ermektedir. Dahası, ekonomik faktörlerin davranışını 2008 küresel finans krizi öncesi ve sonrası olarak iki farklı dönemde incelemekteyim. İki farklı dönemi incelemek zaman içerisinde CBR'nin para politikalarının evrimini incelemeye izin verir. İkincisi Rusya'da para politikalarının asimetrisini ve bunların enflasyon dinamikleri üzerindeki bağımsız etkisini tahmin etmek için döviz kurunun değer kaybetmesi ve değer kazanmasında iki farklı değişken tanımlanmaktadır. Her ne kadar içerisinde Rusya'nın da olduğu gelişmekte olan ekonomilerde döviz kurunun önemini inceleyen devasa bir literatür olsa da, davranışları ortaya koyarak ve ekonometrik Vektör Otoregresif modelden yararlanarak döviz kurunun Rusya'da enflasyon ve para politikası üzerindeki önemini ortaya koyan başka bir çalışma yoktur.

Enflasyona yol açan etkenlerin incelenmesi için Dabrowski vd. (2001) ve Benlialper vd.'nin (2015), çalışmalarını takip ederek Vektör Otoregresif (VAR) ekonometrik model kullanılmaktadır. VAR modeli bu vaka için uygundur, zira bu model geçmiş zaman aralıklarını kendisinin ve diğer değişkenlerinin geçmiş zaman aralıklarının lineer bir fonksiyonu olarak her bir değişkenin incelenmesine mahal verir.

VAR modeli aşağıdaki değişkenleri içerir: aylık enflasyon için tüketici fiyat enflasyonu (önceki yılın ayıyla örtüşecek şekilde fiyatlardaki artış) (InflCPIt), dünya fiyat endeksinin yüzde olarak değişimi (WPIt), üretim açığı (Ygapt), nominal döviz kurunun yüzde olarak değişimi şeklinde ölçülen döviz kuru değişkeni (ERchanget) ve faiz oranı (IRt).

Rusya'da enflasyonun kaynaklarını açıklamak için kullanılan ilk model bir etkisiz değişken içerir. Bu çalışma 2008'de gerçekleşen küresel finansal krizin ilk keskin etkisini dikkate aldığı varsayılan etkisiz değişkeni içermektedir. Etkisiz değişken Eylül 2008-Şubat 2009 dönemi için 1'e eşit bir değer içerirken diğer dönemler için sıfırdır.

Birinci modelin varyans dekompozisyon analizi döviz kuruna bir etkinin, veya bir yeniliğin veya bir şokun enflasyonda diğer değişkenlere olan bir şoktan daha fazla dalgalanmaya yol açacağını göstermektedir. Döviz kuru değişkeni ülkedeki enflasyonda meydana gelen dalgalanmaların %25'ine rekabül etmektedir. Üretim açığı enflasyon değişkeninde meydana gelen değişiklikleri 59.5'inden fazlasını açıklarken, faşz oranı sadece 50.5'ini ve dünya fiyat enflasyonu bunların %0.24'ünü açıklamaktadır. Değişkenlerin gerisi tüketici enflasyonunun kendisinde olan değişkenlerle açıklanmaktadır. Bu anlamda, enflasyonun geride kalan değerleri mevcut enflasyonun anlamakta en etkili açıklayıcı role sahiptir.

Bu bulgular arz yanlısı faktörlerin Rusya'daki enflasyon dalgalanmalarında önemli olduğunu göstermektedir. Dahası üretim açığı değişkenine gelen bir şok enflasyonda önemli bir rol oynamaktadır, ancak bu döviz kuru kadar önemli değildir. Enflasyona neden olan bir faktör olarak döviz kurunun önemli rolü açıktır. Bölüm iki ve üçte tartışıldığı üzere para politikasını belirleyen otoritelerin asıl amacı çoğunlukla döviz kurunun dinamiklerini fiyat istikrarının üzerinde tutmaktır. Rusya'da ortaya çıkan enflasyonda meydana gelen dalgalanmalar üzerinde dünya fiyat enflasyonu değişkenindeki şokların önemli bir olünün olmaması sürpriz değildir. İthalatçı bir ülke olarak Rusya gelişmekte olan ekonomiye sahip diğer ülkeler gibi dünya meta fiyatları indeksine bağımlı değildir. Aslında, Rusya bu fiyatları belirleyebilen ülkelerden birisidir.

Döviz kuru yansıması etkisini analiz etmek için ayrı olarak döviz kuru değerlenmesi ve döviz kuru değer kaybetmesi değişkenlerini yaratan benzer model kullanılmıştır. Asimetrik döviz kuru yansımasının etkisine yönelik yapılan analiz 2001-2015 arasında Rusya'da enflasyonu ortaya çıkartan dinamiklerin çoğunlukla döviz kurunun değer kaybetmesine yol açan dinamikler tarafından belirlendiğini ortaya koymuştur.

