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MONETARY POLICY AND EXCHANGE RATE INTERACTIONS IN A SMALL OPEN ECONOMY: EMPIRICAL EVIDENCE FROM ALBANIA

Ljubljana, October 2017 AIDA SALKO

AUTHORSHIP STATEMENT

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INTRODUCTION

The relationship between exchange rates and monetary policy is important to be studied for an efficient monetary policy implementation strategy in many countries that have adopted inflation targeting. As central banks in these countries focus mostly on expected inflation, a special attention is paid to the exchange rate with a potential effect on inflation developments in economy. Furthermore, many countries have switched to a floating exchange rate while practicing inflation targeting regime. Consequently, this policy setup rise important questions for monetary authorities with regard to exchange rate research. Thus, the role of exchange rate in monetary policy is of interest not only to academics but also to policymakers.

Albania has been one of the many countries to have endorsed the inflation targeting regime. After successful stabilization anchored by the previous monetary targeting regime, Albania officially implemented inflation targeting in 2009. The expected inflation becomes the main focus of the new regime and therefore the exchange rate has taken a considerable attention with a straight effect on inflation or inflation expectations. Based on the significance of the role that exchange rate has within an inflation targeting country, the Bank of Albania has carefully followed changes in exchange rate, even though committed to follow a floating exchange rate regime. The introduction of inflation targeting in Albania generated desirable monetary outcomes by producing stable and low inflation as well as a continuous appreciation of the domestic currency (Tanku, Vika, & Gjermeni, 2009). Therefore, these developments put forward important policy questions for Albanian monetary authorities regarding the importance that exchange rate has in relation to monetary policy. In this aspect, the aim of this thesis is to empirically assess the interactions between exchange rate and monetary policy within the inflation targeting in Albania.

There are different approaches to study the relationships between exchange rate and monetary policy and in this thesis two of them will be investigated. The first one is the Structural Vector autoregression (hereinafter: SVAR) model with a particular emphasis on effects of fluctuations in exchange rate on monetary policy. Following Kim and Roubini (2000), we intend to present some empirical evidence regarding the behavior of monetary policy to the movements of exchange rate in Albanian economy. The impact of shocks is investigated through impulse response analysis. Second approach consists in estimating a forward looking Taylor type of rule by including the effects of changes in exchange rate in addition to expected inflation and output gap. Following Clarida, Gali and Gertler (1998), we will utilize the Generalized Method of Moments (hereinafter: GMM) to determine whether the exchange rate developments has an impact on interest rate setting, as the main instruments of monetary policy in Albania. As follows, the interactions among the exchange rate and monetary policy in Albania are observed in two different aspects: firstly by analyzing the response of monetary policy to shocks in exchange rate through impulse responses analysis and secondly by examining the reaction of monetary policy to changes in exchange rate through estimation of a Taylor rule. Hence, based on these two approaches, it is intended to explore some important research questions regarding the behavior of the Bank of Albania. How does the exchange rate

shocks affects monetary policy and what is its response in an inflation targeting country like Albania? What is the behavior of interest rate as the main monetary policy instrument with regard to exchange rate developments in Albania? These are some of the main questions that I address in this research by providing empirical and theoretical analysis.

This thesis intends to throw some light on the importance of currency movements in the interest rate setting as well as providing empirical evidences about the way that monetary policy responses to exchange rate fluctuations in Albania. To the best of my knowledge, there is not any study for Albania so far which investigates simultaneously two perspectives mentioned above with two different methodological approaches. The results could be useful for the policymakers at the Central Bank of Albania in order to implement an efficient monetary policy strategy in the future.

The thesis is structured as follows: it starts with a short introduction and continues with the first chapter presenting some reviews regarding the issue of exchange rate as well as explaining in detail monetary policy framework in Albania. Chapter 2 offers a basic overview of used methodology, specifically two approaches namely SVAR and GMM. Additionally, it presents important econometric specification tests when empirically applying these two methods. Chapter 3 is about the data. Chapter 4 is devoted to the presentation of results obtained from the estimation of the reaction functions. Additionally, this chapter presents robustness checks by using alternative identification schemes. Finally, I summarize the results and offer the conclusion.

1 THEORETICAL FRAMEWORK

1.1 The Role of the Exchange Rate in Monetary Policy - An Overview

The relationships between exchange rate and monetary policy have received a lot of attention in many research studies. The role of exchange rate in relation to monetary policy has been the subject of many empirical research works which we can classify into different groups. The first group investigates the so called “exchange rate pass-through” in the countries that have adopted inflation targeting. Recent research shows that the implementation of inflation targeting in many countries is associated with the weakness of the exchange rate pass through in these economies. Researchers have numerous explanations for this. Paper of Taylor (2000) is an important example in this group and gives one of the most well known explanations. By presenting a simple price setting model, Taylor demonstrates that in many countries there is a connection between the decline in inflation and a reduction of exchange rate pass through. Moreover he suggests that this decline has come as a result of a lower and stable inflation in most of the countries he analyzed. This explanation is supported by many other authors in their empirical studies. Goldberg and Campa (2002) research for 25 OECD countries over the period 1975 to 1999 and estimate pass-through to import prices. They conclude that those countries that have a lower inflation and less exchange rate volatility, have also a lower pass-through into import prices. Gagnon and Ihrig (2004) take into account twenty-five OECD countries and conclude that the weakening of exchange rate channel is related to changes in

the monetary policy and adoption of inflation targeting. Moreover, Edwards (2006) performs a comparative empirical analysis for a group of 7 countries that have implemented inflation targeting and investigates the exchange rate pass-through to changes into domestic prices. Again, as previous studies, he finds empirical evidences that introduction of inflation targeting is associated with an obvious reduction of the exchange rate pass-through. Sanchez (2008), uses another model that includes the effect of exchange rate pass-through into domestic prices and meantime he differentiates among cases of expansionary and contractionary depreciations between Europe and Middle East countries. The author finds that in the cases of expansionary depreciations there exist a negative correlation between exchange rates and interest rates while there is a positive correlation for contractionary depreciations.

Another group of studies investigate the behavior of monetary policy through different types of Taylor rules by including additionally the effects the exchange rates. Therefore, many studies have incorporated the exchange rate like an additional variable in central bank's monetary policy reaction function. The inclusion of exchange rates in monetary policy rule is a hot topic in the relevant literature. Involving the exchange rate in different Taylor rules, is considered by a lot of authors as an important part by suggesting that central bank may respond directly to exchange rate movements. For example Svensson (1998) and Ball (1999) explain that by adding additionally the exchange rate in the Taylor rule, it is likely to produce more stable economic outcomes and meantime they propose some values for the coefficients of exchange rate. Calvo and Reinhart (2000) examined thirty-nine countries committed to a floating exchange rate regime during the 1970 and 1999 period. They find evidence that in most of these countries, the central banks consider the inclusion of exchange rate while they decide on interest rates. Other authors like Mohanty and Klau (2004), investigated the reaction functions of monetary policy for 13 emerging and transition economies by including also the exchange rate. They conclude that the respond of monetary policy to exchange rate developments is very strong in 11 of these 13 countries. Moreover, Edwards (2006) suggest that central bank may respond directly to changes in the exchange rate even though this is a country-specific issue which should be analyzed empirically. Bjørnland and Halvorsen (2008), use a vector autoregression (hereinafter: VAR) approach to analyze the relations among the exchange rate and monetary policy in six open countries that have implemented inflation targeting. As in previous studies, their results suggest that these countries have considered the inclusion of exchange rate into their policy reaction functions. Another paper from Frömmel, Garabedian and Schobert (2011), takes into account six Central and Eastern European Countries. After estimating their monetary policy rules, authors observe that the influence of the exchange rate is very important on the interest rate setting behavior of central banks even though it differs strongly between different exchange rate regimes.

1.2 Monetary Policy and Exchange rate in Albania

Monetary policy in Albania has appraised the exchange rate fluctuations as one important element to describe inflation development in economy. Therefore, interactions between exchange rate and monetary policy have received considerable attention specially when Albania started introducing the inflation targeting.

The paper of Muco, Sanfey and Luci (2001), is one of the early works that investigates the monetary policy transmission mechanism in Albania. The authors use a simple reaction function for period 1994-2000 to investigate some basic correlations among nominal and real variables in economy. They find a strong relationship between the stability of exchange rate and inflation which in that time was not a surprise for a relatively open economy like Albania where foreign currency was widely present because of high inflow of remittances coming from Albanian immigrants working abroad, particularly in Greece and Italy.

In a slightly different approach, other authors like Muco, Sanfey and Taci (2004) use a VAR approach for the period from January 1994 to May 2003, to analyze the behavior of monetary policy in Albania throughout the transition period of the economy. Their model uses monthly data on five variables: Consumer Price Index inflation, the logarithm of the exchange rate Lek/USD, the rate of growth of M3 aggregate, the logarithm of remittances in USD as well as the rate of growth of trade balance. For the estimation of VAR, the authors put the ordering restrictions as follows: remittances are ordered first, followed by money growth exchange rate inflation and trade balance last. They conclude that there is a strong relation between price stability and exchange rate stability and therefore the exchange rate is an important element with potential influence on inflation expectations in Albanian economy.

Peeters (2004), tests the hypothesis whether the exchange rate transmission channel continues to be significant in the monetary policy process in Albania. The author conducts a VAR analysis using variables of the interest rate, the exchange rate, the amount of deposits as well as credits and inflation. The author estimates different samples of the VAR-models from 1998 to 2004. In this way, the author investigates at once the relative importance of the transmission channel of the exchange rate, the deposits, the credit as well as the wage channel. Peeters shows that since 2001, there is a weakness of the correlation between exchange rate and inflation while the credit channel has become more powerful compared to the exchange rate one.

Meanwhile, Istrefi and Semi (2007) rely on a VAR approach and impulse responses analysis to investigate empirically for Albanian economy the exchange rate pass-through to consumer prices. They use data on monthly frequency for the nominal effective exchange rate, the short-term interest rate to capture central bank reaction, the consumer price index and monetary aggregate M3 to represent demand shock for the period 1994:01- 2006:12. Authors find that in the cases when an exchange rate shock happens, there is a quick reaction of consumer prices. Again as previous study, from 2000 and after, they find a decrease of the exchange rate pass-through to consumer prices. Surprisingly, the study also presents evidence that the exchange rate pass-through is higher in cases of the domestic currency depreciation and weaker in cases of appreciation. The authors conclude that the Central Bank of Albania should react and interfere carefully to the changes in the domestic currency exchange rate.

Tanku et al. (2009) study the exchange rate pass through to inflation in Albania and meantime they examine the response of monetary policy to exchange rate fluctuations. Authors find the exchange rate to be an important determinant of inflation in economy. However, they observe

that after the introduction of inflation targeting by the Central Bank, there is a weaker pass-through. Moreover, the authors estimate a simple Taylor rule for Albania by including the changes in the nominal effective exchange rate in addition to inflation and output gap. The model has been estimated using the least square method for the period 1997q1:2006q4. They show that monetary policy responds very fast to changes in exchange which came as a surprise result since the policy framework in Albania is designed such that does not respond to the exogenous exchange rate shocks. Authors conclude that further research is needed until a reasonable explanation is found.

Evidence of the weakness of exchange rate channel, is further documented by the recent work of Kolasi, Shijaku and Shtylla (2010) based on a SVAR estimation for period 2000:08–2007:07.They present the impulse responses of different equations in the SVAR system and examine the response of the system to shocks of the REPO rate, as the main monetary policy instrument used by the Bank of Albania, and also to the exchange rate shocks. Authors present some empirical evidences showing that that the exchange rate channel in Albania has lost its power during the studied period and thus suggest that the Bank of Albania should not neglect the developments of exchange rate.

1.3 Economic Environment in Albania

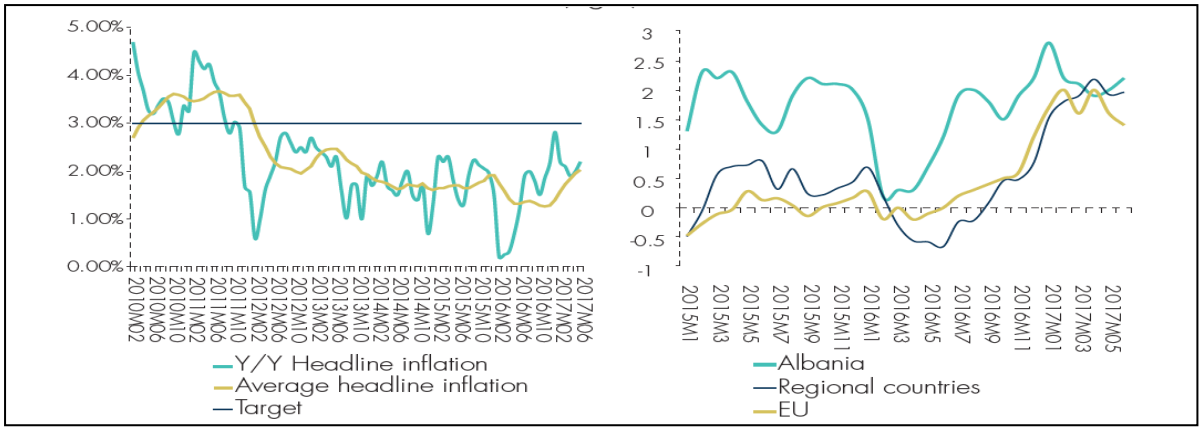
The Albanian economy has undergone a substantial transformation from a centrally planned to a market oriented economy. Following the collapse of the communism in 1990, the transition from a centrally planned for half a century of communist rule to a market economy, associated with plentiful international support as well as other strategic policies, helped the country to go ahead. With poverty declining by half, thanks to a powerful growth of the economy, Albania switched from one of the poorest countries in Europe in the early 1990s, to the middle income status in 2008 (The World Bank, 2017).

In June 2014, the Republic of Albania was awarded candidate status by the European Union. From the economic perspective, the European Union candidate status for Albania, encourages foreign investments as well as leading to new job creation.

After the financial crisis of 2008, Albania and Poland were the only countries in Central and Easter Europe that produced economic growth in real terms. Supported by a gradual recovery in domestic demand as well as energy-related investments, the economic recovery in Albania is strengthening. Driven by the expansion of consumption and large energy-related FDI projects, GDP grew by 3.4 percent in 2016, reflecting a recovery in domestic demand taking economic growth annual rate for 2016 at 3.5%. The Albanian authorities have continued to pursue their reform agenda, aimed at enhancing growth potential and increasing the resilience of the economy (IMF, 2017).

Economic and financial developments in Albania for 2017 are positive and prove an upward trend of the Albanian economy. Gross Domestic Product increased by 3.9% in the first quarter of 2017 and inflation averaged 2.0%, downward from the 2.4% average recorded in the previous quarter (Bank of Albania, 2017a).

Figure 1. Annual inflation and target (left). Inflation in regional and EU countries (right)

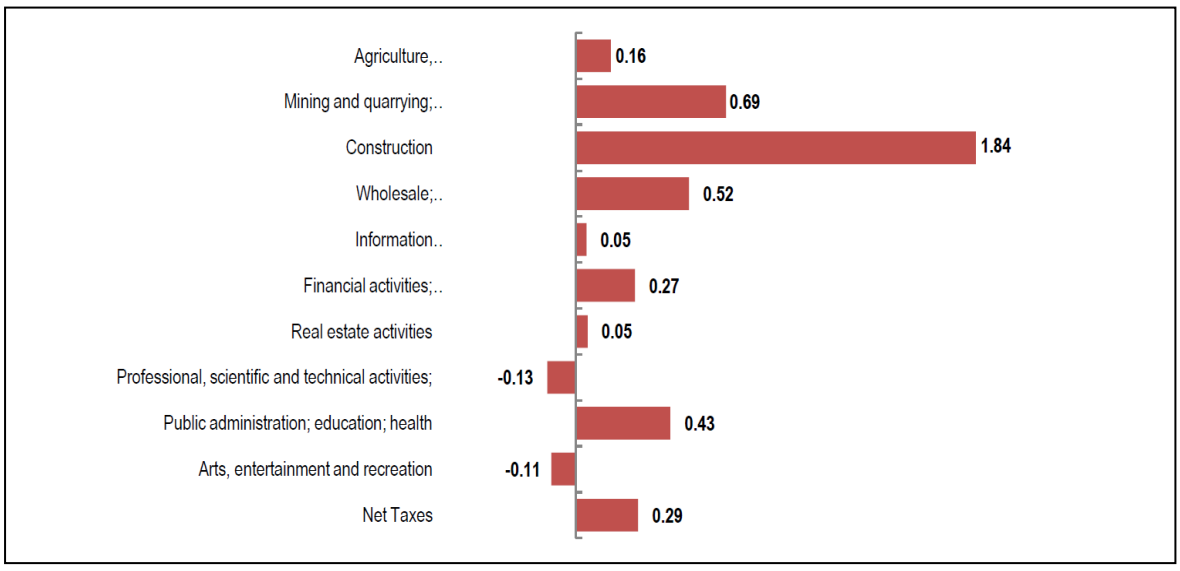


Source: Bank of Albania, *Quarterly Monetary Policy Report 2017/III*, 2017, p.32.

The current and expected performance of both GDP and inflation is in line with the financial markets performance and behavior of monetary policy from the Bank of Albania. The accommodative approach of monetary policy brought interest rates to the lowest historical levels of 1.25 percent since May 2016. Judging on the actual trends of the economic performance, the Bank of Albania considers that economic growth will continue in the medium term. This process is expected to increase medium-term inflationary pressures, contributing to the return of inflation to target within 2018 (Bank of Albania, 2017a).

The second quarter of 2017, marked an increase in volume terms by 4.06 % of the Gross Domestic Product (GDP) of the country, compared with the same quarter of one year before. The construction sector was the main contribution to this increase with a 1.84 percentage point, followed by industry, electricity and water by +0.69 percentage point. Moreover, the increase of the activity in industry and agriculture also contributed to the economic performance. In the meantime the services sector also continues to positively contribute to economic growth (Institute of Statistics (INSTAT), 2017).

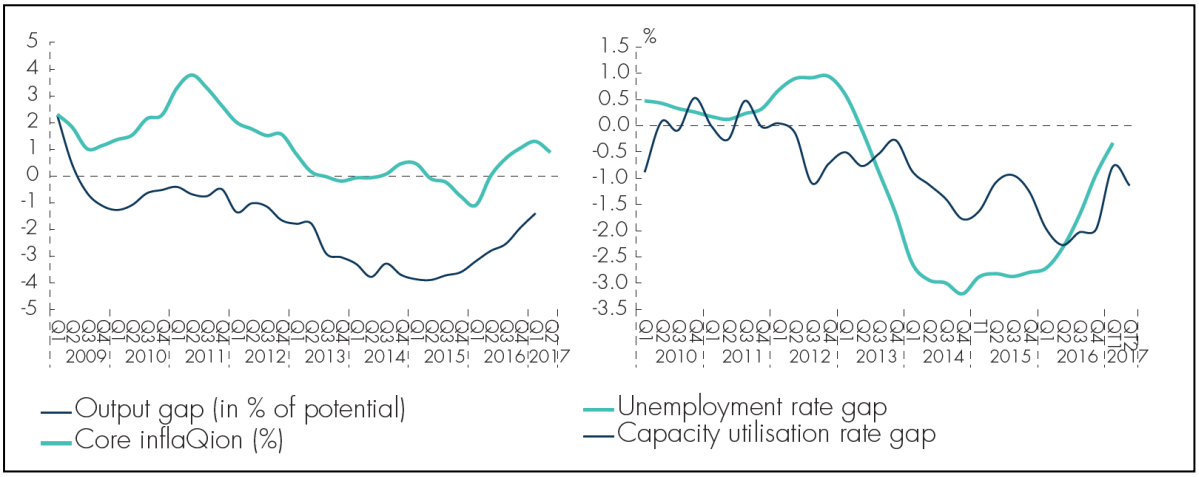
Figure 2. Contributions of the main branches of economy to the real growth rate of GDP



Source: INSTAT, *Quarterly Economic Growth, Second Quarter 2017*, 2017, p.1.