Asimetrik döviz kuru yanısıması analizinin ortaya çıkardığı bulgular Kataranova'nın (2010) bulguları ile uyum içerisindedir. Yazar analizinde modelini bölüştürülmüş zaman aralıkları ile birlikte kullanmaktadır. Bu model farklı sayıdaki zaman aralıkları ile birlikte bir çok değişkenin kısa dönemli etkisinin incelenmesine olanak sağlamaktadır. Kendisi döviz kurunun değer kazanması ve döviz kurunun değer kaybetmesi için modelinde etkisiz değişkeni kullanmaktadır. Yazarın bulguları ruble %1 oranında değer kaybetmişken Rusya'da enflasyonun %0.2 oranında arttığını ve ruble %1 oranında değer kazandığı zaman enflasyonun sadece %0.1 oranında azaldığını göstermektedir. Bu anlamda yazar enflasyonun döviz kurunda meydana gelen değişikliklere yanıtının asimetrik olduğunu bulmuştur. Bu cevap ülkedeki para biriminin değer kaybetmesinde iki kat daha etkilidir.

Rusya ekonomisinin küresel finansal krizden kaynaklı büyük bir şok yaşadığı 2008'den beri, enflasyona yol açan nedenler iki farklı dönem için incelenmektedir. Enflasyona yol açan dinamiklerin davranışlarındaki değişimleri görmek için ilk periyot 2001-2007 ve ikinci periyot 2009-2015 olarak belirlenmiştir. İki farklı dönem için yapılan analiz ilk dönemde enflasyona yol açan dinamiklerin döviz kurunu değer kazanması ve değer kaybetmesinde meydana gelen değişimlere pek de önemi olmayan bir cevap olarak ortaya çıktığını göstermiştir. Ancak ikinci döneme dair yapılan analiz, 2008 küresel finansal krizden sonra ve serbest dalgalı döviz kuru rejimine aşamalı olarak gerçekleşen geçiş esnasında, döviz kurunun değer kaybetmesinin enflasyon üzerindeki etkisinin arttığını ortaya koymuştur. Bu sonuç CBR tarafından aktif bi şekilde takip edilen büyük orandaki döviz arbitrajı müdahaleleri ile açıklanabilir.

Dobrynskaya vd. (2008) gelişmekte olan bir ekonomiye sahip bir ülke olarak Rusya'da döviz kuru yansımasının ülke içindeki fiyatlara yüksek etkisi olduğunu iddia etmektedirler. Rus ekonomisi petrolden elde edilen gelirlere ve dünya pazarlarına olan bağlılığı faiz oranlarının para birimindeki değer kaybına cevabının yüksek olmasına yol açmaktadır. Yansımanın etkisini ortadan kaldırmak veya azaltmak için CBR para politikası uygulamaktadır. Bununla birlikte analiz sonuçları Rusya'da uygulana para politikasının bu amaca ulaşmakta pek de başarılı olmadığını ortaya koymaktadır.

Graniville vd. (2010) Rusya'daki reel faiz oranlarının politikanın uygulamaya koyduğu döviz kuru şoklarına cevap verip vermediğini test etmişlerdir. Vektör Yanlış Doğrulama Modeli'ni kullanarak, yazarlar döviz kuru kanalının 1995-2009 arasında Rusya'da para politikasını uygulanmasında önemli bir rol oynadığını ortaya koymuşlardır. Döviz kurundaki değişimlere enflasyon şeklinde ortaya çıkan bir tepki verilirken, enflasyondaki artışa da faiz oranlarındaki değişimlerle yanıt üretildiğini bulmuşlardır. Bu anlamda yazarlar Rusya'da uygulanan para politikasının ele alınan dönemde fiyat istikrarını sağlamak için tasarlanmadığı sonucuna ulaşmışlardır.

Korhonen vd. (2016) 2003-2015 dönemindeki verileri kullanarak Rusya için çeşitli para politikalarını incelemişlerdir. Taylor para politikası reaksyion fonksiyonu için Genelleştirilmiş An Yöntemi tahmin aracını kullanarak yazarlar para politikasının asıl aracı olarak Rusya'daki faiz oranlarının enflasyon ve üretim açığına önemli bir yanıt olduğunu bulmuşlardır. Aynı zamanda, para biriminin değer kazanmasının teoride beklenildiği gibi gevşek bir para politikası ile sonuçlanmadığını ortaya koymuşlardır. Bununla birlikte, tahmin denkliğine petrol fiyatlarını eklemek açık sonuçlara yol açmaz, zira döviz kuru ve petrol fiyatlarıyla birbirleriyle yakından ilgilidir.

Döviz kurlarının enflasyon üzerinde hayli etkili olduğu gerçeğini göz önüne aldığımız zaman CBR döviz kuru dinamiklerine karşı hayli aktif bir tutum alabilirdi. Sonrasında VAR tekniği kullanılarak para politikasının en önemli araçlarından bir tanesi olarak faiz oranları faktörleri incelenmektedir.

Benlialper vd.'nin (2015) fikirlerine atıfla, Türkiye'de uygulanan para politikasında döviz kuru değişimlerinin asimetrik etkisi incelenmektedir. Model para politikası kararları üzerinde döviz kurunun etkisini ölçmek için genişletilmiş Taylor kuralına dayanmaktadır. Bu model nominal döviz kuru (et), üretim açığı (yt –y*), faiz oranı (it) ve enflasyon açığındaki ($\pi t - \pi t^*$) değişimleri içermektedir. Asıl önemli para politikası değişkeni olarak faiz oranlarının asimetrik yanıtını bulmak için döviz kurunun değer kazanması ve değr kaybetmesi açısından iki farklı değişken tanımlanmıştır.

Modelin varyans dekompozisyon analizi faiz oranının dinamiklerinin %34'ünün döviz kurunun değer kaybetmesinin dinamikleri ile açıklanırken, döviz kurunun değer kazanmasının faiz oranlarında meydana gelen dalgalanmaların sadece %3.5'ini açıkladığını ortaya koyar. Üretim açığı değişkeninde meydana gelen bir şok değer kaybının etkisinin azaldığı daha sonraki dönemlerde faiz oranlarında meydana dalgalanmaların %25'ini açıklayacaktır. Diğer değişken dinamikleri önemli değildir. ERD değişkeninde meydana gelen şoku takriben IRF'nin sonuçları faiz oranının ilk 5 ay içerisinde kayda değer bir şekilde artacağını ispatlamaktadır. Bununla birlikte, değer kazanma değişkeninde meydana gelen şoka faiz oranının cevabı çok daha az ve önemsizdir. Bu anlamda, değer kaybı değişkeninde orataya çıkan bir şok CBR'nin faiz oranları kararında önemli bir etkiye sahiptir.

2001-2015 dönemi için yapılan analizin sonuçları Rusya'da döviz kurunun değer kaybetmesine baplı olarak asimetrik para politikası duruşu hipotezini onaylamaktadır. Faiz oranları göreceli olarak hızlı ve önemli olarak döviz kurunun değer kaybetmesindeki değişimlere cevap üretmektedir. Ve ülkedeki para biriminin değer kazanması çoğunlukla tolere edilmektedir. Bunnula birlikte, Rusya Merkez Bankası'nın incelenmesi CBR'nin döviz kuru politikasının simetrik bir şekilde oluştuğuna, bir başka deyişle aynı orandaki döviz arbitrajı müdahalelerinin döviz kurunun değer kaybetmesi veya değer kazanması durumunda uygulanabilir olduğuna işaret etmektedir.

2008 küresel finansal krizden önce ve bu krizden sonra Rusya para politikasının evrimini incelemek için, analiz 2001-2007 ve 2009-2015 için olmak üzere iki farklı dönemde tekrar edilmiştir.

VDC sonuçlarına göre, ilk dönem esnasında faiz oranları dinamikleri çoğunlukla faiz oranları değişkeni dinamiklerinin kendisi tarafından açıklanmaktadır. ERD ve ERA değişkenlerinin önemi arasında öyle çok da büyük bir fark yoktur. ERD değişkeninde meydana gelen bir şok faiz oranlarında meydana gelen dalgalanmaların %12.5'ini açıklayacaktır, ERA değişkenindeki bir şok ise faiz oranlarındaki dalgalanmaların %15'ini açıklayacaktır. Üretim açığı ve enflasyon açığı değişkenlerindeki şoklar faiz oranları dinamikleri üzerinde neredeyse aynı etkiye sahip olacaktır. Varyans dekompozisyon analizi sonuçları Eklerde Tablo

A.43'de gösterilmektedir. Etki-tepki işlevinin sonuçları IR değişkenine verilen en büyük cevabın kendi dinamiklerine olduğunu ortaya koyar (bkz. Tablı A.44, Ekler). Bu üretim açığı ve enflasyon açığı değişkenlerinde meydana gelen değişimlere etkisiz cevaplar verir. En önemlisi, kısa dönemli faiz oranı dinamiklerinin ERA ve ERD değişkenlerindeki şoka simetrik cevap verdiği görülebilir (bkz. Şekil 6.9).