Despite the presence of spare capacities in the labour and capital markets, current and expected developments suggest that the cyclical position of the economy is improving. Positive developments of domestic demand has helped in narrowing the output gap[1] in economy. Moreover, the latest data on capital and labour markets suggest positive developments during first quarter of 2017. The employment in the economy was raised and the number of employed increased by 3.5%. Meanwhile, employment in the services sector is assessed to have contributed most to the annual growth of employment in the economy. The unemployment rate resulted around 14.2% in the first quarter of 2017, at the same level registered in the previous quarter showing that the unemployment gap[2] continues to be negative, but there is a gradual reduction of spare capacities in the economy (Bank of Albania, 2017a).

Figure 3. Economic cyclical situation indicators



Source: Bank of Albania, *Quarterly Monetary Policy Report 2017/III*, 2017, p.47.

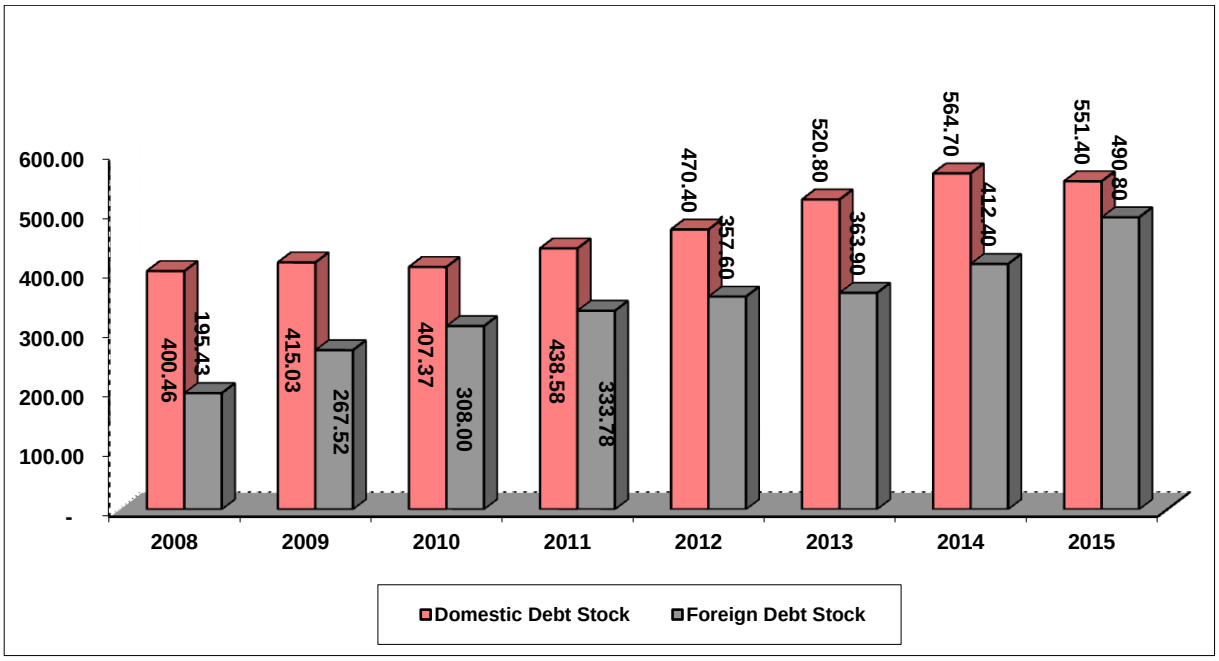
By the end of 2015, the public debt in Albania was at the level of 71.9 percent of its GDP. Consisting in all the gross financial liabilities from the general government, it is made of two main components, the domestic and external part. The public debt-to-GDP ratio started falling in 2016 as a result of the fiscal adjustment during 2014 and the debt accumulation decelerated. An unyielding implementation of reforms as well as a continuing fiscal consolidation will be decisive in order to put the public debt below 60 percent of GDP by 2019 as one of the main targets of the Albanian economy (IMF, 2016).

The management and control of public debt is another priority of the Albanian economy. According to the study conducted by Open Data Albania, the stock of Domestic Public Debt was ALL 551 billion in 2015, less than 2% compared in 2014. Commercial banks hold most domestic debt and a considerable part of it is also hold by the Bank of Albania. Meantime, at the same year, the overall stock of Public Foreign Debt was ALL 491 billion. In 2015, Public

[1] The capacity utilisation rate gap is assessed as a deviation of the current value from the relevant historical average, and then the method of the four terms moving average is applied.
[2] The unemployment rate gap is assessed as a deviation of the balance rate of unemployment with its current value, and then the method of the four terms moving average is applied.

Foreign Debt has been increased by 19% compared with a year ago. In general terms, the level of external debt has increased significantly over the past years (ODA,2016).

Figure 4. Stock of domestic and foreign debt in years (in billion ALL)



Source: Open Data Albania, *Structure of Pubic Debt in 2015*, 2016.*

1.4 Banking and Financial system

Acting like a catalyst for the economic development of a country, the financial system and particulary the banking sector are an important focus of monetary policy. During the last decade, the financial system in Albania has gone through major changes indicating the situation of the economy and thus responding to its needs.

Since the collapse of the communist regime in Albania in 1990, the Albanian banking industry has gone through difficult times as a consequence of political and economic crises. This period found the banking sector underdeveloped and centrally planed. Therefore a reform process regarding the banking system was the main concern. The main developments were followed by the establishment of a two-tier banking system, the presantation of a new regulatory framework, the privatization of the banks that were owned by the state as well as the entry of foreign banks. However, until mid of 1990, the structure of the banking system in Albania continued to be as a typical centrally planned economy consisting on four state-owned institutions, namely the State Bank of Albania functioning as the central bank of the country; the Rural and Development Bank whose main function was to allocate credits to the farms and cooperative that were state owned; the Savings Banks that served as a the main bank where Albanians households could deposit their savings; and finally the Albanian Commercial Bank that was dealing with the transactions in the foreign trade.

In 1991, Albania became part of International Monetary Fund (hereinafter: IMF). Associated with the help of IMF and World Bank, the government of Albania introduced the two-tier banking system that was regulated by the new Central Bank Law and the Commercial Banking Law settled in April 1992. Based on this new law framework, the State Bank of Albania of that time was renamed to what is called today the Bank of Albania, by maintaining the functions of a central bank. Following the law of 1992, the Central Bank of Albania was not anymore depended by government and was going to be inspected by the Parliament. The main goal of the Bank of Albania would be to "maintain the internal and foreign stability of the domestic currency" (Ceca, Rexha, & Orhan, 2008).

The phenomenon of pyramid schemes in Albania during 1996-1997, brought dramatic economic, political and social consequences in the country. The majority of Albanian invested in them and the maximum nominal value of the liabilities of pyramid schemes consisted in almost half of the GDP of the country. When the pyramid schemes fell down, the country rendered to anarchy where around 2000 people were killed because of a civil disorder.

There are several factors that contributed to the growth of pyramid schemes in Albania during those years. For almost 45 years, from 1945 to 1989, the country was isolated from a harsh communism regime where every form of private property was not allowed and therefore this left the country out of influences and information from abroad. As a results, when the transition period started in 1991, the majority of the Albanians were not informed about financial markets and practices. The unfamiliarity of the Albanians regarding market institutions as well as the deficiency of the formal financial system in the country associated with the failures of governance, supported the growth of the informal market as well as pyramid schemes as a part of it.

Even though Albania had a successful transition period toward a market economy, the formal financial system in the country had lots of deficiencies. The three existing state-owned banks of that period held 90 % of deposits and performed restricted banking operations in economy. Therefore, an informal loan market started to develop formed by exchange dealers in the exchange rate market that were not licensed or by different non-licensed lending companies financed mainly by remittances from emigrants. These companies, which later turned into pyramid schemes, had very high interest rates which caused large deposits inflows while they invested them into their own account instead of other profitable investments. Their scheme was insolvent from the beginning since the their liabilities exceeded their assets, but the news about very high returns attracted more and more investors rapidly. The public confidence was lost after the collapse of the first pyramid firm in January 1997 and therefore many people started to immediately withdraw their deposits. As a results, the year 1997 found Albania in a financial, political and social turmoil (Jarvis, 1999).

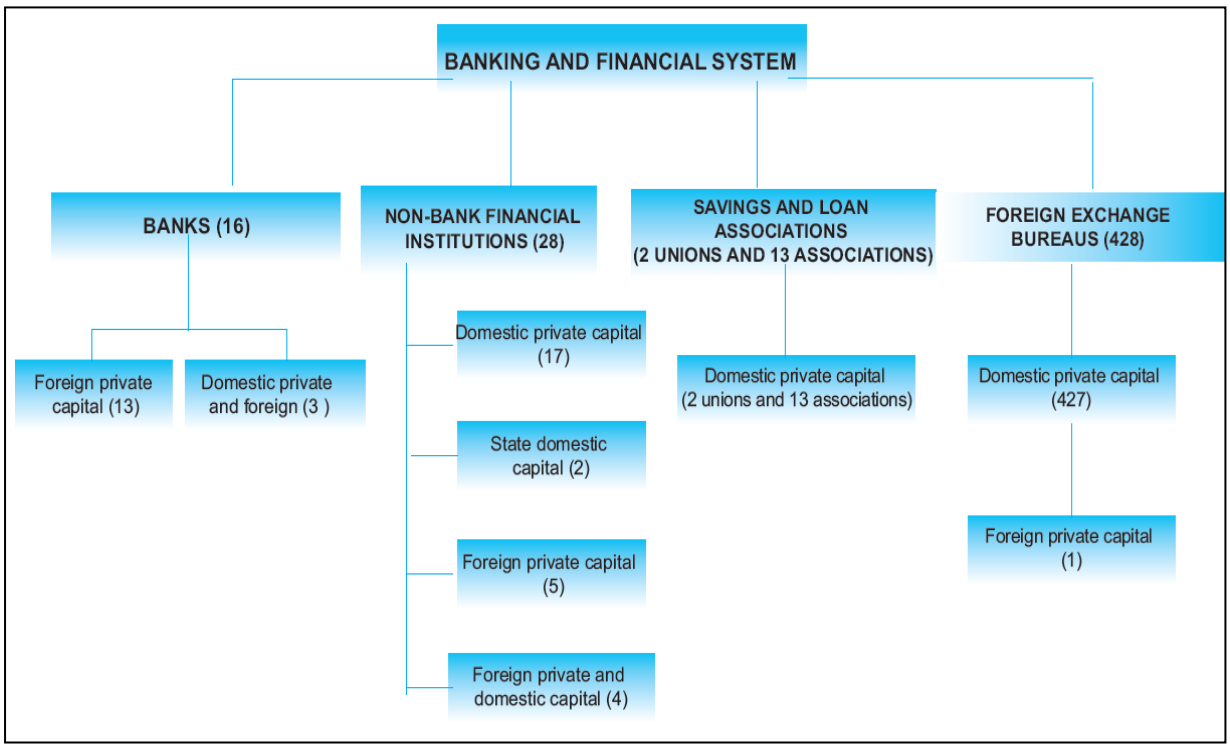
Apart from economic effects, the civil disorder was the main consequence of the collapse of schemes. During 1997, the inflation in economy increased to more than 40 percent due to a rapid depreciation of Albanian currency lek associated with a huge fiscal deficit of the loss of government revenues. However, there were limited long term effects of this collapse

reflecting in this way the resilience of Albanian economy associated with government structural reforms. The macroeconomic stability was quickly restored and the reforms in the following years were mainly focused on the privatization of the state owned banks as well as the entry of the new private banks. This improved the financial intermediation in economy as well as increased obviously the quality of the banking services (Ceca et al. 2008).

The banking sector in Albania remains the main segment of financial intermediation. The formation of the banking and financial system in Albania by the end of 2016 was made up of 16 banks, 28 non-bank financial institutions, 428 foreign exchange bureaus, 13 savings and loan associations as well as 2 unions of savings and loan associations. The Bank of Albania is the authority responsible for monitoring their business performance (Bank of Albania, 2017b).

The remaining financial institutions such as the insurance companies, pension funds and other securities companies are under the supervision of Albanian Financial Supervisory Authority (hereinafter: AFSA), established in 2006. However, compared to the other countries in the region, the pension system in Albania remains underdeveloped and it is based on a state funded pillar recognized as a Social Insurance Scheme (Pay-As-You-Go System) while the activity of the private pension started only in 2006. Therefore it is obvious that the domestic financial system in Albania is strongly bank dominated (Ceca et al. 2008).

Figure 5. Financial and Banking sector structure in Albania



Source: Bank of Albania, *2016 Annual Supervision Report*, 2017, p.23.

The banking sector consists of 16 banks where four large banks share about 70% of the deposits and manage about 65% of loans given by the sector. By the end of 2016, banks operated with 493 branches across the country. These branches are distributed throughout the

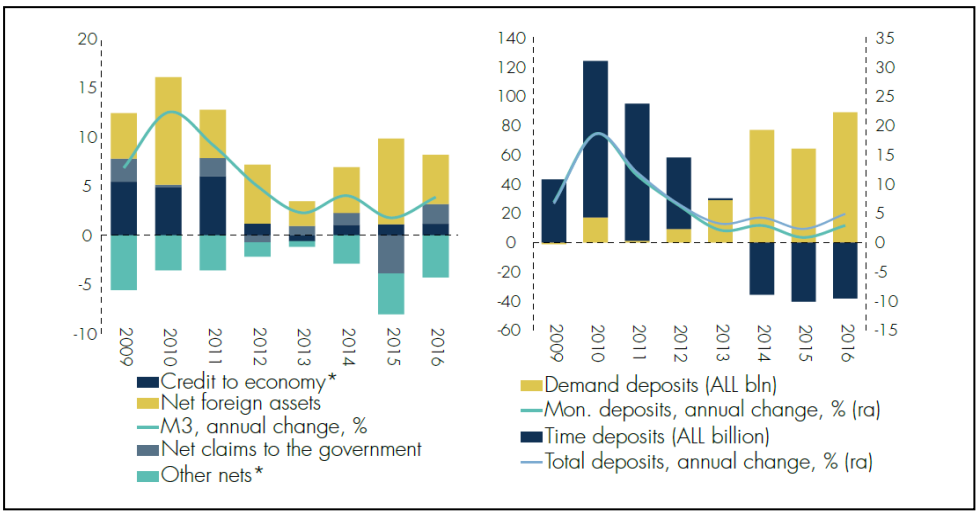
entire territory of the Republic of Albania but the biggest concentration is in Tirana (42%) associated also with greater concentration of population (29%).

The financial crisis of 2008, made the credit growth to private sector in Albanian economy to slow down considerably. During 2016, there was an improvement regarding the lending activity in the economy even though it remains relatively slowly. At the same level with previous year, the credit to private sector accounted for 37.3% of GDP. An obvious increase of credit in Albanian currency (10.2%) comes as a consequence of the fall of interest rates and therefore banks have e tendency of crediting in the domestic currency. The credit portfolio to private sector marked an annual growth of 3.9%.

The growth of credit to private sector shows a good performance of credit to households (5.1%). There are several reasons for this such as continuous easier lending standards, an improvement of the labour market as well as an increase of the confidence. However there is still a small supply and a weak demand for financing the enterprises (with only 2.4 %). Taking into account the purpose of the use, there is an increase of the credit to households for consumption as well as for house purchase. Additionally, the credit to enterprises for investment purposes has also risen during 2016 (Bank of Albania, 2017a).

During 2016, there was an expansion of deposits in the Albanian banking system which was showed from a fast growth of liquid deposits. At the same year, it was an obvious increase of the deposits in foreign currency particularly. By the end of December 2016, the stock of deposits accounted for 73.7% of GDP and 4.9% higher in annual terms compared with the previous year. Therefore 2016 marked a shift toward demand deposits. The deposits to households and enterprises was increased annually by 1.9% and 7.6%, respectively (Bank of Albania, 2017a).

Figure 6. Monetary supply and deposits in the banking system



Source: Bank of Albania, *2016 Annual Report*, 2017, p.48.

The ratio of the total assets in relation to the Gross Domestic Product which presents the share of the banking system in the economy, continues to be high. During 2016, the share of its assets stood at 95.05% of the Gross Domestic Product even though the ratio of loans to GDP fell slightly due to the higher growth of GDP over 2016 (Table 1). Capitalisation, liquidity and profitability as the main financial indicators of the banking sector activity, show that the banking system in Albania has the ability to withstand internal and external shocks. This is supported by the results of the stress test exercises on solvency and liquidity risk, that are performed periodically several times a year from the Central Bank (Bank of Albania, 2017b).

Table 1. Banking system total assets and loan portfolio's share in GDP

Indicators	2011	2012	2013	2014	2015	2016
Total assets (in ALL billion)	1,120.20	1,187.98	1,234.32	1,293.72	1,318.13	1,407.29
Total assets/GDP (in %)	86.10	89.61	91.13	91.56	91.33	95.05
Total loans/GDP (in %)	40.00	43.58	41.88	42.12	40.61	40.55

Source: Bank of Albania, *2016 Annual Supervision Report*, 2017, p.29.

The fluctuation in the indicator of non-performing loans, was the most important development during 2016. There is a downward trend of non-performing loans indicator observed in the last quarter of 2016 and first quarter of 2017. As one of the main priorities of the Bank of Albania to monitor these developments, it has intensively communicated with banks in order to increase the attention and address the non-performing loans or the large borrowers. (Bank of Albania, 2017c).

The effects of monetary policy of the Bank of Albania associated with its supervision role of the banking system in economy, has generated positive effects in the Albanian banking system. The main developments of four to five last years are characterized mainly by:

1)A successful realization of the main objective of the Bank of Albania consisting in maintenance of inflation within its target.

2)An obvious decrease of the level of Non Performing Loans in the banking system (from 25% during 2013-2014 to 18% at the end of first quarter of 2017).

3)The level of banks capitalization remains within international standards.

4)Preservation of liquidity level in Albanian banking system.

1.5 A Historical Prespective of Central Banking in Albania

The independence of Albania on 28 November 1912 was followed by the necessity to establish a national bank so it could pursue its activities in compliance with the rules of other European central banks. Ismail Qemal Bej Vlora, the founder of Independent Albania as well as the President and Prime minister of the country in that time, considered the establishment of the bank as "a second triump" after freedom of the country.

Therefore, on 4 October 1913, the government of Albania reached an agreement between Wienner Bank Verein and Banca Commerciale Italiana for the initiation of the National Bank of Albania, even though it could not start to operate as a result of an unstable situation of the country. Second September 1925 marked the date of the official foundation of the National Bank of Albania. The first national currency called the 'golden frang' was released on February 1926, with 'lek' as its subunits. As in most of the countries during that time, the National Bank implemented the gold standard for its monetary system. Therefore, it was requested for the Bank to hold a certain amount of precious metals equal to one third of the banknotes circulating in the economy.

During the following years, the National Bank of Albania developed its activities in credit sharing due to an increase of competition with the branches in Albania of the Italian Banco di Napoli and the Banca Nazionale del Lavoro.

On 13 January 1945, it was approved the law on the State Bank of Albania which indicated it as the main institution in the Albanian financial system. In the same year, the State Bank started to operate in the field of currency issue and credit. From this period until the end of 1990, the State Bank of Albania operated under a socialist economy. During these 45 years of communism regime, the banking system in Albania was extremely centralized and controlled only by the government. Except issuing the currency in economy, the main roles of the State Bank of Albania consisted as following:

- Assembling free assets and re allocating them to enterprises governed by the state, agricultural cooperatives and to some certain people in form of a short term and long term credit.

- Serving as a cash desk by performing income and expenses statements, holding the foreign currency of the state as well as executing financial activities on the name of government with other countries and banks also.

Following the collapse of communism in 1990, the banking system in Albania went through essential changes. The functions of Central Bank were already separated from those of commercial banks. Other changes such as the increase of the number of commercial banks with many branches in Albanian economy, the growth of credit activities as well as the introduction of foreign banks were the main developments during the following years.

The Bank of Albania was officially established on 22 April 1992 following the law nr.7559 'On the Bank of Albania'. Based on the law, the Central Bank of Albania executes the functions of a classical central bank with the principal objective to achieve and maintain price stability in the economy (Bank of Albania, n.d.).

1.6 Albania's Monetary Policy Framework

The history of modern central banking in Albania begins in 1992 with the establishment of the Bank of Albania as the first central bank of the country.[3] The initial Law of 1992, stated that the main goal of the Albanian Central Bank was to preserve the value of the Albanian domestic currency Lek. Due to an underdeveloped financial system and market economy, the Bank of Albania started operating a monetary regime since 1993. The main focus of initial regime was to control the supply of money in the economy by monitoring the so called broad money or M3 as an intermediate target. Over the next years, as the economy shifted towards a market-oriented structure and financial system progressed, in order to be in line with such developments, Bank of Albania published a target for inflation within 2-4 per cent in 2000 (Kolasi, Hoda, & Note, 2009). In other words, under the umbrella of a monetary targeting regime, the Bank of Albania applied a monetary policy philosophy similar to that of inflation targeting regime. However, Albania officially implemented inflation targeting regime in 2009. This new regime in its final objective seeks stabilization of economy by focusing on stability of prices in the economy, as the other regimes of monetary policy. In essence, the difference emerges as expected inflation becomes the main focus of monetary policy. After several improvements of the initial Law through the following years, the actual Law, clearly defines that the main objective of the Bank of Albania consists in achieving and maintaining price stability. Moreover, except the principal objective, the Bank of Albania has also other objectives such as promoting the development of banking and financial system as well as promoting the development of the payments system, and providing the necessary conditions in order to achieve a balanced and sustained growth (Kolasi & Themeli, 2005).

During these 25 years, Albanian economy and its institutional framework have gone through substantial changes by making it necessary to analyze its impact on monetary policy making. The economic environment in Albania has changed constantly by affecting the design and implementation of monetary policy by several and specific factors. As Themeli (2012) explains, there is a broad range of options while choosing a monetary regime, from the designing of policy instruments to the decision making structures and communication strategies of the central bank. Based on the latest official Monetary Policy document published by Bank of Albania (2015), the following principles are taken into account while formulating and implementing monetary policy:

- Firstly, monetary policy guarantees the stability of the prices in economy and it is always consistent to attain in the medium term inflation target. Therefore, this main principle increases the accountability of monetary policy, strengthen its reliability as well as improves the effectiveness.

[3] For a better treatment of the evolution of Monetary Policy and the institutional framework of BoA, see Fullani A.,"Evolution and Adoption of the Bank of Albania's Monetary Policy: A Forward-Looking Vision and a Call to Be Pre-emptive", published in "Monetary Policy Strategies for Small Economies", Bank of Albania, 2007.

•Monetary policy is forward looking or in other words it is guided by the expected performance of inflation in the medium term.

•Monetary policy is balanced. This means that it can be utilized to mitigate fluctuations in the short run in the economy and therefore to achieve an equilibrium between returning inflation to its target and reducing the fluctuations in economy.

•Monetary policy is robust by taking into account an acceptable range of assumptions and remains within those reasonable restrictions. Fulfillment of this principle reduces the scope for monetary policy errors.

•Finally, monetary policy is transparent meaning that the Central Bank has to issue information to the public about the its objectives, principles as well as instruments. In this way, monetary policy effectiveness is improved as it becomes clear for the public to understand and increase the predictability.

1.6.1 Monetary Policy Decision Making Body

The Supervisory Council of the Bank of Albania is the leading decision-making body of monetary authority. It is in charge of formulating monetary policy as well as the ratification of instructions to officially implement it. The Supervisory Council assembles according to a schedule released at the beginning of each year. The decisions about monetary policy from Supervisory Council are based on periodic reports which have as the main focus inflation forecasting as well as identification of possible monetary policy measures to return inflation to its target.

The official competences of the Supervisory Council of the Bank of Albania are based on article 43, paragraph a of the Law No. 8269, dated officially on 23 December 1997. Following the law, the Supervisory Council has the "legal responsibility to approve the monetary policy of the Republic of Albania as well as determining the limits of the Central Bank operations in the open market. Furthermore, the Council decides about the interest rates on deposits held with the Bank of Albania and on the discounts and loans of the bank. Lastly, the Council assigns the level of reserves that commercial banks are required to hold with the Bank of Albania." The monetary policy is communicated then by the Bank of Albania via different channels and means of communication such as monetary policy documents, regular reports, press releases as well as press conferences following monetary policy decisions (Bank of Albania, 2015).

1.6.2 The Objective of Monetary Policy of the Bank of Albania

As already mentioned, the principal objective of the monetary policy from the Bank of Albania, is to achieve and maintain price stability in the economy. In other words, it indicates attaining a low and positive inflation and meantime maintaining it for a relatively long period of time. There are different indicators like the Consumer Price Index, Production Price Index or other indices that measure prices of specific products, that are used to measure the increase of prices in the economy. Based in the Monetary Policy Document, to assess price stability

and steer monetary policy, the Bank of Albania uses the CPI, which is calculated and published by The Institute of Statistics (hereinafter: INSTAT). In terms of numerical figures, the Bank of Albania targets the annual increase in consumer prices at the level of 3% with a deviation of ± 1 percentage point as a tolerance. Like a small open economy, the inflation target level in Albania, somehow demonstrates the development stage of economy. Explained in detail in the Monetary Policy Document, the inflation target level is set based on several arguments like technological evolution of products, maintaining positive real interest rates and compatibility with the growth requirements for the economy of Albania as an emerging economy[4].

However, besides the usage of the change in the CPI as an assessment of inflation, Bank of Albania employs also other inflation indicators in order to improve and increase the effectiveness of the monetary policy decision making process. Core inflation for example is another way of measuring inflation and presents the steady and long run part of the price level. It is accomplished by excluding from the consumer price index basket those items and services that have a high volatility in their price. In this way, core inflation reflects more evidently the situation of monetary policy in the economy as well as the long run trend of the inflation. Additionally to core inflation, the performance of tradable and non-tradable inflation is another way of inflation measuring in the economy. It assesses in a better way the trends in the price level on both international and domestic markets. Recently, a considerable attention is given by the Bank of Albania to the expectations of economic agents about inflation that issue some helpful information for the current and future behavior of inflation in the economy (Bank of Albania, 2015).

While assuring price stability, the Central Bank of Albania contributes in making a sustainable and long run economic growth of the country as well as improving the standard of living and financial stability of the system. There exist several other structural factors like technological progress or country's economic and financial stability that can determine the growth of economy in the long run and the employment level in a given country. However, by providing price stability, monetary policy enables the economy to fully exploit the resources for the economic growth in the long run.

1.6.3 Exchange Rate Regime in Albania

The Bank of Albania applies a floating exchange rate regime, meaning that the price of the Albanian currency Lek (ALL) opposed to foreign currencies is freely assigned in the foreign exchange market. However, even though Albania has adopted a floating exchange rate regime, the Central Bank occasionally intervenes into domestic exchange market so it can affect the demand and supply for the domestic currency.

[4] See Bank of Albania, Monetary Policy Document. (January, 2015).

In case of economic shocks, the free floating exchange rate regime help the Albanian economy to quickly restore the equilibrium in trade transactions with abroad. In order to facilitate the effects of sudden shocks that might hit the economy and at the same time to be in accordance with monetary policy, the Bank of Albania holds a necessary level of foreign reserve. As a safeguard to the country's financial stability and by being in line with the international best practices, an adequate amount of foreign reserve is hold following two criteria:

1)The amount of the foreign reserve has to be enough in order to cover the import of goods and services in the medium-term for a period of at least four months;

2)The quantity of the foreign reserve must be adequate to defray in the medium run the short-term external debt of the Albanian economy (Bank of Albania, 2015).

In accordance with the relevant regulations, the Bank of Albania has the possibility to interfere in the domestic foreign exchange market so it can increase the quantity of foreign reserve as well as to ensure the stability of the Albanian economy. However, it is important to emphasis that these interventions do not reflect the monetary policy approach in terms that they do not aim to affect the exchange rate path or the achievement of the main objective of the Bank of Albania.

1.6.4 Operational Objectives and Monetary Policy Instruments

The operational objectives of the Bank of Albania are another important part in the design of monetary policy. These objectives somehow reflect a relationship between operations of monetary policy and the principal objective of Albanian Central Bank. The operational objectives of the Bank of Albania consist in directing the short-term interbank rates near the key interest rate which is determined by the Supervisory Council as well as mitigating their fluctuations. In this way, by steering short-term interbank rates close to the key interest rate, it brings to an improvement of the effectiveness as well as transparency of the monetary policy. Consequently this leads to a stronger inspection of long term interest rates in the economy. Furthermore, this operational approach allows for a clear signaling of the monetary policy behavior (Bank of Albania,2015).

Bank of Albania has employed a wide range of instruments which have evolved through time. In 1992, the Bank of Albania introduced its first monetary policy instruments. Explicitly, the Albanian Central Bank established the limit on the total credit to the economy (quantity regulation) and the limit on the minimum interest rate on deposits (price regulation). Additionally, in 1992 the Bank of Albania initiated the statutory reserve requirement that entailed commercial banks to keep 10% of their liabilities at Bank of Albania account. The second half of the year 2000, marked an important phase, when Bank of Albania stopped using these direct instruments and switched to the indirect instruments. Several factors like the underdeveloped domestic banking system and internal financial markets, made these direct instruments ineffective. As a result, the Supervisory Council decided that the Bank of Albania had to started using the indirect instruments as main part of its monetary policy (Themeli,

2012). Based on the decision, the Bank of Albania, started to use the REPO rate which is the interest rate of the repurchase agreements with a maturity of one week, as the main instrument of its monetary policy. Following the Monetary Policy Document, the main indirect instruments that are used by Bank of Albania in order to realize its monetary policy are as follows:

1) Open market operations

The open market operations represent a monetary policy tool in which the Bank of Albania purchases or sells treasury bills with commercial banks. This is the principal instrument used by Albanian Central Bank for implementation of monetary policy with the purpose to keep under control the liquidity level in the banking system. Following the aim of their usage, the open market operations used by the Bank of Albania consist in the Repurchase and reverse repurchase agreements and the outright transactions. The Repurchase agreements (also called as REPOs) happen when the Bank of Albania sells treasury bills to commercial banks but with the agreement to buy the security on a pre specified date also with a pre specified price. The opposite is with the reverse repurchase agreements when the Bank of Albania buys the treasure bills from other banks in order to be repurchased by them at a second moment with some pre specified conditions. Last, the outright transactions are just some simple operations consisting in buying and selling treasury bills to regulate the liquidity level in the market.

2) Standing facilities

Standing facilities are instruments that are used in order to increase and reduce the liquidity level in the banking system for a temporary period of time starting from one day until three months. Part of these instruments are the overnight deposits and the overnight loans as well the Lombard loan. Initiated by the commercial banks, the overnight deposits and loans are used in order to decrease and expand the actual liquidity level in the short-term. Meantime the Lombard loan is used for the same purpose but for a longer period of up to three months.

3) Required Reserve

The required reserve is another instrument used by the Bank of Albania and consist in some certain amounts in both domestic and foreign currency that the commercial banks are required to hold in their accounts. The required reserve is based on the conditions of the balance sheet for each commercial bank which has the right to use 40% of its required reserve on daily basis. The remuneration for the domestic currency reserve is obtained from the base rate while for the foreign one, it is set by the European Central Bank and Federal Reserve. In this way, the Bank of Albania aims to regulate the liquidity level in the banking system as well as controlling the interest rates in the money market.

4) Other Instruments

In order to improve the effectiveness of the above instruments, the Bank of Albania may consider employing other instruments in some particular circumstances. By being in

accordance with the framework of the Bank of Albania, these instruments can only be used occasionally, as deemed necessary by the Bank of Albania. Such a monetary policy instruments is for example the so called “forward guidance”, which helps Bank of Albania's public commitment to pursue a certain monetary policy path in the future and thus reducing the uncertainties in the financial markets as well as increasing the effectiveness of its conventional instruments mentioned above (Bank of Albania, 2015).

1.6.5 Transparency, Independence and Accountability of Monetary Policy

As a broadly discussed topic in the academic literature of the central banks, transparency has become a significant issue of the central banking. In general terms, transparency helps the public to understand what the central bank is doing and why, giving it the possibility to evaluate the performance of the central bank. In the recent years, the Bank of Albania has considered the role of transparency crucial for the monetary policy. It is appropriate to highlight the point that the opening to the public should go along with the increase of the public understanding of monetary policy even though the public understanding comes gradually with the economic development of the country (Note, 2005).

As it is stated in the Monetary Policy Document, the Central Bank of Albania has the juridical responsibility to inform about the monetary policy situation to the Assembly of the Republic of Albania twice a year as well as state its opinion on economic developments publicly every three months. There are several documents such as monetary policy document, periodic analyses, quarterly monetary policy reports and many others used by the Central Bank in order to report the decisions of monetary policy to the public.[5]

The independence of the Supervisory Council while formulating and implementing the monetary policy, is guaranteed by law. Explicitly, the law specifies that the Bank of Albania “is independent of any other power to achieve the primary objective". It is extensively confirmed that guaranteeing central bank’s independence creates better conditions for maintaining price stability (Bank of Albania, 2015).

1.6.6 Future Challenges of Monetary Policy in Albania

The recent financial crisis highlighted the coordination between monetary policy and macroprudential policy. The focus switched to variables such as the leverage and liquidity ratios in the financial system, capital adequacy, real estate as well as asset prices in the capital markets. The insurance of the financial stability requires price stability, the assurance of individual banking institutions as well as the banking system as a whole. The Bank of Albania has to work on a complete macroprudential policy framework, as well as to identify the optimal instruments for the implementation of the macroprudential policy. Therefore it is required to clarify the connection between the objectives of macroprudential policy and the instruments required for their achievement. By being in accordance with the European legislation, it is necessary to highlight stronger regulatory requirements for systemic banks.

[5] For a better treatment regarding the used documents , look the latest Monetary Policy Document published by Bank of Albania, 2015.

The Bank of Albania implements an independent monetary policy under inflation targeting and follows a free floating exchange rate. Even though the flexible exchange rate has produced desirable outcomes in the economy, it is sometimes criticized as a factor that affects the limitation of the independence of monetary policy. The explanation is related with the argument of the risk premia in the foreign exchange market and hence central banks is somehow forced to implement an independent monetary policy regarding the deviation of the interest rate. Consequently, taking into account the role of exchange rate in an inflation targeting country like Albania, the central bank has to think carefully regarding the interventions in foreign exchange as an additional instrument to control the liquidity level in the economy. This topic could bring problems for the communication of monetary policy to the public. It is crucial to emphasize that in the cases when the Bank of Albania has to interfere in the foreign exchange market, it must explain in detail that the nature of this interference is not associated with the achievement of the final objective. The improvement of the transparency regarding the activity of the Bank of Albania is important to be done through an open and clear communication with the public.

Last, it is important to have a good coordination between monetary policy and fiscal policy in Albania. The recent financial crisis emphasized the significance that fiscal position has for the macroeconomic stability of the country. The level of public debt in Albania has always been high, therefore the Bank of Albania has highlighted the necessity for a fiscal rule that would regulate short and medium trends of fiscal policy and meantime assure the sustainability of the long term debt in the economy. Consequently, the fiscal authorities in Albania should put on their priority the proper design of such a rule (Themeli, 2012).

2 METHODOLOGY

2.1 Structural Vector Autoregressive (SVAR)

Several papers use variants of the VAR models to examine the interactions that exist between exchange rates and monetary policy. In many recent empirical studies, the structural VAR models have been widely used in order to show the effect of exchange rate disturbances to monetary policy. SVAR models are an useful tool for analyzing the dynamics of a model by focusing on the role of unexpected shocks. The literature about this method indicates a common characteristic: “the attempt to organize, in a structural theoretical sense, instantaneous correlations among the relevant variables” (Amisano & Giannini, 1996). Introduced first by Sims in 1980, SVAR approach has become one of the most used methods in the study of transmission mechanism of monetary policy. This section presents the baseline model of the study, including the data description and identification procedures of the SVAR model. Within this framework, our empirical work is done through JMulTi software.

2.1.1 Modeling of Structural VAR

Using the Structural VAR, we intend to study the impact of a shock in exchange rate to monetary policy in particular. This thesis modifies a SVAR model following the scheme proposed in the influential paper of Kim and Roubini (2000).

Following Kim and Roubini (2000), we suppose that there exists the following structural type equation for the economy:

$$G(L)y_t = e_t \quad (1)$$

where *G(L)* represents a matrix polynomial in the lag operator L, y_t is the (n x 1) data vector, and e_t is an (n x 1) structural disturbances vector which is serially uncorrelated and $var(e_t) = \Lambda$ where Λ is a diagonal matrix. Hence, structural disturbances are assumed to be mutually uncorrelated. The VAR equation takes the following reduced form :

$$y_t = B(L)y_t + u_t \quad (2)$$

where *B(L)* is a matrix polynomial of lag operator L and $var(u_t) = \Sigma$. However, following the explanation of Kim & Roubini (2000), there are a lot of possibilities to retrieve the parameters in the structural form equations from the estimated parameters in the reduced form equation.

For example, a popular method is the so called Cholesky decomposition of the VAR reduced form residual matrix which is designed as a lower triangular matrix and implies a recursive scheme among variables. Firstly introduced by Sims in 1980, this method of identification, follows the so called Wold-causal chain which applies only a recursive structure.[6]

Another method is the so called generalized method that consist in setting restrictions only on contemporaneous structural parameters by allowing in this way for non-recursive structures. The combinations of possible contemporaneous restrictions between variables are based on the researcher's own creativity. Therefore, it is necessary that restrictions have an economic logic and theoretical support, since erroneous restrictions can quickly lead to wrong conclusions.

If G_0 is the coefficient matrix on L^0 in *G(L)* that is, the contemporaneous coefficient matrix in the structural form and $G^0(L)$ the coefficient matrix in *G(L)* without contemporaneous coefficient G_0. That is :

$$G(L) = G_0 + G^0(L) \quad (3)$$

After that, the parameters in the equation of the structural form and those in the reduced form are connected as follows:

$$B(L) = -G_0^{-1}G^0(L) \quad (4)$$

[6] Look at Lütkepohl, H., & Kratzig, M.(2004). Applied Time Series Econometrics Pages 159-165.

Moreover, the structural disturbances and the reduced form residuals are related by $e_t = G_0 u_t$, implying that :

$$\Sigma = G_0^{-1} \Lambda G_0^{-1\prime} \quad (5)$$

As Σ contains n(n+1)/2 parameters, at least n(n-1)/2 restrictions are required on G^0 so the identification can be attained. In the case of using the Cholesky decomposition in a VAR modeling, G^0 is supposed to be triangular.[7]

The basic structural VAR model in our study contains four variables constituting the short term interest rate presenting the monetary policy instrument, the Consumer Price Index (hereinafter: CPI) as a measure of inflation, Gross Domestic Production (hereinafter: GDP) which is a measure of aggregate output and the Nominal Effective Exchange Rate (hereinafter: NEER). Therefore, the vector of endogenous variables is written as:

$$y_t = [\text{INTEREST, CPI, GDP, NEER}] \quad (6)$$

The variable ordering for Albania follows an economic logic and it is theoretically supported. As an inflation targeting country with a free floating exchange rate, it is logical for the interest rate to be sensitive against changes in inflation. In our model, it is supposed a behavior of monetary policy reaction based on a simple Taylor rule meaning that the interest rate responds to the price level (in our case CPI) and output (in our case GDP). Additionally we have also included in the model the effects of NEER, so we can investigate the response of monetary policy to this variable over time in the Albanian economy. Having the nominal effective exchange rate ordered last, means that it reacts contemporaneously to all other variables. This is supported even theoretically in literature, given that the exchange rate is a forward looking variable that quickly captures changes in all other variables (Cushman & Zha, 1997; Kim, 2001).

Following the same specification as Kim and Roubini (2000) in their paper, but adjusted to fit the Albanian economy, the structural model is identified via restrictions as follows:

Table 2. Identification Restrictions

Residual form \ Structural	INTEREST	CPI	GDP	NEER
INTEREST	X	X	0	X
CPI	0	X	X	0
GDP	0	0	X	0
NEER	X	X	X	X

In matrix notation, the structural model is expressed as:

[7] For further detailed explanation, see Kim & Roubini (2000).

$$\begin{bmatrix} e_t^{INTEREST} \\ e_t^{CPI} \\ e_t^{GDP} \\ e_t^{NEER} \end{bmatrix} = \begin{bmatrix} G_{11} & G_{12} & 0 & G_{14} \\ 0 & G_{22} & G_{23} & 0 \\ 0 & 0 & G_{33} & 0 \\ G_{41} & G_{42} & G_{43} & G_{44} \end{bmatrix} \begin{bmatrix} u_t^{INTEREST} \\ u_t^{CPI} \\ u_t^{GDP} \\ u_t^{NEER} \end{bmatrix}$$

where G represents the non-restriction values. $e_t^{INTEREST}$, e_t^{CPI}, e_t^{GDP}, e_t^{NEER} are the structural disturbances while the terms "u" on the right side present the residuals in the reduced form equations that are considered as unpredicted changes of each variable.

Following the original restrictions used by Kim and Roubini (2000), this thesis modifies the restrictions to fit the Albanian economy. Nominal effective exchange convey information about changes in all other variables and thus it reacts contemporaneously to all structural shocks. Another important change to this new structure is the fact that the Albanian monetary policy can now respond contemporaneously to the nominal effective exchange rate. This is supported from the idea that a small open country like Albania, imports a considerable amount of its consumption from the rest of the world and thus being exposed to exchange rate fluctuations. Therefore, the Central Bank will take the exchange rate into consideration in order to control too much volatility, or as it is called in the literature, "fear of floating." Moreover, we decide for some other behavioral restrictions like for example some variables respond gradually to changes in policy variables. For instance, the scheme uses information lags in monetary policy decision meaning that the interest rate does not respond to contemporaneous shocks of inflation and real output. The used scheme seems more realistic in the case of Albania when information, especially as regards output is available with considerable lags (Kolasi et al., 2010). Last, following the same approach like in Kim and Roubini (2000), regarding the second equation of the consumer prices, it is supposed to respond to the output.

Except the interest rate variable, all the other variables are in logarithms. The data are on quarterly frequency for the sample April 2001- March 2017 period. We choose this sample period for Albania, because it corresponds with the phase when the Bank of Albania started to use indirect instruments for implementation of the monetary policy.

2.2 Model specification

2.2.1 Stationarity Test

The analysis starts by checking the stationarity of all the variables. Stationarity test helps us to avoid the misleading results which can create wrong predispositions in the model. The process is considered to be non-stationary if it contains a unit root. Starting by taking into account a simple first order autoregressive process as following:

$$y_t = \rho_1 y_{t-1} + \varepsilon_t \quad (7)$$

with a characteristic polynomial defined as α(L)=1-ρL=0. The process has a unit root when ρ=1, so that the root of the polynomial z=1/p=1. In that case, we can rewrite the process by iterative substitution, starting from $y_0 = 0$, so that :

$$y_t = y_0 + \sum_{j=1}^{t} \varepsilon_j \quad (8)$$

(6)In that case, the variance of the process takes the form of $E(y_t^2) = \sum_{j=1}^{t} \sigma^2 = t\sigma^2$. In other words it means that the variance depends on t and it is diverging to infinity with t. In order to check for the potential unit roots present in the data, we compute the test of Augmented Dickey-Fuller (hereinafter: ADF). The Dickey-Fuller is applied to the following form of the model :

$$\Delta y_t = intercept + \beta t + \phi y_{t-1} + \sum_{j=1}^{p-1} \alpha_j^* \Delta y_{t-j} + u_t \quad (9)$$

where $\phi = -\alpha(1)$ and $\alpha_j^* = -(\alpha_{j+1} + \cdots + \alpha_p)$. Restrictions on the deterministic parts of the equation can be imposed, which corresponds to modeling a random walk (intercept and β equal to 0) or a random walk with drift (β equals to 0) (Lütkepohl & Kratzig, 2004, pp. 11-12).

The ADF statistics check the null hypothesis of the presence of the unit root. Values of the DF statistics smaller than critical values, reject the null hypothesis and thus reject the existence of a unit root. Confidence interval is set as 5%. Critical values of the test depend on the deterministic terms which have to be incorporated. This is why, in cases when a constant or the trend term is included, there are applied different critical values (Lütkepohl & Kratzig, 2006). It should be emphasized first that all the series used in our study have a nonzero mean as well as a linear trend excepting NEER variable. Results are presented in the following table:

Table 3. Augmented Dickey-Fuller Test Results

Variables	ADF Test Statistic	Deterministic Terms
GDP	-0.5775	Constant, Trend
CPI	-1.4122	Constant, Trend
INTEREST	-2.3501	Constant, Trend
NEER	-1.4278	Constant

Note: *5% critical values for ADF test with constant and trend and constant are -3,41 and -2,86 respectively.

As shown from the results, the values of test statistics are above the critical value with 5% confidence interval, meaning that all series are non-stationary. However, even if we are dealing with non stationary variables, the SVAR model can be estimated in level. Authors like Sims, Stock and Watson (1990), explain that in the case of the non stationary variables, the estimated coefficients of the model are consistent and also the asymptotic distribution of each estimated parameter is standard (normal distribution). Furthermore, Phillips (1996) shows that except in the long run, the impulse responses are in accordance with the estimators of the true impulse response functions. Therefore, in cases when the VAR model is estimated with non-

stationary variables, the impulse responses in the short run are credible estimators compared with the true impulse responses.[8]

2.2.2 Lag Selection

Choosing the lag order is an another main step for an appropriate estimation of the VAR model. The setting of the lag order is determined through information criteria computation. The information criteria computation is based on testing the goodness of fit and is comprised of two terms : minimizing variance-covariance term and penalty term.

$$C(m) = logdet(\Sigma_m) + C_T\varphi(m) \tag{10}$$

where $\Sigma_m = T^{-1}\sum_{t=1}^{T}\hat{u}_t\hat{u}_t'$ is the term estimating residual variance-covariance for the model of order m, $\varphi(m)$ is a function that penalizes the large VAR orders and C_T is the sequence that identifies a specific criterion (Akaike Info Criterion, Hannah-Quinn criterion and Schwarz Criterion). When the sum of the two terms is at minimum, the lag order is determined. The rule for choosing the lag number, was to pick the lag that most tests were pointing to. When there were different results, the possibilities for different lags were tried starting with the smallest lag. When a certain lag showed least deficiency of the residuals along with the significance of the coefficients, that lag was considered a proper choice.[9]

Results for the most frequently used statistics, namely Akaike Info Criterion, Hannah-Quinn Criterion and Schwarz Criterion , are showed below in Table 4. As Lütkepohl (2007) explains, the Akaike Info Criterion shows the largest order, Schwarz Criterion stands for the smallest order while Hannah-Quinn Criterion is in between of them. According to his analysis, the Akaike Info Criterion tends to overestimate the optimal number of legs hence it is more preferred to choose a number which is between the results according to this and the Schwarz Criterion (conservative). These findings are also supported by other authors like Ivanov and Kilian (2001) who suggest the when dealing with quarterly data, it is better to choose the Hannan-Quinn Criterion as the most correct number of lags. Consequently due to our sample period, we consider Hannah-Quinn criterion as our optimal number of lags. The described method above was used to decide for the appropriate lag order and based on the information criteria, we choose a number of 2 lags as the most appropriate one.

Table 4. Information Criteria for lag selection

OPTIMAL ENDOGENOUS LAGS FROM INFORMATION CRITERIA	
Endogenous Variables	Interest CPI_log GDP_log NEER_log
Optimal number of lags (searched up to 5 lags of levels)	
Akaike Info Criterion:	5
Final Prediction Error:	4
Hannan-Quinn Criterion:	2
Schwarz Criterion:	1

[8] See (Sims et al., 1990) and (Phillips, 1996).
[9] See (Lütkepohl & Kratzig, 2004, pp.33-37).

2.3 Residual Analysis

Analyzing residuals is a crucial part of each statistical modeling, because it tells us whether the choice of model is appropriate and assumptions are reasonable. In our case, it is crucial to ensure whether the residuals of our VAR model are well-behaved, meaning that there does not exist any problem with autocorrelation or non-normality. Therefore, in order to verify the validity of the used model, we execute different tests to check for the problem of autocorrelation and non-normality between residuals.

2.3.1 Breusch-Godfrey LM test for autocorrelation

For autocorrelation, The Breusch-Godfrey test is applied. The LM test or the Breusch-Godfrey test, verifies whether the residuals follow the autoregressive process of the following form :

$$u_t = \rho_1 u_{t-1} + \rho_2 u_{t-2} + \cdots + \rho_p u_{t-p} + e_t \tag{11}$$

meaning that the past errors influence the size of the errors in the present period. Therefore, the null hypothesis tested is $H_0: \rho_1 \dots \rho_p = 0$ against the alternative hypothesis H_1 stating that at least one of the parameters is statistically different from zero. The Breusch-Godfrey test statistics is constructed with estimates of the residuals of the above autoregressive process and are obtained from the following auxiliary VAR model:

$$\hat{u}_t = \alpha_1 y_{y-1} + \cdots + \alpha_p y_{y-p} + \rho_1 \hat{u}_{t-1} + \cdots + \rho_p \hat{u}_{t-p} + e_t \tag{12}$$

The Breusch-Godfrey LM test statistics takes the following form :

$$LM = T\left(K - tr\left(\tilde{\Sigma}_R^{-1}\tilde{\Sigma}_e\right)\right) \sim X^2 \tag{13}$$

where $\tilde{\Sigma}_e = 1/T\tilde{\Sigma}_{t=1}^{T}\hat{e}_t\hat{e}_t^{'}$ is the residual covariance matrix estimator taken from the full auxiliary model, whereas $\tilde{\Sigma}_R = 1/T\tilde{\Sigma}_{t=1}^{T}\widehat{e_t^R}\,\widehat{e_t^{R\prime}}$ is the residual covariance matrix estimator received from a restricted auxiliary model, where $\rho_1 \dots \rho_p = 0$. The statistics is proven to follow the asymptotic distribution X^2. Therefore, the autocorrelation problem is treated where needed by increasing endogenous lags. (Lütkepohl, 2007,pp. 27-28).

However, Edgerton and Shukur (1999)**,** find that in the cases of small samples, this test may not work properly and therefore another statistic (the LMF statistic) may operate better. It is of the following form :

$$LMF_h = \frac{1-\left(1-R_r^2\right)^{1/r}}{\left(1-R_r^2\right)^{1/r}} * \frac{Nr-q}{Km} \tag{14}$$

where $R_r^2 = 1 - \frac{|\tilde{\Sigma}_e|}{|\tilde{\Sigma}_R|}$ with $r = \left(\frac{K^2m^2-4}{K^2+m^2-5}\right)^{1/2}$, $q = \frac{1}{2}Km - 1$, $N = T - K - m - \frac{1}{2}(K - m + 1)$,

n is the number of repressors in the original system and $m= Kh$ represents the number of repressors added in the auxiliary system (Lütkepohl, Kratzig, & Boreiko, 2006, pp.10-11).

In the table below, one of the specification tests for autocorrelation of residuals is presented.

Table 5. The Breusch-Godfrey LM Test for Autocorrelation

Reference: Doornik (1996), LM test and LMF test (with F - approximation)	
LM statistic :	197.4241
p-value:	0.0236
df:	160.0000
LMF statistic:	1.0416
p-value:	0.4749
df1:	160.0000
df2:	26.0000

2.3.2 Tests for non-normality

As the next step, the process was also tested for deviation from normality assumption. Economic data can often fail the assumption of normally distributed residuals due to the outliers and volatile nature of the data. Normality condition is not a necessary one for the estimation of the model, but indicates that improvements are required . The third moment was examined for potential asymmetries in distribution (skewness) as well as the fourth moment for potential fat tails of distribution (kurtosis). In other words, the non-normality test consist in transforming the vector of residuals so its elements are independent and then verifies if the third and fourth moments are the same as with those in the normal distribution (Lütkepohl & Kratzig, 2006). The covariance matrix of residuals is computed as:

$$\tilde{\Sigma}_u = T^{-1} \sum_{t=1}^{T} \hat{u}_t \hat{u}_t' \tag{15}$$

from which the standardized residuals can be computed as $\hat{u}_t^S = (\hat{u}_{1t}^S \dots \hat{u}_{Kt}^S)' = \tilde{\Sigma}_u^{-\frac{1}{2}} \hat{u}_t,$ where $\tilde{\Sigma}_u^{-\frac{1}{2}} = \sigma.$ Then, by using standardized residuals, the third moment (skewness) can be defined as:

$$b_1 = (b_{11} \dots b_{1K})' \text{ with } b_{1K} = T^{-1} \sum_{t=1}^{T} (\hat{u}_{kt}^S)^3 \tag{16}$$

and the fourth moment (kurtosis) as :

$$b_2 = (b_{21} \dots b_{2K})' \text{ with } b_{2K} = T^{-1} \sum_{t=1}^{T} (\hat{u}_{kt}^S)^4 \tag{17}$$

Then, the Jarque-Bera statistic is defined as :

$$\text{Jarque-Bera} = \frac{T}{6} \left(S^2 + \frac{1}{4} K^2\right) \tag{18}$$

where S^2 is the test statistics for skewness defined as $S^2 = b_1' b_1$ and K^2 defined as $K^2 = (b_2 - 3_K)'(b_2 - 3_K)$ is the test statistics for the excessive kurtosis. Vector $3_K = (3 \dots .3)'$

with dimension (K x 1) is a correction term that makes normal distribution kurtosis 0. This means that normal distribution samples have a value of skewness equal to 0 as well as a value of excessive kurtosis equal to 0 (thus value of kurtosis equal to 3). Larges JB statistics implies larges deviations from the normal distribution. In case of non-normalities, impulse dummies were applied in order to encompass excessive extreme deviations (values of standard residuals larger than three standard deviations) . Based on the residual plots, extreme deviations and thus dummy variable of 1 was determined. However, the rule was not to allow for more than 1% of such observations.(Lütkepohl & Kratzig, 2004,pp.45)

A variety of other normality tests have been developed by various statisticians. Doornik and Hansen proposed an idea to change the residual vector in so that its elements to be both standardized and independent, and then verify the accordance of skewness and kurtosis compared to those in a normal distribution. Lütkepohl proposed a different method of computing standardized residuals, therefore the results based on his test statistics are also shown. (Lütkepohl, 2007,pp.29-30). In the majority of cases, because of the very short series of data employed in our research, the tests cannot reject the hypothesis of non normality at 5% significant level. The detailed output of non-normality tests mentioned above, is listed in Appendix B. In the table below, Jarque-Bera test for non-normality of residuals is presented:

Table 6. Jarque-Bera test for non-normality

Variable	Teststat	p-Value (Chi^2)	Skewness	Kurtosis
U1	7.1697	0.0277	0.3108	4.6064
U2	0.4246	0.8087	0.1665	2.7454
U3	5.0775	0.0790	-0.2034	4.3913
U4	7.7645	0.0206	0.3449	4.6544

2.4 Implementing GMM in a Taylor rule setting for Albania

In 1993 John B.Taylor, proposed a simple rule that was meant to describe rate setting by Central Banks. The original Taylor rule is a backward looking rule and in simple words, it says that the central banks of different countries consider only the last period of inflation and output gap when setting the interest rate. In other words, this rule does not observe the expected values of inflation and output gap. Therefore, forward looking monetary policy rules have become widespread in empirical studies. Firstly introduced in the influential paper of Clarida, Gali, & Gertler (1998), the so called forward looking version, estimates the monetary policy function by using a consistent and efficient econometric technique, the Generalized Method of Moments. The implementation of expectation terms in the forward looking Taylor rule is done in order to be more realistic and consistent with real-life conduct of monetary policy by central banks.

Given that many countries have recently adopted inflation targeting regime and expected inflation becomes the main focus of central banks, a special attention is given to the exchange rate with a potential effect in inflation developments in economy. Therefore, many studies have incorporated exchange rate as an explanatory variable in the reaction function of many

central banks. In the recent empirical studies, a lot of authors consider the inclusion of exchange rate in Taylor rules as an important part by suggesting that in most of the cases, central bank might respond directly to exchange rate changes.[10]

In this section we investigate the role that exchange rate has in the interest rate setting in Albanian economy. We employ a forward looking Taylor type of rule in our analysis and include the effects of changes in the exchange rate in addition to expected inflation and output gap. In order to estimate our equation, we will utilize GMM method to determine whether the exchange rate developments entail effects in monetary policy interest rate. In the following part, we present our model using Albanian data and discuss its basic properties.

2.4.1 Baseline Policy Reaction function

As many other central banks, the Bank of Albania use the short term interest rate as the main operating instrument for its monetary policy. The Central Bank of Albania has decided to use as interest rate the rate of the repurchase (reverse) agreements with one week maturity. Following the influential paper of Clarida et al. (1998), the target interest rate takes the following form:

$$i_t^* = i^* + C_1(E[\pi_{t+n}|\Omega_t - \pi^*) + C_2\,(y_t - y^*) \qquad (19)$$

where i_t^* is the target nominal interest rate; i^* is the equilibrium nominal interest rate that prevails when both inflation and output is at its respective targets; E is the expectation operator; $E_t\pi_{t+n}$ is the expected inflation rate between periods t and $t+n$; Ω_t represents the available information set to the central bank at time t; π^* represents the inflation target rate which in case of Albania is 3%; y stands for the real output and y^* is the potential output.

As seen from equation (19), we suppose that the central bank targets the nominal interest rate in period t, which is a function of expected inflation and output gap. However, it is widely recognized that central banks tend to smooth their interest rates. Therefore, I assume that a central bank does not pursue a simple policy rule such as suggested in equation (19), but actual interest rate adjusts to its target as follows:

$$i_t = (1-p)i_t^* + pi_{t-1} + u_t \qquad (20)$$

where the parameter $p \in [0,1]$ presents the degree of interest rate smoothing, u_t is a zero mean exogenous interest rate shock and i_t^* is determined in equation (19). With the partial adjustment equation (20), the central bank smoothes its policy rate over several periods. Therefore by combining equation (20) with equation (19), and including the variable of nominal effective exchange rate in addition to expected inflation and output gap, we obtain the following policy reaction function:

$$i_t = (1-p)(C_0 + C_1(E[\pi_{t+n}|\Omega_t) + C_2\,x_t) + C_3 NEER_t + p\,i_{t-1} + u_t \qquad (21)$$

[10] See Svensson (1998), Ball (1999), Calvo & Reinhart (2000), Mohanty & Klau (2004).

where $C_0 = i^* - C_1\pi^*$, x_t is the deviation of actual real output from its potential trend where the latter is obtained by using the Hodrick-Prescot filter and *NEER* represents the nominal effective exchange rate expressed as the amount of domestic currency required to buy one unit of foreign currency (an increase in NEER indicates a depreciation of Albanian Lek value).

As we see from equation (21), one problem for this equation is that it contains the term $E_t\pi_{t+n}$ which can't really be observed. By rewriting the terms in the realized values and therefore eliminating the unobserved forecast variable:

$$i_t = (1-p)(C_0 + C_1\pi_{t+n} + C_2\, x_t) + C_3 NEER_t + p\, i_{t-1} + \varepsilon_t \qquad (22)$$

where the error term $\varepsilon_t = -(1-p)\{C_1(\pi_{t+n} - E_t[\pi_{t+n}|\Omega_t]) + C_2\, x_t\} + u_t$ is a linear combination between forecast errors of expected inflation and output gap and the exogenous disturbance term u_t.[11] By defining $\beta_1 = (1-p)C_0,\ \beta_2 = (1-p)C_1,\ \beta_3 = (1-p)C_2,\ \beta_4 = C_3\ and\ \beta_5 = p$ we finally get the linear estimable equation:

$$i_t = \beta_1 + \beta_2\pi_{t+n} + \beta_3\, x_t + \beta_4 NEER + \beta_5\, i_{t-1} + \varepsilon_t \qquad (23)$$

Following Clarida et al. (1998), let v_t be a vector of variables present in the central bank' information set at the moment when it chooses the interest rate ($v_t \in \Omega_t$) which are orthogonal to ε_t. The elements of v_t include any lagged variable that help to forecast inflation as well as any contemporaneous variable which is uncorrelated with the current shock of interest rate u_t. Therefore, since $E[\varepsilon_t|v_t] = 0$, equation (23) entails the following orthogonal conditions that are exploited for estimation :

$$E\left[\, i_t - \beta_1 - \beta_2\pi_{t+n} - \beta_3 x_t - \beta_4 NEER - \beta_5\, i_{t-1} \mid v_t\right] = 0 \qquad (24)$$

Lastly, when considering the time horizon for the inflation forecast as a part of the reaction faction, we choose a one-year forecast horizon as used in the paper of Clarida et al. (1998). This is a logical approximation on how central banks operate in the real world.

In order to estimate the parameter vector $[\beta_1, \beta_2, \beta_3\beta_4, \beta_5]$, we use the econometric technique of GMM which is explained in the next session. Additionally, baseline instruments that we incorporate for estimation, include the first four lags of inflation and the output gap, interest rate itself and NEER. The used data are on quarterly frequency from 2002Q4 to 2017Q1.

2.4.2 GMM in general

Firstly Introduced by Hansen in 1982, the Generalized Method of Moments (GMM) has turned into a widely used method among researchers, especially in the field of rational expectation in the last twenty years. Moreover, a lot of other estimators, such as IV or OLS, are considered as some special cases of GMM method. This method is extremely useful in cases when the distribution of the data is unknown. It combines the information in the population moment condition with economic data used in the model. The first step is to define

[11] This approach is developed by Clarida.et al.(1998) and we suppose that within my short sample, short term interest rate and inflation are I(0).

properly the moment conditions. A general representation of the population moment condition can be written as the expected value of a function of observed economic data x_t and unknown parameter vector θ_0 being equal to zero for all t. Thus the moment conditions are as following:

$$E[f(x_t, \theta_0)] = 0 \tag{25}$$

As we cannot calculate the expectation to solve the equation, we need to define a sample moment condition, that would replace the population average with a sample average:

$$f_T(\theta) = T^{-1} \sum_{t=1}^{T} f(x_t, \theta_0) \tag{26}$$

Equation (26) is nothing more that the Method of Moments estimator of (25) $E[f(x_t, \theta_0)] = 0$. If the sample moments gives suitable estimates for the population moments, then we might expect that the estimator $\hat{\theta}_T$ that solves the sample moment conditions $f_T(\theta) = 0$, would provide a good estimate of the true value θ_0 that solves the population moment conditions $E[f(x_t, \theta_0)] = 0$ (Lazlo,1999 p.7).

In order to find the estimator, the number of equations (q) is needed at be at least as we have parameters (p). In other words, the order condition for the identification is $q \geq p$. In our case, the equations $E[f(x_t, \theta_0)] = 0$ represent q equations for p unknowns which are solved exactly by θ_0. If we proceed with the exact identifications (q=p), the estimator is denoted by the Method of Moments (MM) estimator, or $\hat{\theta}_{MM}$.

However, if we have more equations than unknowns (q>p) meaning that we are dealing with over-identification, the estimator is marked by the Generalized Method of Moments (GMM) $\hat{\theta}_{GMM}$. In this case, we cannot find a vector $\hat{\theta}_T$ that satisfies $E[f(x_t, \theta_0)] = 0$. Instead, we will find the vector $\hat{\theta}_T$ that makes $f_T(\theta)$ as close as possible to zero. This can be done by defining:

$$\hat{\theta}_T = argmin_\theta \theta_T(\theta) \tag{27}$$

where

$$\theta_T(\theta) = f_T(\theta)' W_T f_T(\theta) \tag{28}$$

and W_T is a stochastic positive definite weighting matrix (Lazlo,1999,p.10).

In order to see the function of the weighting matrix, consider a simple example with two moment conditions:

$$f_T(\theta) = \begin{pmatrix} g_a \\ g_b \end{pmatrix} \tag{29}$$

Consider the simple case with a simple identity weighting matrix, $W_T = I$

$$\theta_T(\theta) = f_T(\theta)' W_T f_T(\theta) = (g_a \; g_b) \begin{pmatrix} 2 & 0 \\ 0 & 1 \end{pmatrix} \begin{pmatrix} g_a \\ g_b \end{pmatrix} = 2{g_a}^2 + {g_b}^2 \tag{30}$$

The best choice regarding the weighting matrix is to minimize the population variance from the sample moment (S) or in other words, $W=S^{-1}$. However this brings difficulties when implementing GMM since the parameters of vector θ_0 are needed for the calculation of S. Therefore, GMM is implemented in a 2-step (or multi step) process, where in the first step the identity matrix is used in order to produce preliminary parameter estimates which are then used in the following steps (Hall, 2009).

2.4.3 Hansen test of over-identifying restrictions

Researchers needs to check about the validity of the chosen instruments or in other words if there exist any correlation between the used instruments the errors. This can be checked in case of an overidentified model where by testing the overidentifying restrictions we can present the empirical evidence for the validity of the chosen instruments. However, such a test can be conducted if and only if we have more excluded instruments than included endogenous variables. This allows for the decomposition of the population moment conditions into the identifying and the overidentifying restrictions. In the GMM context the test of the overidentifying restrictions is done through the so called J statistic presented by Hansen (1982). It presents the value of the following GMM objective function:

$$\theta_T(\theta) = f_T(\theta)' W_T f_T(\theta) \tag{31}$$

assessed at the efficient GMM estimator:

$$J_T = T Q_T(\hat{\theta}_T) \tag{32}$$

This test is one of the most used in GMM estimation in order to confirm and verify the validity of the model. If the null hypothesis is rejected, it means that there is something wrong with the instruments orthogonality conditions as a result of not being really exogenous, or because of being excluded from the regression in a wrong way. (Schaffer, Baum, & Stillman, 2003).

2.4.4 Heteroskedasticity and Autocorrelation

The GMM estimation technique may be preferred over that of Instrumental Variables (hereinafter: IV) in cases of presence of heteroskedasticity in the error process and that of serially correlated errors. Despite the fact that the estimation through IV is unaffected by the existence of heteroskedasticity or serially correlated errors, the standard IV estimations of the standard errors are not consistent, and thus affecting a valid conclusion.

The presence of heteroscedasticity is a common problem in empirical work. The GMM technique, brings the advantage of the efficiency and consistency in cases of the existence of random heteroskedasticity. In other words, it allows for an efficient estimation if heteroskedasticity exist in any form by using orthogonality conditions even though with a possibly poor finite sample conlusion as a consequence.

The other problem is that of a serially correlated error process which similar to that of heteroskedasticy, it causes the IV estimator to be inefficient. As explained above, it is

necessary for GMM to define an optimal choice of weighting matrix in order to minimize the population variance of the sample moment. A correct estimation of covariance matrix is necessary for both statistical inference and an efficient parameter estimation.

A general covariance estimator consistent in the existence of heteroskedasticy and serially correlated errors was presented from Newey and West (1987). The so-called HAC covariance estimators, have a wide range of applications beyond GMM.[12] Therefore, we use HAC estimators, robust to autocorrelation or to both autocorrelation and heteroskedasticy, depending on which problem is present in the certain estimated model.

3 DATA

In this part, we explain the used data in our empirical work. The sample period used in SVAR estimation consists of quarterly observations starting from 2001:Q2 to 2017:Q1, while for the GMM from 2002Q4 to 2017Q1. We choose this sample period for Albania, because it corresponds with the phase when the Bank of Albania started to use indirect instruments for implementation of the monetary policy. The data are obtained from the Bank of Albania.

3.1 Nominal Effective Exchange Rate

In principal, Nominal Effective Exchange Rate is a measure of the price of the national currency versus major foreign currencies basket and is calculated by the weighted geometric average:

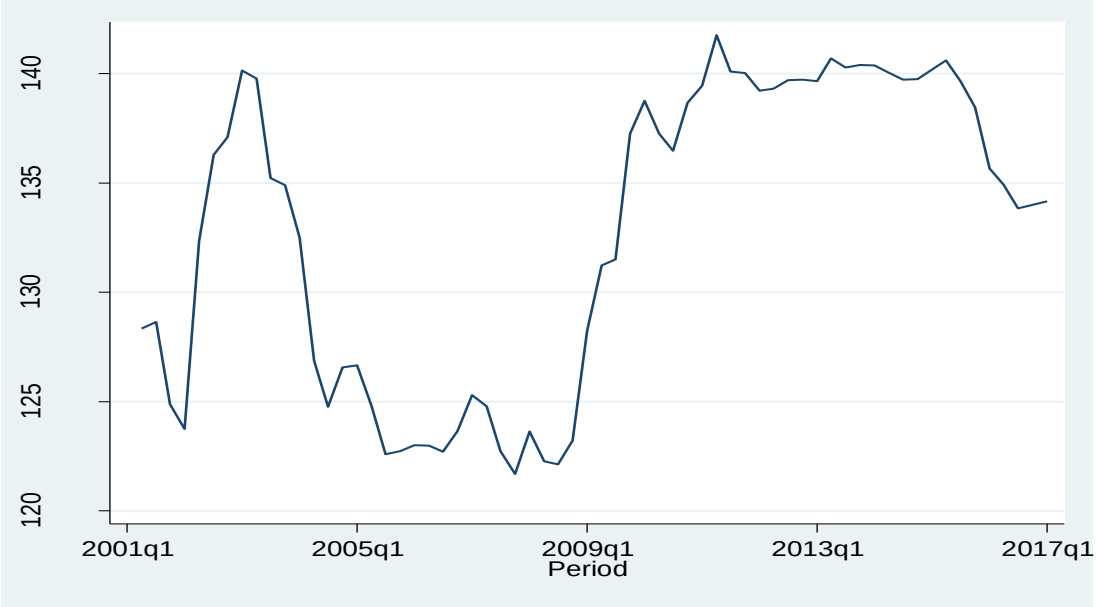
$$NEER_t = \prod_{n=1}^{N} K_n^{W_n}$$

Where K is the nominal exchange rate for the national currency and i of the trade partner country n and W_n is the share of the partner trade country in the trade activity of a country.

NEER is determined as a basket of currencies weighted according to their respective trade weights of the five major trading partners in Albania, respectively: Italy, Greece, Germany, Turkey and China. Moreover, the nominal effective exchange rate index shows the appreciation or depreciation of the national currency against a basket of selected currencies for a certain period. The nominal exchange rate shows how much units of Albanian currency is needed to buy one unit of foreign currency (for example 138 ALL/EUR). If the nominal exchange rate increases, it indicates that more Albanian Lek is required in order to buy one unit of foreign currency. Therefore, if NEER increases, it presents a depreciation of the Albanian currency and a lower NEER implies appreciation of the Albanian Lek against foreign currencies (Bank of Albania, 2011).

[12] Interested readers can see Laszlo (1999), Chapter 3.

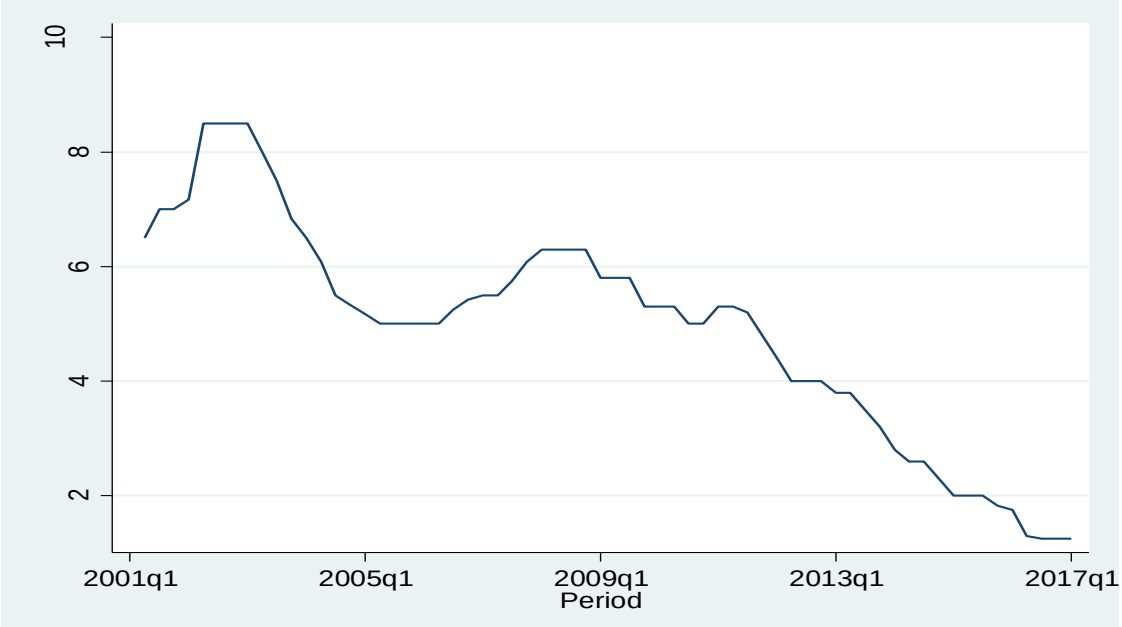
Figure 7. Nominal Effective Exchange Rate



3.2 The Interest Rate

The Bank of Albania uses the short term nominal interest rate as the main instrument of the monetary policy. This instrument is derived from the repurchase agreements (also called as REPOs) are part of the open market operation, that happen when the Bank of Albania sells treasury bills to commercial banks but with the agreement to buy the security on a pre specified date also with a pre specified price. The Bank of Albania's Supervisory Council is responsible for setting the interest rate of these Repurchase agreements with a maturity of seven days. The opposite is with the reverse repurchase agreements when the Bank of Albania buys the treasure bills from other banks in order to be repurchased by them at a second moment with some pre specified conditions. (Bank of Albania, September 2017).

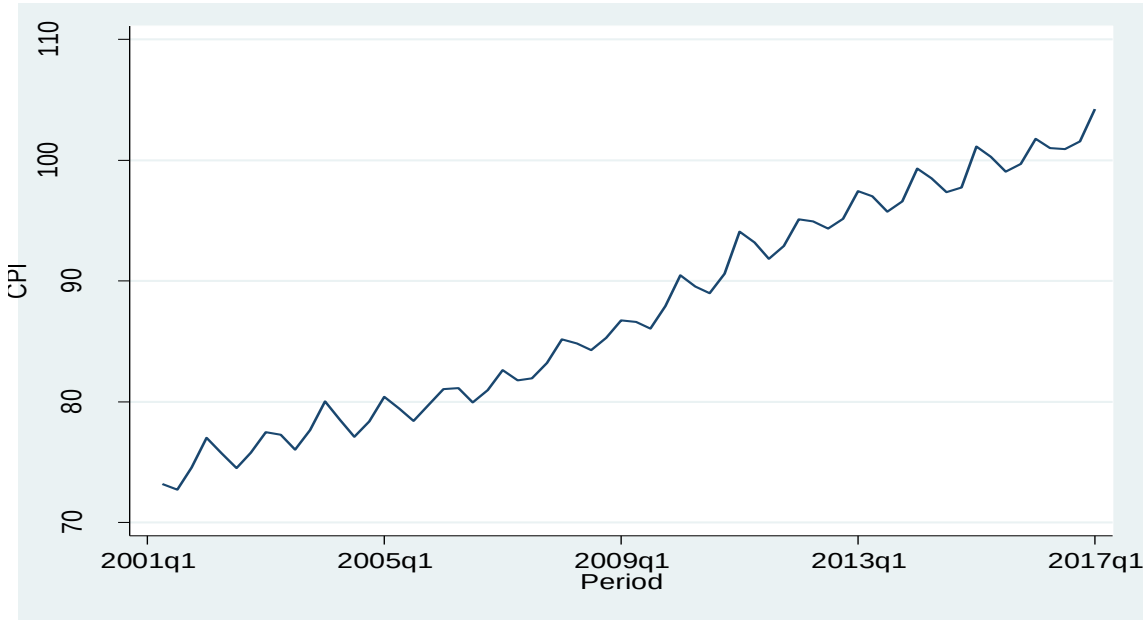
Figure 8. REPO Rate



3.3 Consumer Price Index

Consumer Price Index assesses the average change of prices which is paid from consumers for a certain basket of goods and services compared to a base reference period of time. The price reference period for Albania, is the December of each year. The major intention of the Consumer Price Index is to measure and present the inflation rate in Albania. In other words, Consumer Price Index in Albania, intends to provide a general measure of inflation for all the Albanian residents. From January 2008, CPI is calculated on the new basket basis and includes all country territory. Weights of goods are calculated based in the results of the family budget questionary (INSTAT, September 2017).

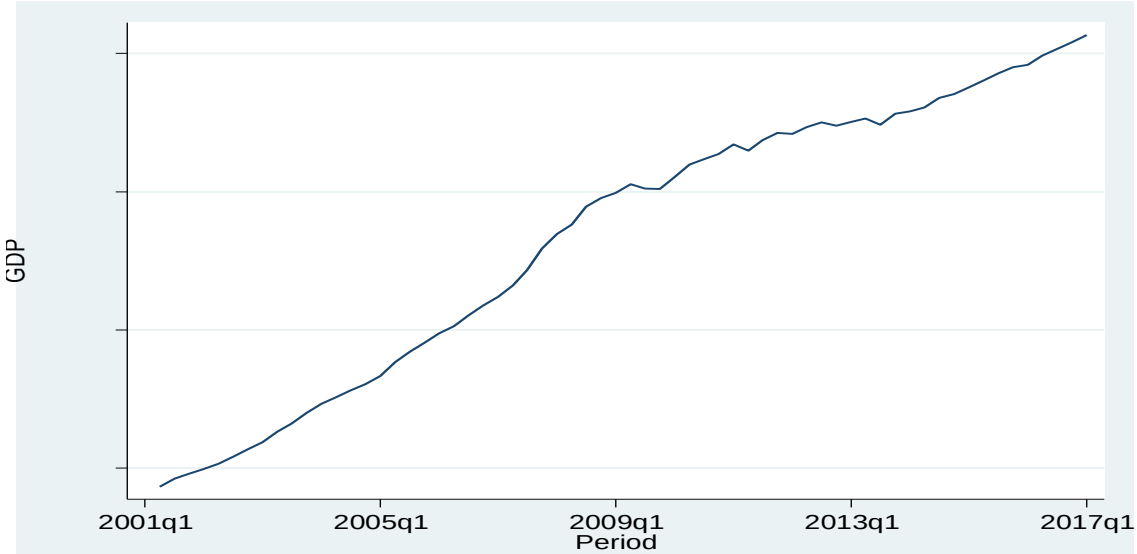
Figure 9. Consumer Price Index



3.4 Gross Domestic Product

Gross domestic product is one of the main indicators for every country. It represents the entire cash value of all goods and services that are produced for a set period of resident producer units. GDP data are at current prices by production approach. According to this method GDP is the sum of gross added value of the various branches of the economy adding taxes and deducting any subsidies on products. For constant price estimators, current prices are deflated with the previous year CPI index. In our model the output gap is calculated as a difference between the actual level of GDP and its potential level. To assess the level of potential GDP, we apply the Hodrick Prescott filter (hereinafter: HP filter), which divides the GDP indicator into the two main components (long-term average and volatility on long-term average).

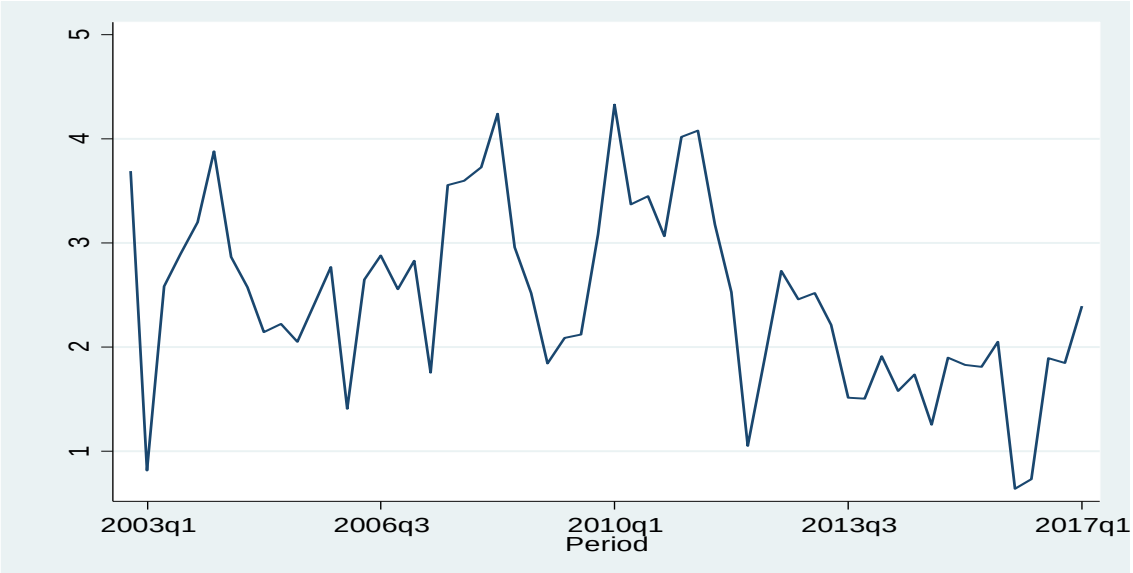
Figure 10. Gross Domestic Product



3.5 Inflation

Inflation measures the overall level prices in a given economy. It is calculated as the change in the Consumer Price Index, that shows the change in the prices of goods in a certain basket, representing the most consumed goods by a normal family. As mentioned above, the main objective of the Bank of Albania is to achieve and guarantee price stability. This means to have a low but positive inflation rates while trying to maintain them for long periods of time. The Bank of Albania determines the price stability as maintaining inflation rate at 3.0 percent, with a tolerance limit of ± 1 percentage points. The inflation target is assessed from the annual rate of changes in the total Consumer Price Index, applicable throughout the 2009-2011 period. The Bank of Albania predicts that the chosen target of inflation at 3.0 percent, will help the Albanian economy for further growth and development (Bank of Albania, October 2017).

Figure 11. Inflation



4 RESULTS

4.1 Results of SVAR

The results of our SVAR model are based on the impulse responses functions as well as the analysis of the forecast error variance decompositions. We investigate the effects of shocks in exchange rate on the other variables in the system as well as the reaction of variables to the monetary policy shocks. The number of periods is set equal to 15 and we choose 100 as a number of bootstrap replications with 95% Efron and Hall Percentile confidence interval which shows us the uncertainty of our estimation. The empirical evaluation is done by using the JMulTi software.

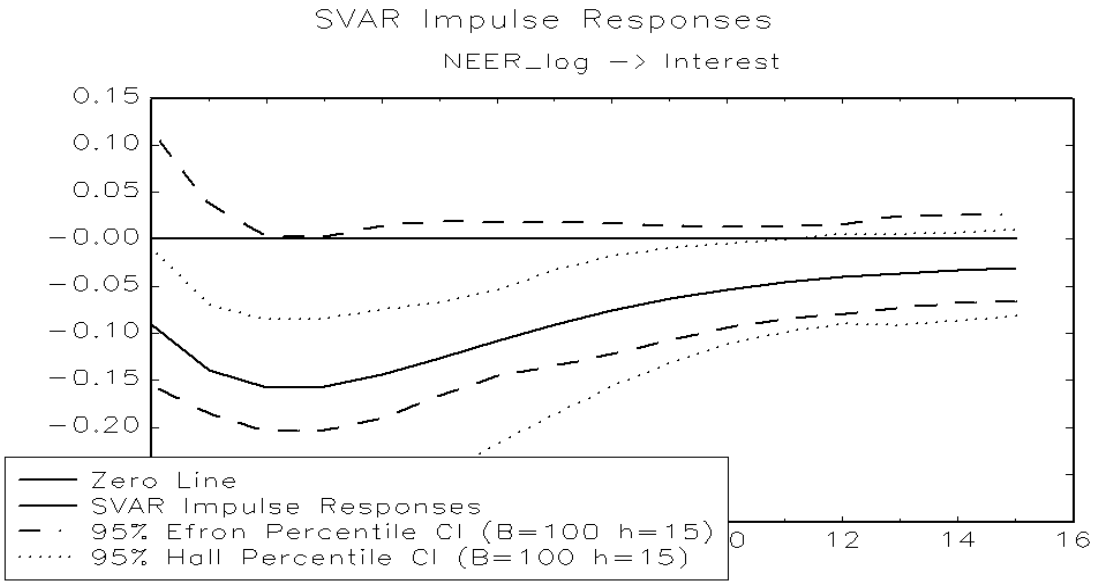
4.1.1 Impulse Responses Analysis

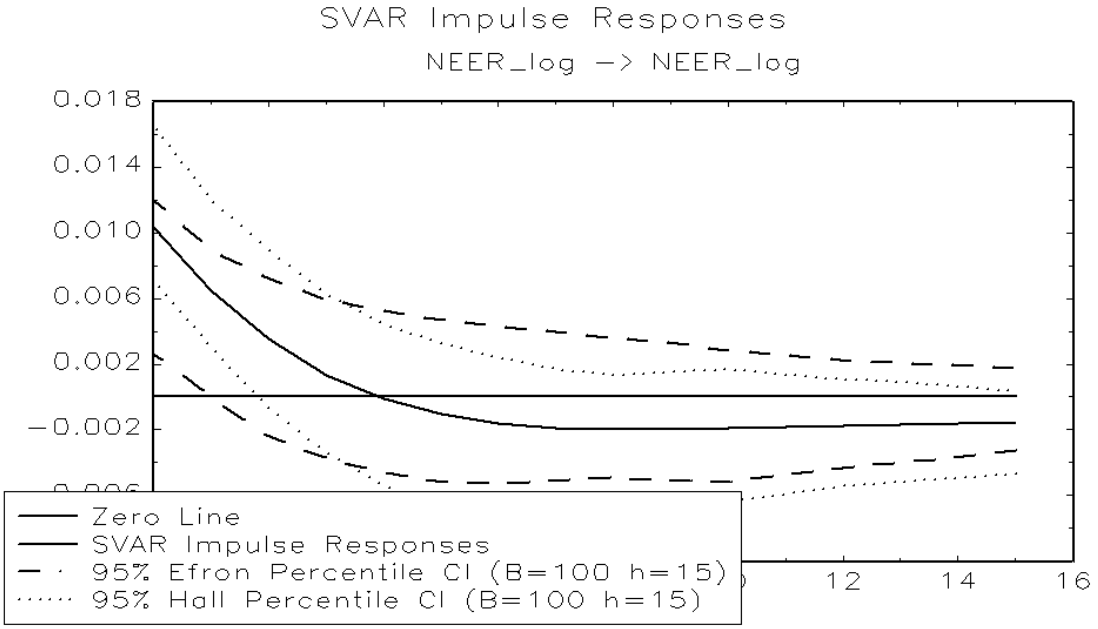
In this section we evaluate the baseline model[13] and summarize the conclusions for the impulse response functions of our model. Figures 7 and 8, present the response of the system to shocks to the exchange rate and shocks to the interest rate that are the monetary policy shocks. It is important to emphasize in advance, that two connections must be true for an accurate work of the exchange rate channel within the monetary transmission structure. First, it must be a connection between the exchange rate and monetary policy. Secondly, the exchange rate has to affect the output and inflation (Kolasi et al., 2010). We seek to investigate the importance of exchange rate channel and to explore whether the monetary policy is responsive to exchange rate developments.

Regarding the exchange rate shock, the reaction of the domestic variables is consistent as predicted by economic theory. The vertical axis in the figures shows the estimated percentage point change in the respective response variable because of a one-percent shock after n periods. First, we observe that a positive shock to the exchange rate causes a fall in the interest rate, with an effect becoming significant after three quarters. Interest rate will respond on time to the shock in the exchange rate and decrease with 0.14% in reaction to the 1% depreciation of the ALL currency. This indicates that the Bank of Albania has in fact considered exchange rate shocks smoothing in its policy rule. Considering the latest developments in economy, the Bank of Albania has systematically decreased the interest rate during last years. The purpose has been to stimulate the economy through further financing in ALL loans from banking system. In other words, as Central Bank responses by decreasing domestic interest rate, the local currency becomes more attractive hence it is required more in the loan market. Another argument is that the Central Bank of Albania responses by decreasing domestic interest rate as an effort to make local investments more attractive thus triggering investment inflows. In the short run, these inflows from investments can cause the domestic currency to strengthen as local currency becomes more attractive and it is required more.

[13] Refer in paragraph 2.4

Figure 12. Response of Interest to a positive NEER shock



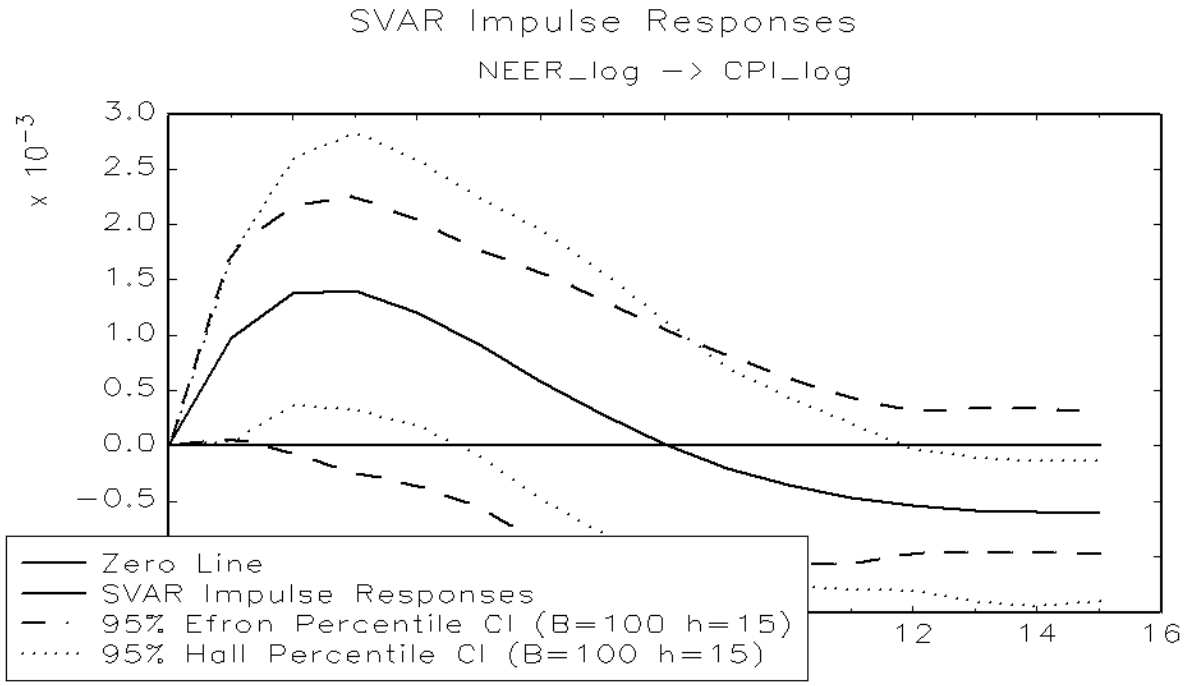


Furthermore, we observe that a positive shock of exchange rate has an expected positive reaction on CPI inflation that reaches the maximum after about three quarters and the effect declines after ten to twelve periods. The response of CPI is very small and Figure 12 suggests that consumer prices will respond to the shock in the exchange rate by an increase of 0.002% as a reaction of the 1% depreciation of the domestic currency. The transmission of exchange rate movements to consumer prices is widely known in the literature as the 'exchange rate pass through'. As the economic theory tells us, when the domestic currency of a country depreciates against foreign currencies (for instance Euro which is the main foreign currency circulating in the Albanian economy), this brings the increase in the domestic market price for the goods which are imported. Therefore it is expected a rise of the Consumer Price Index. Meantime the goods destined for export, have become cheaper in the other foreign markets. As a result, this somehow supports Albanian exports at a time when the goods are exported out of the country and also improves the trade balance of the country. However, an

appreciation of the foreign currency, makes imported goods more expensive thus Albanian consumers will find it more attractive to buy domestic products. In this way, the competitiveness of domestic producers increases. On the other hand, higher import prices cause an increase on the domestic inflation. Given this, we are faced with the so called "imported" inflation. This is an expected result in a country like Albania, relying heavily on imports in particular.

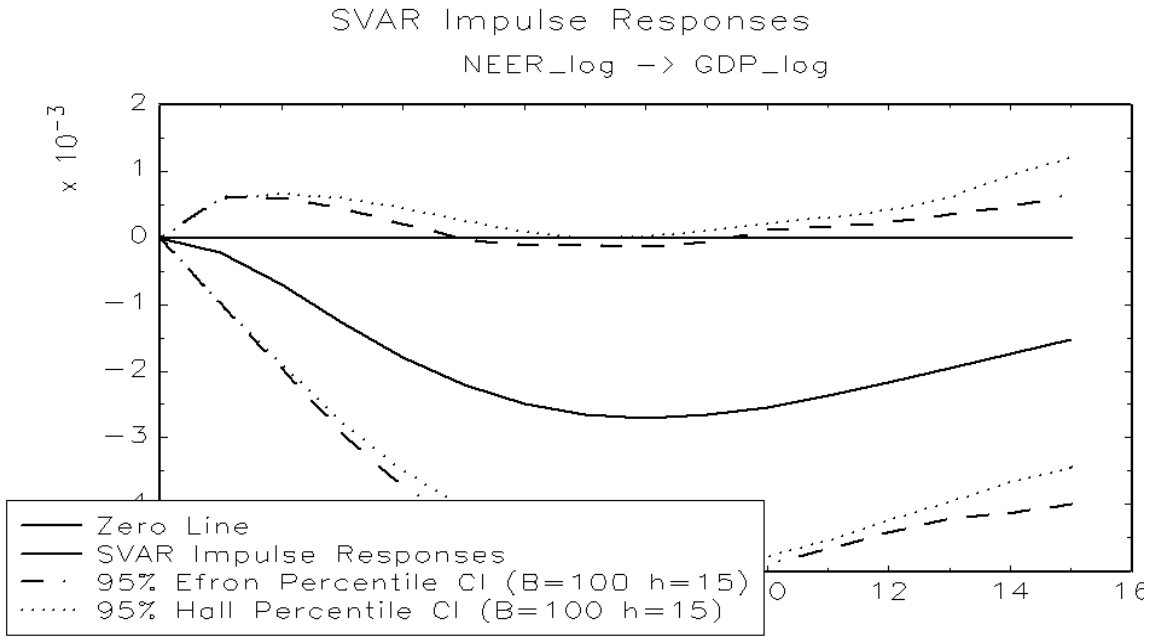
If we consider the overall picture of exchange rate pass-through on prices in Albania, we can say that the effect is relatively small and has become weaker. However, developments like changes in the market structures, the low inflation rates in recent years as well as the stability of Albanian currency, are some possible reasons to explain the decline of exchange rate pass-through. Furthermore, NEER itself has been relatively stable during recent years, showing a decreasing volatility year after year and it has been harder to discover important statistical relationships between exchange rate and other economic elements. This result is in line with empirical findings of a similar research for Albania by Istrefi and Semi (2007).

Figure 13. Response of CPI to a positive NEER shock



Next we observe that there is a decrease in the real output even though during the short run it does not respond a lot. The reasons for the decrease in the output may be related with the increase in the level of foreign currency debt in Albania during last years. In 2015, the Public Foreign Debt has been increased by 19% compared with a year ago. The level of external debt has increased significantly over the last years which indicates that the domestic borrowing is covering the need for debt less and less (ODA, 2015). As a result, there is an increase of the exchange rate risk associated with the growth of foreign currency debt.

Figure 14. Response of Output to a positive NEER shock



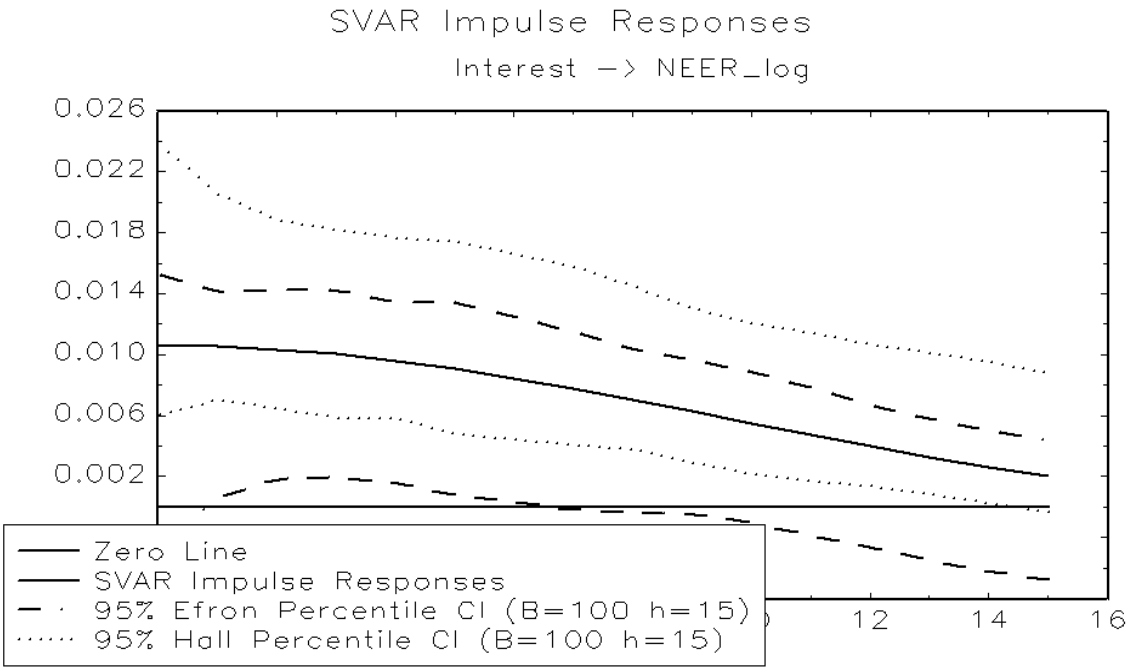
If we consider the overall result, we observe that monetary policy is very responsive to exchange rate shocks and surprisingly maybe even more than to inflation developments. This result is in line with empirical findings of Tanku et al.(2009). As these authors also explain, this is an unexpected result since the operational policy framework in Albania is designed in such way that does not respond to shocks in the exchange rate thus further research is needed for a for a reasonable explanation.

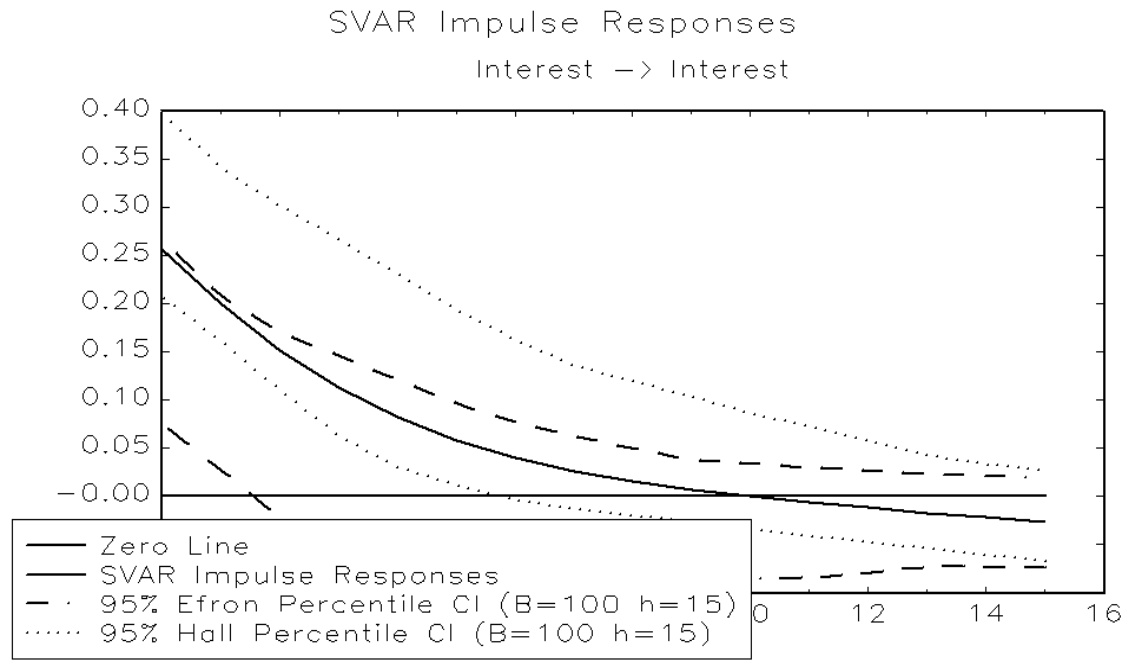
Except analyzing the effects of a shock on exchange rate, the responses of domestic variables to a shock of monetary policy are also observed. If the interest rate raises, it has a direct impact on an increase in NEER which means a depreciation of the Albanian Lek. The normal reaction to an increase in the policy rate, would be a rise in the value of the domestic currency, as assets denominated in domestic currency would become more attractive for foreign investors. In our case, we are faced with the so called "the exchange rate puzzle" that happens when a contractionary monetary policy causes a depreciation of domestic currency. However, a logical explanation behind this is that the interest rate alone cannot determine the value of a currency since host of other factors can affect exchange rate such as inflation rate, balance of trade between imports and exports, economic stability and many other external factors. Furthermore, according to Égert and MacDonald (2006), VAR models can lead to mixed results regarding the relationship between interest and exchange rates. These authors explain that a positive interest rate shock can lead to appreciation or depreciation of the exchange rate.

In the case of Albania, the trade balance can be one of the arguments. The trade balance has been often decreasing because imports versus exports have grown considerably. During the last 5-years period (2012-2016), even though the import of goods has been fluctuating (ups

and downs), it has resulted in an average annual increase with 1.4 %. Therefore, this may lead to a relatively less demand for Albanian currency (INSTAT, 2016).

Figure 15. Response of NEER to a positive Interest shock





Moreover, we observe that if the interest rate increases, this cause a decrease in domestic prices. Generally, higher interest rates lead consumers to save more as returns from savings are higher. This indicates that the economy slows and inflation decreases due to an increase in savings. Hence, the results leads to the so called "the price puzzle", a phenomenon by which an increase in interest rates, causes a continuous increase in the level of prices. Sims (1992), suggests one of many explanations regarding this phenomenon. The Central Bank reacts

against higher expected inflation by increasing the interest rate by not as much as necessary to prevent inflation from the actual increase. Consequently, if the interest rate increases, it is followed also by an increase in inflation.

Furthermore, Balke and Emery (1994) consider another explanation related with the monetary authority responses against supply shocks in the economy. As authors explain, an example of a temporary negative supply shock, would at least in the short run, have the effect of raising real interest rates, decreasing output, and increasing prices. Considering a small open economy like Albania where imported products have a relatively large share in the structure of final consumer goods, supply-side shocks can also take the form of consumer price increase in trading partners or the form of exchange rate shocks (Bank of Albania, 2017a). Therefore, effects of supply shocks are of primary importance to the Bank of Albania.

Last we observe that in case of a positive interest rate shock, there is a very small positive effect on output. The insignificant response may be due to behavioral restrictions imposed in our baseline model. However, an increase in interest rate make loans in foreign currency to become more attractive and generally tend to attract foreign investments. Since 2000, there has been an obvious increase on foreign direct investments in Albanian economy. Even after the financial crisis of 2008, the foreign direct investments continued to increase. By the end of 2015, the foreign investment stock in Albania increased with 15% on annual terms, and reached a level of EUR 4,353 million (KPMG, 2017).

Figure 16. Response of CPI to a positive Interest shock

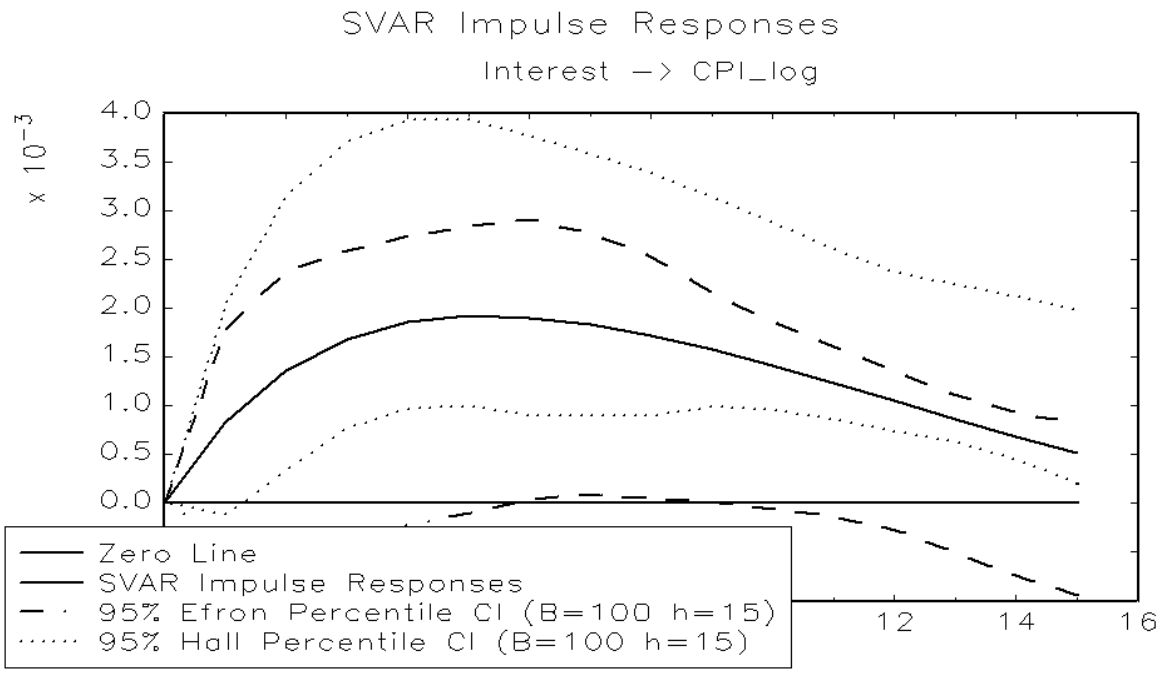
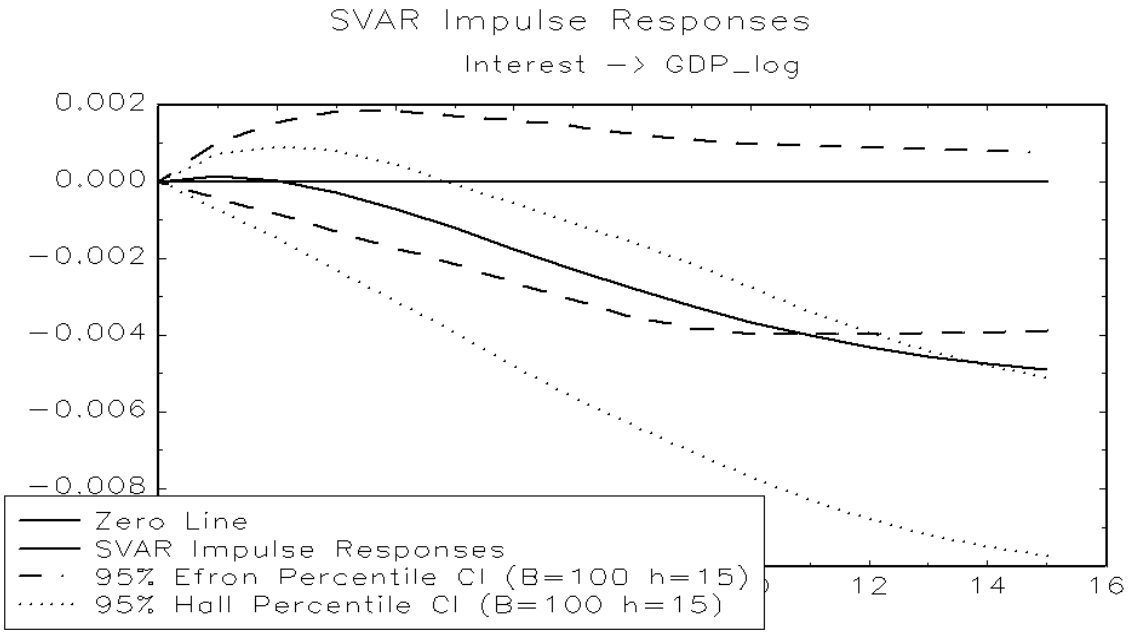


Figure 17. Response of Output to a positive Interest shock



After giving possible reasons for the impulse responses results, we now focus on checking if our results are consistent with those already existing in the literature which are mentioned in first chapter. Our results appear to match up very well to the findings of Kolasi et al.,(2010), about the effect of a sudden exchange and interest rate shock on the Albanian economy. Moreover, the shapes of their model's impulse responses are the same to ours which therefore confirm the results we have discussed above.

Additionally, Table 7 and 8 present the results of estimated coefficients of impulse responses functions of exchange rate and interest rate shocks into domestic variables.

Table 7. Impulse Responses functions: effects of exchange rate shock

Time	NEER_log ->Interest	NEER_log ->CPI_log	NEER_log ->GDP_log	NEER_log ->NEER_log
1 point estimate	-0.1397	0.0010	-0.0002	0.0065
3 point estimate	-0.1579	0.0014	-0.0007	0.0035
5 point estimate	-0.1270	0.0009	-0.0022	-0.0010
7 point estimate	-0.0910	0.0003	-0.0027	-0.0019
9 point estimate	-0.0634	-0.0002	-0.0027	-0.0020
11 point estimate	-0.0461	-0.0005	-0.0024	-0.0018
13 point estimate	-0.0362	-0.0006	-0.0020	-0.0017
15 point estimate	-0.0305	-0.0006	-0.0015	-0.0016

Table 8. Impulse Responses functions: effects of monetary policy shock

Time	Interest ->Interest	Interest ->CPI_log	Interest ->GDP_log	Interest ->NEER_log
1 point estimate	0.1996	0.0008	0.0001	0.0106
3 point estimate	0.1127	0.0017	-0.0003	0.0100
5 point estimate	0.0582	0.0019	-0.0012	0.0091
7 point estimate	0.0261	0.0018	-0.0023	0.0078
9 point estimate	0.0067	0.0016	-0.0033	0.0063
11 point estimate	-0.0066	0.0014	-0.0040	0.0047
13 point estimate	-0.0172	0.0011	-0.0046	0.0033
15 point estimate	-0.0264	0.0008	-0.0049	0.0020

4.1.2 Forecast Error Variance Decomposition

Forecast error variance decompositions (hereinafter: FEVDs) are well known methods to interpret the VAR models. Following Lütkepohl et al.(2006), if we denote the i jth element of the orthogonalized impulse response coefficient matrix Ψn by $\psi ij,n$, the variance of the forecast error which is expressed as:

$$y_{k,T+h} - y_{k,T+h|\mathrm{T}} \tag{33}$$

is

$$\sigma_k^2(h) = \sum_{n=0}^{h-1}\left(\Psi_{k1,n}^2 + \cdots + \Psi_{kK,n}^2\right) = \sum_{j=1}^{K}\left(\Psi_{k1,0}^2 + \cdots + \Psi_{k1h-1}^2\right) \tag{34}$$

where the term $\left(\Psi_{k1,0}^2 + \cdots + \Psi_{k1h-1}^2\right)$ is the contribution of variable *j* to the *h*-step forecast error variance of variable *k*. By dividing the above terms by $\sigma_k^2(h)$, it gives the percentage contribution of variable *j* to the *h*-step forecast error variance of variable *k*,

$$\omega_{kj}(h) = \left(\Psi_{kj,0}^2 + \cdots + \Psi_{kj,h-1}^2\right)/\sigma_k^2(h) \tag{35}$$

In our model, the variance decomposition shows us about the importance of every shock on the variance of interest rate. In this way, we try to understand how much is the explanatory power of a shock of exchange rate on the policy reaction function. In other words, variance decompositions assess the percentage of the interest rate forecast variance that can be explained by different shocks. The results are presented below in Table 9.

As we see from the results, the interest rate variance is explained up to 30 percent by exchange rate shocks and the major part is explained by shocks of domestic prices with up to

31 percent. However, the majority of the variance of interest rate is attributed to its own innovations. As an inflation targeting country following a free floating exchange rate, this result is logical for Albania, since the interest rate is more sensitive to the changes in inflation. Moreover, from the forecast error variance of monetary policy, we observe that the effect of exchange rate shock declines over time and the maximum explanatory power of inflation shock increases over time as a result of inflation targeting implementation in Albania.

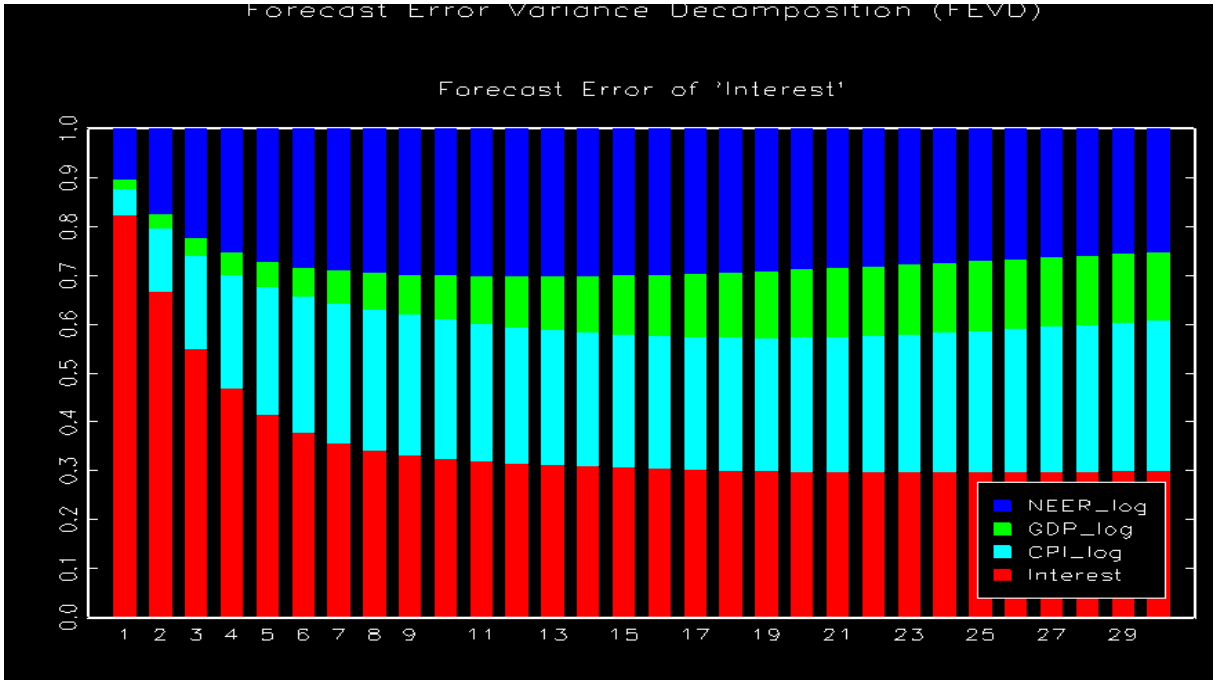
Table 9. FEVD: The maximum effects of shocks on monetary policy

Proportion of forecast error in "Interest" accounted for by:				
Forecast Horizon	Interest	CPI_log	GDP_log	NEER
1	0.82	0.05	0.02	0.10
2	0.67	0.13	0.03	0.18
3	0.55	0.19	0.04	0.22
4	0.47	0.23	0.04	0.26
5	0.41	0.26	0.05	0.27
6	0.38	0.28	0.06	0.29
7	0.35	0.29	0.07	0.29
8	0.34	0.29	0.08	0.30
9	0.33	0.29	0.08	0.30
10	0.32	0.29	0.09	0.30
11	0.32	0.28	0.10	0.30
12	0.31	0.28	0.10	0.30
13	0.31	0.28	0.11	0.30
14	0.31	0.27	0.12	0.30
15	0.30	0.27	0.12	0.30
16	0.30	0.27	0.13	0.30
17	0.30	0.27	0.13	0.30
18	0.30	0.27	0.13	0.29
19	0.30	0.27	0.14	0.29
20	0.30	0.27	0.14	0.29
21	0.30	0.28	0.14	0.29
22	0.30	0.28	0.14	0.28
23	0.30	0.28	0.14	0.28
24	0.30	0.29	0.14	0.28
25	0.30	0.29	0.14	0.27
26	0.30	0.29	0.14	0.27
27	0.30	0.30	0.14	0.26
28	0.30	0.30	0.14	0.26
29	0.30	0.30	0.14	0.26
30	0.30	0.31	0.14	0.25

If we consider the overall picture of exchange rate shock on policy reaction in Albania, we can say that from 2001 and after, monetary policy has been very responsive to changes in exchange rate shocks, even though the effect of exchange rate has become weaker. The developments of market structures, a general low inflation rate as well as a stable Albanian currency over the last years, may be the causes for the decline of the effects of exchange rate. Furthermore, NEER itself has been relatively stable during recent years, showing a decreasing

volatility year after year and thus it has become more difficult to search for statistical interactions between exchange rate and other economic variables. Therefore, the Bank of Albania must react carefully to changes in exchange rate. Keeping under surveillance the exchange rate, can be a helpful tool in order to control the desirable level of consumer prices.

Figure 18. Variance Decomposition



4.1.3 Robustness Analysis

The robustness check is another important part of our empirical study. In order to control if our results are correct and to verify the robustness, we propose a reordering of the variables and compare the results with the first scheme proposed in section 2.1.1. Therefore, we put the nominal effective exchange before the interest rate while the restrictions remain same as before. The outcomes of the new ordering system show almost the same results and impulse responses compared with the previous identification scheme. Moreover, the results show insignificant changes between estimated coefficients based on two different specifications. This leads us to the conclusion that our model is robust. The results are summarized in Appendix C.

4.2 Results of GMM

This part presents in detail the empirical findings of our baseline model (23). The used instruments in the estimation of the model include the first four lags of inflation rate and the output gap, interest rate itself and NEER. For our GMM analysis we use heteroscedasticity and autocorrelation covariance matrix estimation. Moreover we choose Barlett weights in

order to ensure a positive definiteness of the estimated variance covariance matrix. The results are obtained by implementing GMM in E-views.

To test the validity of the chosen instruments and overall specification of the model, we compute the Hansen's J-test, for over-identifying restrictions. As seen from the results, the p-value of the J-statistics (0,68) , shows that we can't reject the null hypothesis that our instruments are valid or the model is correctly specified. Therefore, we decide for two main conclusions: validity of our instruments set and monetary policy rule in our model does not omit important variables that enter the central bank rule.

The empirical findings of the baseline model are presented in Table 10. To begin with, every coefficient is statistically significant and shows the expected sign. Moreover, the high R-squared shows that our open economy Taylor rule explains very well the behavior of the interest rate setting from the Bank of Albania.

Being in line with findings in Clarida et al.(1998), our result regarding the estimation of the expected inflation (1.10) with a standard error (0.31), shows that an increase in the expected annual inflation of one percent, causes the Bank of Albania to rise the interest rate by 10 basis points. As showed from the results, since this coefficient is significantly bigger than one, it is statistically significant that the Central Bank of Albania increases the interest rate as a reply to inflationary pressures.

Furthermore, we observe a high level of sustainability of the base interest rate (0.91). This coefficient shows that if the interest rate increase with 1 point percent in the previous quarter, this brings to an increase of the actual rate with 0.91 point percent. In other words, the lagged coefficient of the interest rate points out smooth movements in the monetary policy indicator. This is also supported by graphical presentation (Figure 7), which demonstrates a gradual and volatile change of the interest rate over time.

Moreover, judging on the coefficient on the output gap, we observe that it is positive (0.50) and statistically significant with an error term (0.20). We can say that, a one percent increase of the output gap, causes the Bank of Albania to raise the interest rate by 50 basis points. However, we emphasize the fact that the response of Central Bank to real economy is independent to its reaction regarding inflation. Again, the estimation results regarding expected inflation and output are in line with those provided by Clarida et al.(1998).

It is observed that monetary policy in Albania reacts to the changes in nominal effective exchange rate. The significance of exchange rate indicates that Bank of Albania takes exchange rate developments into consideration while setting its policy rate. Factors such as the developments of market structures, stability of the domestic currency and a general low inflation may be the causes for the decline of the effects of exchange rate. Furthermore, NEER itself has been relatively stable during recent years, showing a decreasing volatility year after year and thus it has become more difficult to search for statistical interactions that might exist between exchange rate and other economic variables.

The expected negative sign of the exchange rate coefficient, shows that Bank of Albania decreases its policy interest rate in response to an increase in NEER (or an depreciation of Albanian currency). As Central Bank responses by decreasing interest rate, the local currency becomes more attractive hence it is required more in the loan market. Therefore the Bank of Albania tends to strengthen the domestic currency (ALL). This tendency is also supported by graphical presentation of the interest rate. Moreover, the accommodative monetary policy stance in Albania, brought interest rates to the lowest historical levels of 1.25 percent since May 2016. Therefore, the results show that Central Bank in Albania is responsive to changes in exchange rate, even though committed to an inflation targeting framework with a floating exchange rate regime.

Table 10. Generalized Method of Moments results

	Coefficient	Std. Error	t-Statistic	Prob.
INTEREST(-1)	0.917446	0.019783	46.37513	0.0000
Constant	2.364881	8.007511	4.312970	0.0001
INFL(+4)	1.101051	0.313554	3.511519	0.0010
OUTPUTGAP	0.505919	0.201052	2.516367	0.0155
NEER	-0.018913	0.004044	-4.677024	0.0000
R-squared	0.977195	Mean dependent var		4.671800
Adjusted R-squared	0.975168	S.D. dependent var		1.402887
S.E. of regression	0.221069	Sum squared resid		2.199209
Durbin-Watson stat	1.235946	J-statistic		9.225604
Instrument rank	17	Prob(J-statistic)		0.683550

We conclude that our results obtained from GMM estimation are in line with the results acquired from SVAR. The empirical evidence presented above, confirms the finding of previous studies about the interest rate setting from Bank of Albania. Our results appear to match up very well to the findings of similar research from Tanku et al. (2009) and Kolasi et al. (2010) also showing that that monetary policy in Albania is responsive to changes in exchange rate.

CONCLUSION

Albania has been one of the last countries so far, to have endorsed inflation targeting. Many empirical studies in Albania have been performed focusing on the importance of the exchange rate within an inflation targeting framework. In this context, our research work wanted to throw some light on the existing interactions between monetary policy and exchange rate in Albania, by using Structural VAR and GMM method for the period from 2001 to 2017.

The purpose of this thesis was twofold: one to investigate how the monetary policy reacts against shocks of the exchange rate and vice versa in an inflation targeting country like Albania and the other is to explore the status of monetary policy with regard to exchange rate developments in Albania.

Using Structural VAR, the impact of shocks was investigated through impulse response analysis. Following the scheme proposed in the influential paper of Kim and Roubini (2000), our results show that the monetary policy in Albania is responsive to changes in exchange rate developments. We observed that in cases when a positive exchange rate shock happens, it leads to a fall in the interest rate, with an effect becoming significant after three quarters. The Central Bank of Albania replies by decreasing domestic interest rate thus making local currency more attractive to investors. As Albanian Lek is required more, the domestic currency will tend to appreciate. Moreover, we analyzed the variance decomposition in order to examine the explanatory power of a shock of exchange rate on the policy reaction function.

Our results showed that the interest rate variance is explained up to 30 percent by exchange rate shocks and the major part is explained by shocks of domestic prices with up to 31 percent. However, the effect of exchange rate shock declines over time and the maximum explanatory power of inflation shock (or CPI shock) increases after the adoption of inflation targeting in Albania. Therefore, a careful monitoring and observation of the exchange rate can be a helpful tool to manage the level of consumer prices in economy.

The second approach consisted in analyzing a forward looking Taylor type of rule by including the effects of exchange rate in addition to expected inflation and output gap. Following Clarida et al. (1998) and applying the Generalized Method of Moments to estimate the equation, we intended to investigate whether the exchange rate developments entail changes in monetary policy interest rate setting. Our result regarding the estimation of the expected inflation suggest that its statistical significance implies the Bank of Albania to increase its interest rate as a reply against inflationary pressures in the economy. Moreover, the significance and expected sign of exchange rate showed that the Albanian Central Bank decreases the monetary policy interest rate in response to an increase in NEER (a depreciation of Albanian currency Lek). As a result, the Albanian currency Lek becomes more attractive and it is required more in the loan market. The tendency of the Bank of Albania to strengthen the domestic currency Lek, brought interest rates to the lowest historical levels of 1.25 percent since May 2016.

As a result, we conclude that the outcomes from GMM estimation are consistent with the results obtained from SVAR. We infer that Central Bank in Albania is responsive to changes in exchange rate, even though committed to inflation targeting. As an economy that import the majority of the goods, the role of exchange rate should be brought into a special focus in relation to monetary policy. Therefore the Bank of Albania must maintain a stabilizing role in the economy and consider the occasional exchange rate management to prevent large exchange rate fluctuations in the economy.

Finally, the inclusion of the exchange rate in Taylor rule could bring problems for the communication of monetary policy to the public and thus affecting its credibility. It is crucial to emphasize that in any case when the Bank of Albania decides to interfere in the foreign exchange market, it must explain in detail that the nature of this interference is not related with the achievement of the final objective. The transparency regarding the activity of the Bank of Albania is important to be done through an open and clear communication with the public.

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APPENDIXES

TABLE OF APPENDIXES

APPENDIX A: List of Abbreviations

ADF	Augmented Dickey-Fuller
AFSA	Albanian Financial Supervisory Authority
ALL	The Currency Code for Albanian Lek
CPI	Consumer Price Index
FEVD	Forecast Errors Variance Decomposition
GDP	Gross Domestic Product
GMM	Generalized Method of Moments
HP	Hodrick-Prescott filter
IMF	International Monetary Fund
INSTAT	The Institute of Statistics
IV	Instrumental Variables
NEER	Nominal Effective Exchange Rate
ODA	Open Data Albania
REPO	Repurchase Agreement
SVAR	Structural Vector autoregression
VAR	Vector autoregression

APPENDIX B: Tests for non-normality and Estimated Coefficients for SVAR

Table 1. Tests for non-normality

```
Reference: Doornik & Hansen (1994)
joint test statistic:     17.6436
 p-value:                  0.0241
degrees of freedom:    8.0000
skewness only:           4.6636
 p-value:                  0.3236
kurtosis only:          12.9800
 p-value:                  0.0114

Reference: Lütkepohl (1993), Introduction to Multiple Time Series Analysis, 2ed, p. 153
joint test statistic:     11.3594
 p-value:                  0.1822
degrees of freedom:    8.0000
skewness only:           2.4796
 p-value:                  0.6483
kurtosis only:           8.8798
 p-value:                  0.0642
```

Table 2. Estimated Coefficients for SVAR

```
Obtaining starting values from decomposition of correlation matrix.
Iterations needed for correlation matrix decomposition:  24.0000
Vector of rescaled starting values:
  2.8030
 -3.0955
-35.4227
181.8304
 31.3176
  6.5923
174.7429
 80.8422
 24.6442
 69.3681
Structural VAR Estimation Results
ML Estimation, Scoring Algorithm (see Amisano & Giannini (1992))
Convergence after 1 iterations
Log Likelihood: 810.1141
Structural VAR is just identified

Estimated A matrix:
  2.8030 -35.4227   0.0000  24.6442
  0.0000 181.8304   6.5923   0.0000
  0.0000   0.0000 174.7429   0.0000
 -3.0955  31.3176  80.8422  69.3681

Estimated standard errors for A matrix:
  0.9169  25.3765    0.0000  19.8347
  0.0000  16.8825  22.9530    0.0000
  0.0000   0.0000   16.2245    0.0000
  0.9230  26.4830  24.1569  10.0473
```

APPENDIX C: Robustness Check

Figure 1. Exchange Rate shock

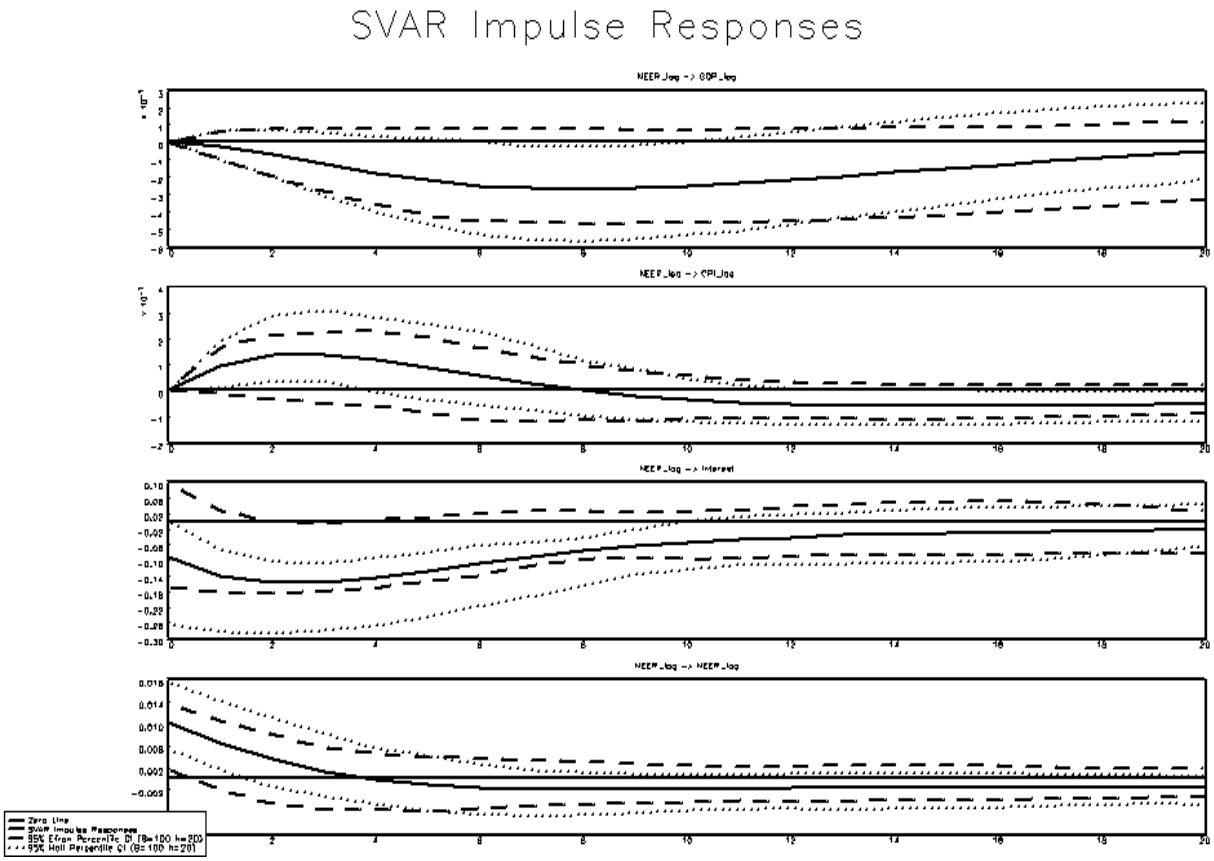
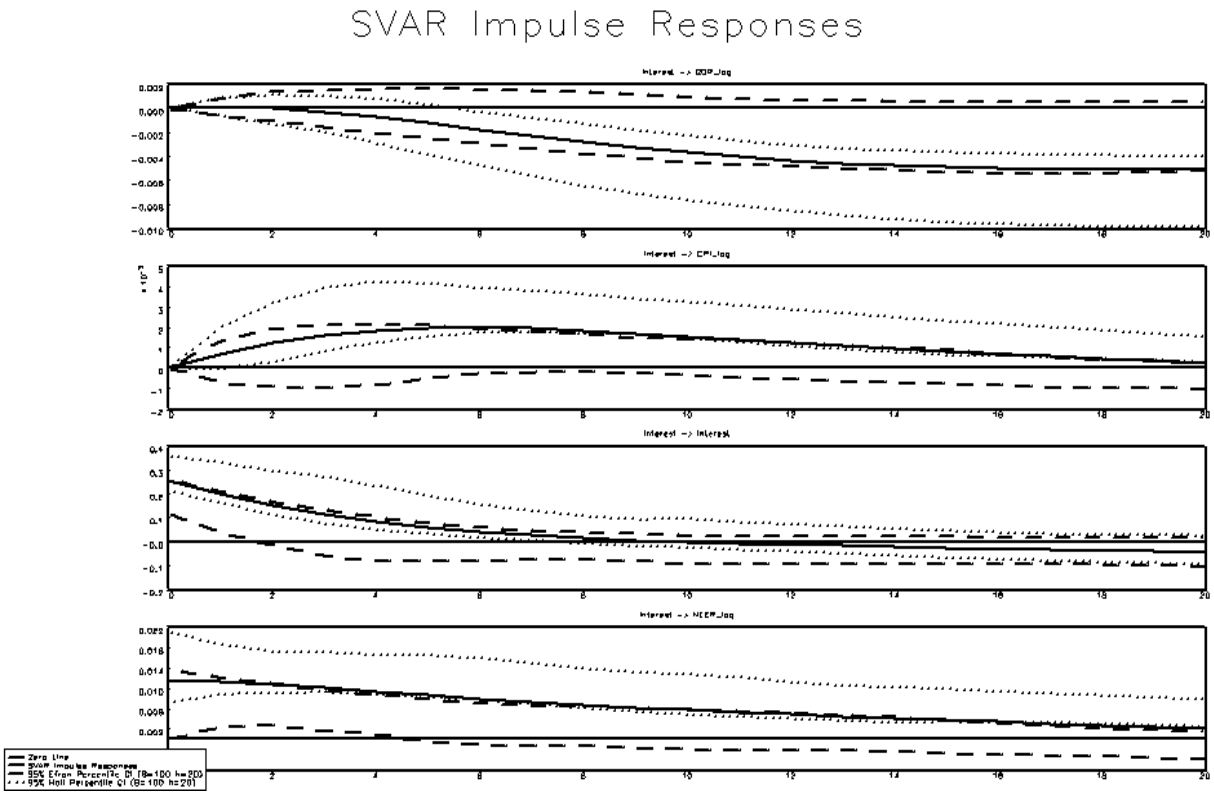


Figure 2. Monetary Policy shock



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« I dedicate this Master Thesis to my mom and dad »