İkinci dönemin analizinin varyans dekompozisyonunun sonuçları faiz oranı dinamiklerini belirlemekte döviz kurunun değer kaybetmesinin öneminin önemli ölçüde arttığını gösterir. Faiz oranlarındaki dalgalanmaların neredeyse %64'ü ERD değişkenindeki şokla açıklanır. Dahası enflasyon açığının rolü de ayrıca artmıştır. Bu anlamda, enflasyon açığındaki şok faiz oranlarındaki dalgalanmaların %11'ini açıklayacaktır. Dahası, ERA değişkenin rolünün yalnızca %5'e düştüğü farkedilmiştir. Model 9 için varyans dekompozisyonu analizinin sonuçları Ekler'de Tablo A.55'de sunulmaktadır. Şekil 6.15 ve Tablo A.56 (Ekler) etki-tepki işlevi analizinin sonuçlarını gösterir. Beklenildiği üzere, fiaz oranları dinamiğin kendisine ve döviz kurunun değer kaybetmesinin dinamiklerine önemli cevaplar verirken, ERA değişkeninde meydana gelen şok fiaz oranlarından pek de bir cevap almaz.

İki farklı dönemin analizi daha belirgin sonuçlar ortaya koyarlar. Dolayısıyla, bu çalışma ekonomik büyümenin sağlıklı ve petrol fiyatlarını yüksek olduğu zaman dilimi olan 2008 küresel finans krizinden önce para politikasını belirleyen otoritelerin nominal döviz kurlarına göre daha az veya dah fazla simetrik para politikasına yönelik bir tutum aldığını iddia etmektedir. CBR ülkedeki para biriminin yönetmli dalgalanan kur sistemi rejimi altında aşamalı olarak değer kazanmasını sağlamıştır.

Krizden sonra, CBR serbest dalgalı döviz kurumu rejimine geçmeye karar vermiştir. Yeni rejimin ülkedeki para politikalarını dünyadaki ekonomik şoklardan daha az etkilenir bir duruma getireceği varsayılmıştır. Bununla birlikte, bulgular Rusya'daki para politikasının ikinci dönemde krizden önce olduğundan daha fazla olarak döviz kurunun değer kaybetmesine yol açan dinamiklerden etkilendiğini göstermiştir. Petrol fiyatlarında yaşanan bir düşüş, ekonomik yavaşlama ve Rusya'da meydana gelen mevcut siyasi gelişmeler rublenin sert bir biçimde değer kaybetmesine neden olmuştur. CBR para biriminin değer kaybetmesine bir cevap üretmek durumunda

kalmıştır. Bu anlamda, 2009-2015 arasında geçen dönemde döviz kurunun değer kaybetmesinin ilk dönemde olduğundan daha fazla para politikası üzerinde etkili olduğu gözlemlenmiştir.

Bu sonuçların daha sağlam bir şekilde ortaya çıkmasını sağlamak için, döviz kurunun değer kaybetmesi ve döviz kurunun değer kazanması hususunda yeni değişkenlerin de işin içine katılmasıyla benzer bir model uygulanmıştır. Yeni değişkenler Ruya'da para politikasını düzenleyen otoritelerin sadece %2'den daha yüksek olan nominal döviz kurunda meydana gelen değişimleri dikkate aldığını göstermiştir. Yeni değişkenlerin gerçekleşmesiyle ortaya çıkan analiz sonuçları önceki analizlerin sonuçlarından farklılık göstermektedir.

CBR'nin uyguladığı para politikasının asimetrisi döviz kurunun değer kaybetmesine cevaben büyük miktarda döviz arbitrajı müdahaleleri ve arttırılmış faiz oranlarında vücud bulmuştur. Para politikasının asimetrik davranışının bir çok farklı nedeni olabilir. Ponomarev vd. (2014) rublenin değer kaybetmesinin döviz kurunun ülkedeki fiyat seviyesine büyük oranda yansırken, ülkedeki para biriminin değer kazanmasının hemen hemen hiç bir etkisi olmadığını iddia etmişlerdir. Bu anlamda, döviz kuru dalgalanmalarını kontrol etmek finansal sistem için çok ciddi zararlar doğurabilecek dışsal şokların önlenmesine yardım eder.

İkinci neden ülkedeki para biriminin değer kaybetmesinin ülkedeki bankaların ve firmaların yabancı borçlarına dair ödemeleri yükseltecek olmasıdır. Bu durum bilanço tablolalarını bozar.

CBR'nin para biriminin değer kazanmasını neden tolere ettiği ve ülkedeki para biriminin değer keybetmesine karşı neden mücadele ettiğinin bir diğer nedeni Rusya ekonomisindeki rublenin değişim değerinin önemine bağlanabilir. Rusya en büyük petrol ithalatçılarından birisidir. Petrol fiyatları bütün dünya çapında ABD doları cinsinden belirlendiği için, ruble-dolar döviz kuru oranı dinamikleri Rus ekonomisi için aşırı önemlidir. Döviz kurundaki büyük oynamalar ticari dengeyi ve ödemeler dengesini olumsuz yönde etkileyecektir.

2008 krizinden sonra, CBR resmi olarak enflasyonu hedefleyen bir rejime geçmeyi hedeflediğini duyurmuştu, bu da serbest dalgalı döviz kuruna geçiş demekti. Bu

gelişmenin amacı döviz kurundaki dalgalanmaların enflasyon üzerindeki etkisini azaltmaktır. Yine de, CBR rublenin serbestçe dalgalanmasına izin veremez. Para politikasını belirleyen otoriteler döviz piyasasını takip eder ve finansal istikrarı sağlamak ve döviz kurundaki dalgalanmaların enflasyon üzerindeki doğurdan ve dolaylı yollardan kaynaklı etkisini yumuşatmak için ülkedeki para biriminde gerçekleşen büyük değişimlerin önüne geçerler.

Sonuçları yorumlarken, bu çalışmanın sınırları göz önünde tutulmalıdır. Bu çalışmada kısa dönemli faiz oranlarının ele alınan dönem için CBR'nin en önemli para politikası aracı olduğu varsayılmıştır. Hatırlanacağı üzere, Rusya ele alınan dönemde tam anlamıyla enflasyon hedefini merkezine koyan bir ülke değildir, dolayısıyla CBR yıllık raporlarında faiz oranlarını kendi para politikası araçlarından sadece birisi olarak belirtmektedir. Bununla birlikte, aynı zamanda para politikasını belirleyen otoritelerin bunun önemini arttırmaya çalıştıklarına ve enflasyon hedefiyle hareket eden rejim için bunu tek araç yapmaya çalıştıklarına işaret edilmiştir.

İlerideki çalışmalar için Rusya'daki para politikasının sonraki gelişimini analiz etmek ilginç olacaktır. Günümüzde, CBR para biriminin akışına izin vererek ve döviz arbitrajı müdahalelerinin miktarını azaltarak döviz kurunun dinamiklerinin ekonomi üzerindeki etkisini azaltmaya çalışmaktadır. Rusya ekonomisi bir kaç yıl içerisinde mevcut krizden çıktığı zaman, döviz arbitrajı müdahelelerinin miktarını azaltmak mümkün olacaktır. Bu CBR'nin faiz oranlarını da kullanarak döviz kurlarına müdahale etmesine neden olabilir.

Bu sorunla ilgili anlamlı olabilecek başka çalışma alanları da mevcuttur. Yeni araştırmalar döviz kurları dinamiklerinden etkilenen arttırılmış sayıda iktisadi değişkeni inceleyebilir. Bir diğer alan döviz arbitrajı müdahalelerinin parametrelerini ve bunların bir para politikası aracı olarak nasıl uyglandıklarını incelemektir. Yeni çalışmanın bulguları mevcut para politikalarını geliştirmeye veya ekonomik ve finansal reform paketleri oluşturmaya yardımcı olabilir.

APPENDIX C. TEZ FOTOKOPİSİ İZİN FORMU

ENSTİTÜ

Fen Bilimleri Enstitüsü [ ]

Sosyal Bilimler Enstitüsü [x]

Uygulamalı Matematik Enstitüsü [ ]

Enformatik Enstitüsü [ ]

Deniz Bilimleri Enstitüsü [ ]

YAZARIN

Soyadı : GAYANOVA
Adı : ELİNA
Bölümü : İKTİSAT

TEZİN ADI (İngilizce) : THE ROLE OF THE EXCHANGE RATE IN INFLATION AND MONETARY POLICY IN RUSSIA

TEZİN TÜRÜ : Yüksek Lisans [x] Doktora [ ]

Tezimin tamamından kaynak gösterilmek şartıyla fotokopi alınabilir. [x]

Tezimin içindekiler sayfası, özet, indeks sayfalarından ve/veya bir bölümünden kaynak gösterilmek şartıyla fotokopi alınabilir. [x]

Tezimden bir (1) yıl süreyle fotokopi alınamaz. [ ]

TEZİN KÜTÜPHANEYE TESLİM TARİHİ: