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DOLLARIZATION AND ITS IMPLICATIONS ON MONETARY POLICY DECISIONS: THE CASE OF GEORGIA

Master's Thesis

Supervisor: Professor Karsten Staehr

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I declare I have written the master's thesis independently.

All works and major viewpoints of the others authors, data from other sources of literature and elsewhere used for writing this paper have been referenced.

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ABSTRACT

Dollarization in Georgia has been a reaction to macroeconomic instability, fluctuating inflation and volatile exchange rate. In the presence of dollarization, the total money supply in the economy is not entirely controlled by the central bank and therefore, conducting monetary policy is less effective. This thesis investigates both, theoretically and empirically, possible determinants and their significance on dollarization in Georgia using composition of bank deposits and broad money, accompanied by Granger causality testing of three possible driving factors based on VECM. Findings indicate two main channels through which dollarization is affected by. Based on the results, implications on monetary policy decisions and author's recommendations are given.

Keywords: dollarization, inflation targeting, exchange rate regimes, monetary policy, Granger causality, Georgia.

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INTRODUCTION

It is empirically seen that from time to time some currencies become stronger compared to other currencies. In 2015, the best example of such a currency is the U.S. dollar which has a negative correlation with oil price and denominates as a currency in oil trading. As the price of crude oil has continuously decreased from July 2014, U.S. dollar has started to become stronger and, therefore, weakening another countries' domestic currencies. This leads to an issue of currency substitution due to the fact of depreciated value of money which applies incredibility of the domestic currency and inducing the existence of anchor currency within the country.

Different literature has suggested that the main causes of currency substitution i.e., dollarization are high inflation and unstable economy in general. In Georgia, fluctuating inflation rate has been an issue for many years which also decreases the trustworthiness of the national currency. In addition, floating exchange rate regime makes Georgian lari dependent on international currencies. As a result of recent decrease in the price of crude oil, the exchange rate between U.S. dollar and Georgian lari has increased approximately 30 percent.

In the presence of dollarization, the total money supply in the economy is not entirely controlled by the central bank and therefore, conducting monetary policy is less effective. In Georgia, dollarization index measured by percentage of foreign deposits to broad money has recently increased from 45.08% (in December 2014) to 49.54% (February 2015). Taking into account the importance of dollarization in the context of conducting monetary policy, the central research questions in this thesis are:

1) how significant is dollarization in Georgia by analysing the composition of total deposits and dollarization index over time,
2) what are the driving factors causing dollarization in Georgian economy, and
3) which are the main monetary tools available to the National Bank of Georgia to control for dollarization.

In order to answer to the research questions, the author aims to analyse other author's articles and research papers in order to obtain the main understandings of the term of dollarization and

its essence in several countries including both developed and developing ones. For this purpose, the author uses academic literature and scientific articles obtained from international peer-reviewed economic journals.

After gathering relevant information about dollarization and its determinants, the author turns to the case of Georgia. Indices based on foreign currency deposits and the structure of bank deposits are analysed in order to assess the effect of dollarization and its change in time on Georgian economy. Furthermore, Granger causality test is used for the purpose of determining the relationship between dollarization and its possible factors. The latter one is rather important factor to consider in making monetary policy decisions.

The thesis is structured into three main parts. In Chapter 1, different terms of dollarization are presented and factors affecting it are analysed. In addition, connections between dollarization and monetary policy are discussed focusing, in particular, on inflation targeting and exchange rate regimes. Moreover, a short overview about the definition and trends of de-dollarization are shown.

Chapter 2 gives the general overview about dollarization phenomenon in Georgia and its change over time. Additionally, the choice of inflation targeting and floating exchange rate regime is explained and analysed in regards of making monetary policy decisions in the existence of dollarization.

Chapter 3 builds on a four-variable VECM focusing on the possible relationship and Granger causes between dollarization and its three possible driving factors. The essence of these relationships is important to take into consideration by the National Bank of Georgia in regards of conducting monetary policy, in particular, controlling for the domestic currency in circulation or setting short-term interest rates.

1. DOLLARIZATION

1.1. The Role of Money in an Economy

Money can be defined as a commodity or group of commodities which are paid or received in exchange for other commodities and services. In further detail, the person who receives money in exchange for commodities or services has no other aim that of using it in another exchange for goods and services. Therefore, money is the only commodity which never finds an ultimate destination as it is circulating from hand to hand, and eventually worn out or lost. (Young 1999 266) In general, money has four basic functions. First, it is used as a standard of value. Second, it serves as a standard of deferred payments. First two are also referred to as non-quantitative functions. The last two functions of money applies as a medium of exchange and store of value which are its quantitative functions as they rather refer to the quantity than existence of money. (Copeland 1952, 211)

Money which has two above mentioned quantitative functions takes the form of various types of financial assets and it helps to construct the concept of broad money aggregates. In this regard, it is necessary to focus on the extent to which a financial asset provides liquidity and store of value. Monetary aggregates together form a definition of either broad money or divisia money. In the first case, the money components are weighted linearly and equally whereas in the latter, according to the usefulness for transactions purposes. Therefore, divisia money formulation points out the possible trade-off between the medium of exchange and store of value functions of holding different money components such as currency, transferable deposits, and time deposits. In particular, relatively illiquid deposits are less likely used for transactions purposes than highly liquid currency and in order to compensate the trade-off of less liquidity, higher interest rates should be paid on the less liquid financial assets. (International Monetary Fund 2008, 183)

Based on the two quantitative functions of money, the demand for money as a function of different variables can be formed. Specifically, the theory focuses the variables that motivate market participants to some proportion of their wealth in money instead of other assets. It is possible to distinguish between three main approaches which are the classical, the Keynesian and the post-Keynesian approach. In the classical approach, the transactions demand for

money in terms of the velocity of circulation of money is emphasized as a key variable influencing the interaction between the money supply and the demand for money. Therefore, money acts mainly as a medium of exchange rather as a store of value. (Bitrus 2011, 771-772)

Keynes introduced three motives for holding money which are the transactionary, the precautionary, and the speculative motive. Each of the motives focuses on one component of the demand for money and includes already the second quantitative function of money – store of value. Transactionary demand for money is all about the need of holding cash for current consumption and business expenditures. In addition to daily expenditures, the precautionary motive brings out the need to hold cash for unexpected events. Finally, the speculative demand focuses on the importance of uncertainty about the future interest rate. In particular, due to risk and uncertainty of expectations, the negative relationship between the interest rate and the speculative demand for money is expected. (Bitrus 2011, 772)

Post-Keynesian approach builds on interest rate as one the factors affecting only speculative money demand. However, James Tobin points out the importance of the interest rate also in regards of transactions and precautionary demand of money. James Tobin theory of transactions demand relies on the interaction between the marginal revenue and marginal cost where the number of optimal transactions determines the demand for money. Milton Friedman also assumes that demand for money in general depends on rates of return. Specifically, an increase in the expected rate of inflation has a positive effect on the demand for commodities while it affects negatively the demand for money. (Bitrus 2011, 772)

1.2. Definitions of Dollarization

In order to understand the phenomenon of dollarization, it is important to focus on different definitions and classifications of dollarization. Dollarization in general implies the replacement of domestic currency with any foreign currency (Zoryan 2005, 43). In other words, the residents of a country use foreign currency along with or instead of their own local currency in order to store value in a better way as well as making significant transactions. Dollarization does not only apply the usage of the U.S. dollar but the usage of any other country's foreign currency which can be used in international transactions and is reliable (Ghalayini 2011, 129). Such currencies also can be, for example, euro or pound sterling.

Nevertheless, U.S. dollar is considered an appropriate substitute of the domestic currency as it has many advantages compared with other currencies (Loiseau-Aslanidi 2012, 70). First, being a stable currency makes it a reliable store of value. Additionally, it is widely accepted as a medium of exchange in most of the countries and protects its users against of domestic bank failures, currency devaluation and inflation (Feige 2002 cited in Zoryan 2005, 48). Therefore, this paper mostly focuses on such cases where U.S. dollar is used along with national currency.

Dollarization can be further divided into three different types which are official (*de jure*), unofficial (*de facto*) and semi-dollarization (partial). In the case of official dollarization, foreign currency has typically exclusive legal tender status which implies the official recognition of foreign currency as a medium of payment within a country. Such countries are, for example, Panama, El Salvador and Ecuador (Ghalayini 2011, 129-130). Some literature has referred to the situation where a country entirely substitutes its domestic currency with another one as *full dollarization* (Calvo 2002, 395).

Unofficial dollarization occurs when residents of a country prefer the foreign currency over the domestic currency for the purpose of private transactions. Although the currency is not used as legal tender, locals might hold their deposits in foreign currency as a result of incredibility of local currency. Therefore, the existence of unofficial dollarization enables residents to hedge themselves against currency depreciation or high inflation (Ghalayini 2011, 129).

The occasion where domestic and foreign currencies are used interchangeably is referred to as bi-monetary system or semi-dollarization (Ghalayini 2011, 130). Therefore, foreign currency

is used in addition to domestic currency in any of the following roles of money such as a unit of account, means of payment or store of value (Calvo 2002, 394). In this situation also the term of co-circulation can be used which implies the regular use of two or more currencies within the country's economy (Zoryan 2005, 41). Semi-dollarized countries nowadays are, for example, Liberia, Cambodia, and the Bahamas.

Unofficial dollarization can be further classified based on three functions of money:

1. Payment dollarization refers to the use of foreign currency as a mean of payment.
2. Financial dollarization implies holding financial assets/keeping savings in foreign currency and at the same time preferring trading operations in local currency.
3. Real dollarization applies setting prices and wages in foreign currency in addition to domestic currency. Therefore, in the case of real dollarization, payment dollarization occurs along with financial dollarization as in addition to official domestic currency, foreign currency can be used for payments and holding financial assets. (Samadashvili 2010)

1.3. Determinants of Dollarization

Previous research has shown that dollarization mainly takes place in developing countries. The main possible explanation for this is the history of macroeconomic instability which has implied high inflation and fluctuating exchange rate issues (Loiseau-Aslanidi 2012, 70). Although there is no clear empirical evidence about the exact direction of impact how determinants of dollarization affect the usage of foreign currency, this part mostly focuses on theoretical understandings and explanations, based on previous empirical findings, of possible factors affecting the existence of dollarization.

1.3.1. Changing Inflation Rate

Most of the empirical work has focused on developing countries where currency substitution is expected to be caused by changing inflation and where correlation between the two variables is positive. Bogetié (2000) has explained this phenomenon that as high is the domestic inflation rate relative to the foreign inflation rate, the level of foreign currency holdings becomes higher due to the fact of decrease in the relative purchasing power of domestic currency (Ghalayini 2011, 132). Therefore, in the case of high and volatile inflation, basic functions of domestic currency are severely hindered which encourages dollarization as an inflation hedge (Zoryan 2005, 44). High inflation rate is considered as the main reason of dollarization in Latin American countries such as Bolivia, Argentina, Mexico and Peru (Ozsoz *et. al.* 2010, 6).

Although positive relationship between inflation and dollarization is explained by theoretical understandings, empirical evidence gives an opposite outcome. The empirical analysis of the determinants of dollarization in Tanzania suggests negative correlation between inflation and dollarization ratio in 2000-2009. In particular, five-variable VAR model was used including one of the influencing factor of dollarization which is inflation. From the results, a negative sign for inflation rate was obtained which is counterintuitive as the declining inflation rate of the domestic currency would be expected to improve the resident's confidence on the local currency and therefore leading to less foreign currency holdings. (Kessy 2011, 21-23) Thus, this gives a clear evidence that dollarization in Tanzania does not respond to inflation in a manner that is predicted by the theoretical literature.

In addition to correlation between inflation and dollarization, the direction of impact has been modelled. Although it is expected that inflation causes dollarization and not the other way, research from Lebanon suggests the causal effect moves in an opposite way. In particular, the

possible direct influence of the consumer price index on dollarization was researched using monthly data for the period of 2008-2010. A bivariate VAR was used in order to test for Granger causality between the variables. The results obtained showed that the relation between inflation and dollarization was a unidirectional relation running from dollarization to inflation and not the other way (Ghalayini 2011, 136-137). Therefore, dollarization could not be explained by inflation, in fact, rather high inflation was the consequence of dollarization.

1.3.2. *Changing Exchange Rate*

The impact of exchange rate volatility on different macroeconomic variables has been investigated in a number of empirical and theoretical studies and in general, the causality is expected to run from exchange rate volatility to another macroeconomic variable. Theoretically, higher volatility in exchange rate motivates domestic residents to hold and use more foreign currency as possible exchange rate depreciation lowers the value of domestic money in the portfolio of assets (Yinusa 2008, 811-812). However, this relationship is still both theoretically and empirically unresolved as the impact of dollarization can depend on the exact form and state of dollarization that exists in a given economy which also determines the central bank intervention and regulation of the foreign exchange market (Mengesha and Holmes 2013, 99-101).

In the empirical studies, both, the effect of exchange rate on dollarization and *vice versa* has been researched. The study about dollarization in Georgia for the period of 1996-2007 focuses on the first possible effect. Specifically, three partial effects models are used where the effect of inflation, exchange rate, and time deposit interest rates on dollarization is modelled. The results give clear evidence that the partial effects model that accentuates the role of the exchange rate is the most effective to model dollarization. (Loiseaus-Aslanidi 2012, 71-80)

A study about the relationship between dollarization and foreign exchange volatility in Eritrea uses an augmented E-GARCH-in mean model through the inclusion of a dollarization variable in the conditional variance equation. For the analysis, the dataset for the years of 1996-2008 is used in where both official and black market data are used. The result suggests that an increased reliance on hard currency leads to increased volatility in both, the black foreign exchange market and real official exchange rate. (Mengesha and Holmes 2013, 102-113)

The determination of the causal effect between exchange rate volatility and dollarization has been modelled also in Nigeria where Granger causality test was estimated within a VAR setup. For the purpose of analysis, quarterly time series data on dollarization index and Naira exchange to U.S. dollar is used for the period of 1998-2003. The results indicate a bi-directional relationship; however, causality from dollarization to exchange rate volatility appears stronger and dominates. (Yinusa 2008, 816-820)

1.3.3. *Changing Domestic and Foreign Interest Rates*

The theory suggests that domestic and foreign interest rates have an important role in influencing the level of dollarization. Domestic interest rates have a negative effect on domestic currency loans whereas it affects positively on foreign currency loans as consumers have lower borrowing costs (Brzoza-Brzezina 2010, 5-8). In particular, it is important to pay attention to an interest rate differential defined as the difference between domestic and foreign interest rates. A wider interest rate differential on loans is expected to have a positive impact on loan dollarization as domestic interest rates become higher than foreign interest rate. In contrast, bigger positive gap between domestic and foreign interest rates has a negative effect on deposit dollarization. (Basso *et al.* 2011, 794-795)

There has been a research conducted which main objective was to find the effect of interest rate differentials for loans and deposits on currency and loan dollarization. For the purpose of analysis, panel VAR model was used based on the monthly data for 24 transition economies. The estimated model yields consistent results for all the above mentioned assumptions in terms of the impact of interest rate differentials on dollarization. The positive effect of interest rate differential on loans dollarization and negative on deposit dollarization seemed to be the case for both, households and firms. (Basso *et al.* 2011, 798-800)

The model used for the research also indicated that banks may create these differentials by themselves to increase the demand for foreign currency loans and the supply of local currency deposits. The empirical results supported the idea that differentials are tools for banks to use in order to chase loan market shares using foreign funds. (Basso *et al.* 2011, 798-800) Therefore, according to the interest rate differential theory, the economy either faces a loan dollarization (in the case of positive differential) or deposit dollarization (in the case of negative differential) which implies that they are interchangeable.

1.4. Benefits and Costs of Dollarization

Based on the literature, several benefits and costs of dollarization can be pointed out. In general, there is a clear understanding of the categories of benefits and costs, however, the exact effect of those benefits and costs is still unclear (Karnovitz *et al.* 2010, 7). Therefore, the aim of this section is to give an overview of different benefits and costs arising from dollarization rather than rank them based on their importance.

1.4.1. Benefits of Dollarization

First, in the case of small and emerging economies, higher inflation is expected due to weakness of a monetary authority and other institutions which creates volatile politics. The existence of an anchor currency such as the U.S. dollar helps to create more stability and eliminates currency exchange risk. (Karnovitz *et al.* 2010, 8) In particular, due to a limited influence on domestic money supply, inflation rate is expected to be under control of the monetary policy of the Federal Reserve (Berrios 2006, 62). Furthermore, it helps for a developing economy to send a signal of long-term growth to foreign investors and, as a result of increased foreign direct investment, the development of real sector accelerates (Karnovitz *et al.* 2010, 8).

Second, the presence of dollarization reduces the difficulty of borrowing abroad as lower interest rates are required as a hedge against currency devaluation. Therefore, the substitution of domestic currency with more reliable foreign currency would eliminate currency risk and increase foreign capital inflow which in turn can generate more economic growth. (Berrios 2006, 62; Karnovitz *et al.* 2010, 8-9) In conclusion, for a country with unstable domestic currency, currency risk is remarkably decreased as a result of having higher percentage of strong foreign currency in the banking system (Karnovitz *et al.* 2010, 8)

Finally, more highly dollarized economy benefits from higher economic integration as an elimination of currency risk and using the same currency induces international trade. In particular, reduced costs of trade due to using a common currency significantly increases the volume of trade. For example, Central and Eastern European countries have become a member of the EU and Eurozone in order to integrate their small economics with the European Union. In conclusion, the main aim is to have strong domestic financial system and become a participant of the international financial markets. (Berrios 2006, 62; Karnovitz *et al.* 2010, 9) However, in the case of unstable macroeconomic environment, dollarized economy is more vulnerable to systemic risks in the banking system.

1.4.2. Costs of Dollarization

First, dollarization is associated with non-independent monetary policy and relinquishing financial sovereignty since it becomes difficult to the central bank to set interest rates. Specifically, due to increased capital mobility, domestic and foreign currency deposits become close substitutes which also increases the correlation between interest rates. Additionally, dollarization limits the usage of different countercyclical policies. For example, if a dollarized economy is countercyclical to the United States, monetary decisions by the Federal Reserve could be detrimental to a dollarized economy. Furthermore, a dollarized country gives away seigniorage benefits which are derived as a difference between costs of producing currency and its face value. However, in the case of dollarization, seigniorage benefits is a forgone profit as currency is outsourced to another country. (Berrios 2006, 62; Karnovitz *et al.* 2010, 9)

Second, highly dollarized country faces higher currency mismatch risk due to exchange rate volatility and higher portion of assets or liabilities in the bank's balance sheet denominated in foreign currency. In particular, bank's currency mismatch risk is faced when a bank receive deposits in foreign currency and lend in domestic currency. In the case of a sudden drop in the value of domestic currency, there is an increase of bank's liabilities in terms of domestic currency, however, assets side remains the same. Therefore, it can cause bank's failure when sudden exchange rate movement take place. (Ozsoz *et al.* 2010, 5-6)

Finally, the central banks can be called as *lenders of the last resort* which points out their importance in regards of preventing domestic bank failures. In particular, in the presence of *bank run*, the central bank can compensate for the decreasing amount of domestic deposits by printing unlimited amount of national currency. This phenomenon was proved during the financial crisis of 2008 when the Federal Reserve had a significant role in rescuing numerous commercial banks that were about to fail. However, in the existence of dollarization, the central bank can only compensate for the decreasing amount of foreign deposits by the amount of foreign reserves on its disposal. Therefore, without help from international financial institutions, the central bank is not able to compensate for all the outflow of deposits. (Karnovitz *et al.* 2010, 9-10)

1.5. Dollarization and Monetary Policy

Many researchers agree that it is hard to determine the amount of foreign currency holdings outside the banking system. This is considered as the main problem of dollarization which is called as "non-observability" problem. (Calvo and Vegh 1992) The parallel circulation of a foreign currency, either as means of payment or as a store of value, affects the conduct of monetary policy and the inflation outcome. In particular, Cowan and Do (2003) indicated that through dollarization it is possible to correct a devaluation bias of a particular currency through forcing the central bank to run more disciplined monetary policy. In the case of existence of dollarization, the monetary authority does not increase the domestic money supply that easily as it might depreciate the value of domestic currency. However, dollarization also puts the economy in a dollarization trap as a consequence of imperfect information. (Alvarez-Plata and Garcia-Herrero 2008, 10) As a result of negative effect on money supply, dollarization reduces the ability of the monetary authority to earn seigniorage from the issuance of its own currency (Zoryan 2005, 42).

1.5.1. Inflation Targeting

One strategy of conducting monetary policy is to adopt explicit inflation targeting. Inflation targeting is relatively new monetary policy regime which has started to evolve from the 1990s. In particular, it was first used in New Zealand and Canada. Among transition and developing economies, the Czech Republic and Brazil were the first countries in where the idea of price stability was implemented. (Meskhia 2008) Inflation targeting is defined as a framework in which the monetary authority announces quantitative targets or target ranges for the rate of inflation. Furthermore, it is announced how the central bank will achieve these targets and how the public will hold it accountable for doing so. (Santos 2012, 257) Accordingly, an institutional commitment by the monetary authority in regards of price stability becomes the primary goal. In particular, decisions on monetary policy are based on the deviation of forecasts of future inflation from the announced numerical target. (Alvarez-Plata and Garcia-Herrero 2008, 20)

Generally, dollarization has been considered to be as a reaction to economic instability and high inflation as it was in Argentina, Bolivia, Uruguay, and Vietnam in the late 1980s and in Cambodia in the beginning of the 1990s. Nevertheless, although inflation has decreased significantly over the last decade, dollarization remains still in a high level. Furthermore, though the average inflation rate in highly dollarized economies can be larger than in less

dollarized economies, it does not allow to believe that dollarization is an impediment in stabilizing inflation as the latter has been decreasing in most dollarized countries. (Alvarez-Plata and Garcia-Herrero 2008, 10-11) The phenomenon where dollarization remains high even if inflation is reduced is referred to as a "*hysteresis effect*" - which occurs as a result that it is not easy to substitute foreign currency with domestic currency due to raised additional costs associated with currency substitution (Oomes 2003; Havrylyshyn and Beddies 2003 cited in Zoryan 2005, 47).

It is also possible to find explanations that inflation targeting has a significant impact on actual financial dollarization. Empirical studies in the financial dollarization literature assumes that in the existence of high degree of financial dollarization, the country also suffers from slower and volatile growth of economy, financial instability and fragility, and no gains in financial market development. Accordingly, the policymakers aim to search for tools which will effectively reduce undesirable outcomes. In order to test empirically the treatment effect of inflation targeting on financial dollarization, a large sample of 106 developing countries for the years of 1985-2004 was used. In particular, it is examined whether adoption of inflation-targeting regime reduces the financial dollarization. They estimate the propensity scores using a probit model, where the dependent variable is the inflation-targeting dummy. (Lin and Ye 2013, 1253-1261)

From the empirics, it was found that the average treatment effect of inflation targeting on financial dollarization is negative and quantitatively large in the 13 targeting countries. On average, the adoption of inflation targeting induced to reduce financial dollarization by over 8 pp. Therefore, the findings suggest that inflation targeting is an effective policy tool to deal with the issue of financial dollarization existence in developing countries and should help the country to de-dollarize. (Lin and Ye 2013, 1271)

1.5.2. Exchange Rate Regimes

In general, there exists two exchange rate regimes between where the world has been shifting: fixed and floating regimes. In the case of fixed exchange rate regime, the exchange rate is fixed at a predetermined rate which includes a peg to another currency (Alesina and Barro 2001, 381). Consequently, the main advantages related to this policy are reduced uncertainty of fluctuations in the exchange rate and preventing monetary authorities from pursuing inflationary policies. However, the main disadvantages in regards of committing to a fixed exchange rate are having an exchange rate as an exogenous economic shock absorber and

limiting the ability to use domestic monetary policy to stabilize the economy. (Palley 2003, 67)

In theory, if the country operates with a floating exchange rate, the monetary authority can design a countercyclical policy that responds optimally to economic disturbances in the country. (Alesina and Barro 2001, 381) Under a floating exchange rate regime a liquid and efficient enough foreign exchange market is assumed in order to allow the exchange rate to respond to market forces. The main draw-back of such policy can be an excessive volatility and deviations from the equilibrium rate. (Duttagupta *et. al.* 2005, 2-3)

A common view is that dollarization makes conducting any monetary policy more complicated and less effective as it increases the volatility of money demand of domestic currency due to the reduced costs of switching from domestic to foreign currency holdings. Furthermore, as it was established before, currency substitution should also increase the exchange rate volatility. (Alvarez-Plata and Garcia-Herrero 2008, 18) As a result, in the dollarized economy with controlled inflationary processes, monetary authorities would have an incentive to intervene in the foreign exchange markets to control for exchange rate variations. (Ozsoz *et al.* 2010, 8) However, the central bank cannot intervene in the foreign exchange market for the purpose of stimulating the development of the real sector. The main explanation for this is the irrelevancy of domestic currency in the face of the predominant role of foreign currency denominated assets in the economy. (Ghalayini 2011, 137)

The elasticity of substitution of domestic currency with foreign currency is likely to increase in periods when the exchange rate is floating. The main reason for this change is the increased risk of holding domestic currency. Consequently, there is a greater incentive to diversify the portfolio of liquid money assets with foreign currency under floating than in the case of fixed exchange rate regime. (Ortiz 1983, 174-176) Therefore, based on reduced uncertainty in regards of the fluctuating value of domestic currency, the author would assume that the level of dollarization should be smaller in the case of fixed exchange rate regime. Nevertheless, exogenous economic shocks could still be an explanation of increasing dollarization.

An important issue to consider in regards of exchange rate is the exchange rate pass-through which measures the impact of changing exchange rate on domestic inflation. Reinhart *et al.* (2003) posit that highly dollarized countries face significantly higher exchange rate pass-through than non-dollarized ones. Coexistence of the higher rate pass-through with more volatile exchange rate applies that the conduct of before mentioned inflation targeting and the

achievement of inflation objective becomes more challenging. Accordingly, floating exchange rate regime reduces the monetary authorities' control of inflation due to the side effect of the relatively higher change in prices of imported goods as a respond to the exchange rate change. (Alvarez-Plata and Garcia-Herrero 2008, 17-18) In conclusion, currency substitution makes a flexible exchange-rate regime exactly like one of fixed rates for a small open economy where higher inflation abroad necessitates inflationary monetary policy domestically (Rogers 1990, 204). In other words, based on the theory of exchange rate pass-through, a small open economy can control for change in domestic inflation through keeping its exchange rate fixed. However, as it becomes fixed, any change in inflation of large economies require either inflationary or deflationary monetary policy as a response in order to keep exchange rate still fixed.

In one of the studies, the hypothesis that economies with high level of deposit dollarization and where inflation is controlled, central banks closely monitor the changes in the exchange rate as sudden movements could lead to currency mismatches or increases in their client's default risk. In order to test the validity of the hypothesis, probit model is used with the purpose of testing the probability of central banks' decisions to intervene in the foreign exchange market. The research focuses on three transition economies such as Croatia, the Czech Republic, and Slovakia. The results show that in the three economies, real exchange rate volatility for the past twelve-month period significantly explains direct central bank interventions. Furthermore, they found empirical support for the use of deposit dollarization as a new investment signal under the assumption that the inflation is controlled for. (Ozsoz *et al.* 2010, 6-10) In particular, dollarization could be seen as a signal of the monetary authority's willingness to intervene in foreign currency markets. Therefore, it gives a crucial input for global investors for their investment decision.

1.6. De-Dollarization

In the case of dollarization, a large proportion of assets or liabilities is denominated in foreign currency. There has been quite a lot of discussion about whether a country should be in favour or against of dollarization. Consequently, the definition of *de-dollarization* arises which implies restrictions of holding foreign assets or liabilities by residents (Calvo 2002, 395). Galindo and Leiderman (2005) has pointed out that de-dollarization in general is costly and difficult to induce as there have been very few successful transformations from dollarization to de-dollarization. Most of the policies used by countries are aimed at restoring or enhancing the financial market development (for example, using inflation-linked instruments such as inflation-indexed bonds) as it takes time to gain credibility of fiscal and monetary policy (Erasmus *et al.* 2009, 9).

Empirical study performed by German Institute for Economic Research distinguishes between two approaches to promote de-dollarization. First group of countries have approached to dollarization issue unilaterally i.e., by legal means. One example can be considered Argentina which forced locals to substitute their foreign currency deposits with domestic currency deposits. Second group have used market forces to decrease the amount of foreign currency deposits in the economy. (Alvarez-Plate and Garca-Herrero 2008, 6-8) In this case, the combination of macroeconomic policies and microeconomic measures are used in order to increase the trustworthiness of local currency (Kokenyne *et al.* 2010, 7). The best example is Israel who managed to de-dollarize through effective deflation (Alvarez-Plate and Garca-Herrero 2008, 8).

According to Erasmus *et al.* (2009), there exists three basic approaches to induce de-dollarization in the country:

1. Macroeconomic policies applies to stable exchange rate and prices, for example fixed-exchange rate regime or inflation targeting. Furthermore, increasing domestic interest rates on deposits through financial liberalization also helps to reverse dollarization.

2. Regulatory and legal reforms that indicates the change in regulatory incentive structures. The examples are setting differential reserve or liquidity requirements. Additionally, alternative financial instruments can be introduced which are required to hold in local currency.

3. The most extreme form to induce de-dollarization is administrative enforcement through prohibition of, or limits on, foreign currency deposits and loans, restrictions

on holding accounts in abroad, and forced conversion of foreign currency holdings in any form to domestic currency holdings.

The empirics show that de-dollarization process had been successfully carried out only in four countries which are Poland, Israel, Chile, and Egypt. In particular, the foreign currency deposits from total deposits declined at least 20 percentage points and remained below 20%. Furthermore, the outcome was achieved through market forces without any substantial macroeconomic costs. Conversely, Mexico and Pakistan had implemented de-dollarization policies in a more forced way which also led to the reduction in dollarization level, however, the outcome included different macroeconomic costs. Completely forced de-dollarization took place in Bolivia and Peru (in 1985) which resulted initial sharp decrease in the percentage of foreign currency deposits from total deposits. However, the government was obliged to abandon its requirement to have only domestic currency holdings due to substantial macroeconomic costs such as capital flight and financial disintermediation. (Erasmus *et al.* 2009, 9-10) In conclusion, the examples show that although forcing de-dollarization might be successful in the short-term. However, due to the negative side effects in the economy, the government is forced to abandon de-dollarization policy and in the long-run dollarization level starts to increase again.

2. DOLLARIZATION IN GEORGIA

A developed industrial base was one of the characteristics which explained Georgia before the start of its independence in the 1990s. The collapse of the communist system forced the Georgian economy to reorient foreign trade due to a breakdown of cooperation with former USSR enterprises. The first years of independence were deteriorated due to conflicts which ended up with the Russia's war against Georgia in August 2008. As a result of political, economic, and other factors, Georgia has found itself in a crisis which encompasses a decrease in productivity and a decline in the standard of living (Papava 2013, 3-4)

The Georgian lari is the only legal means of payment used in Georgia. Although the central bank of Georgia was established after its re-independence in 1991, the Georgian lari entered into circulation from October 1995 (National Bank of Georgia 2015e). After 1991, Georgian residents have suffered from two severe hyperinflations: the Russian ruble devaluation in 1992 and the coupon devaluation in 1994. Additionally, U.S. dollar was circulating in the economy along with the Russian ruble and the coupon. U.S. dollar was mainly used for real estate and other significant transactions whereas the Russian ruble and coupons for essentials - standardized goods. From 1995, the Russian ruble and coupons were replaced with newly issued Georgian lari. However, U.S. dollar still existed as a store of value for the long-term purposes and the high percentage of U.S. dollar deposits from total deposits in the banking system shows that preferences of economic agents in regards of using U.S. dollar have not changed since. (Samadashvili 2010)

Due to the lack of credibility of the market participants in the domestic currency, dollarization has been an issue in Georgia since the start of its current national currency. International Monetary Fund (IMF) has pointed out the importance of dealing with dollarization as it slackens the monetary policy effectiveness and creates extra risks for the commercial banks (International Monetary Fund 2014, 3). National Bank of Georgia provides different reasons that has caused dollarization. These factors include the lack of trustworthiness of national currency, volatile inflation and exchange rate in the past, undeveloped financial markets, unstable political situation, and other historical factors. (National Bank of Georgia 2015a)

2.1. Bank Deposits and Loans Composition

In order to understand the essence of dollarization in Georgia, it is crucial to analyse the composition of bank deposits and loans by taking into account the type of bank account/maturity and currency. For this purpose, the dataset covering the period of 2003-2015 provided by National Bank of Georgia is used.

2.1.1. Deposits Composition

In Figure 1, the composition of domestic and foreign currency deposits by types of bank accounts is given. It is clearly seen that in 2003-2005 residents of Georgia preferred neither domestic demand (DDD) nor domestic time deposits (DTD). It could be explained by the fact of higher foreign interest rate for both types of foreign currency bank accounts. From 2006, the amount of demand deposits is quite equally distributed between DDD and FDD. Furthermore, in 2012-2013 more DDD was preferred over DTD as domestic interest rate on demand deposits became higher than foreign interest rate. However, always more foreign time deposits (FTD) have been held during the period of 2003-2015. It can be considered as a paradox as in most of the time during this period domestic interest rate on time deposits has been higher than foreign interest rate. The most recent interest rate differentials of time deposits are over 3%. Therefore, it may be the case of incredibility of domestic currency as locals prefer foreign currency time deposits even if interest rate on domestic currency becomes higher.
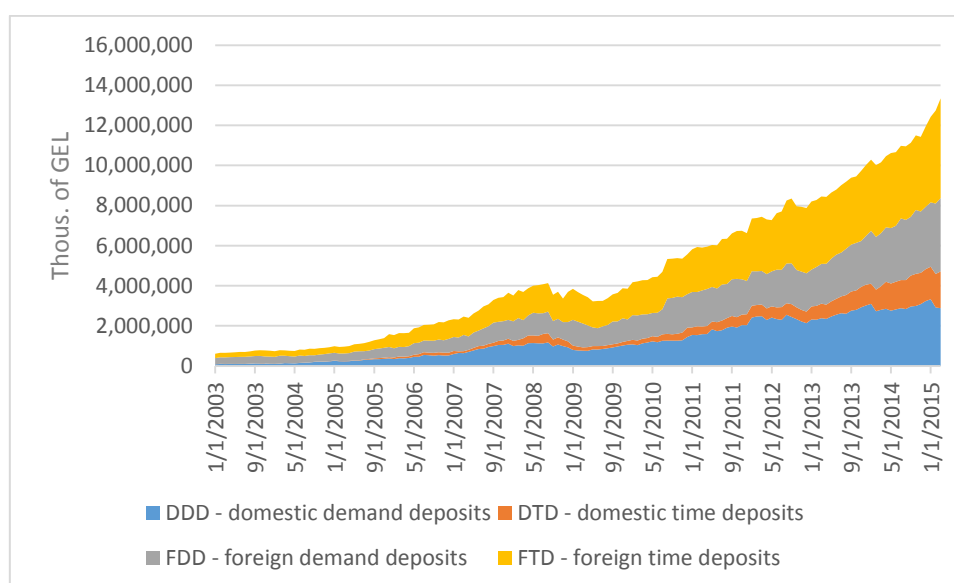

Figure 1. Domestic and foreign deposits composition by types of bank accounts in 2003-2015

Source: National Bank of Georgia database and author's calculations

In Figure 2, the composition of foreign currency deposits by currencies used is given. During the period of 2003-2015, U.S. dollar has always dominated over any other currency. In addition, the proportion of using euro for the purpose of deposits has increased from 2008. For the period of 2010-2012, Swiss franc became the third important foreign currency used for deposits. The main explanation can be the reason of continuous appreciation of Swiss franc in regards of dollar. Although other currencies such as pound sterling and Russian rouble have also been used, however, the proportion of them is clearly insignificant.
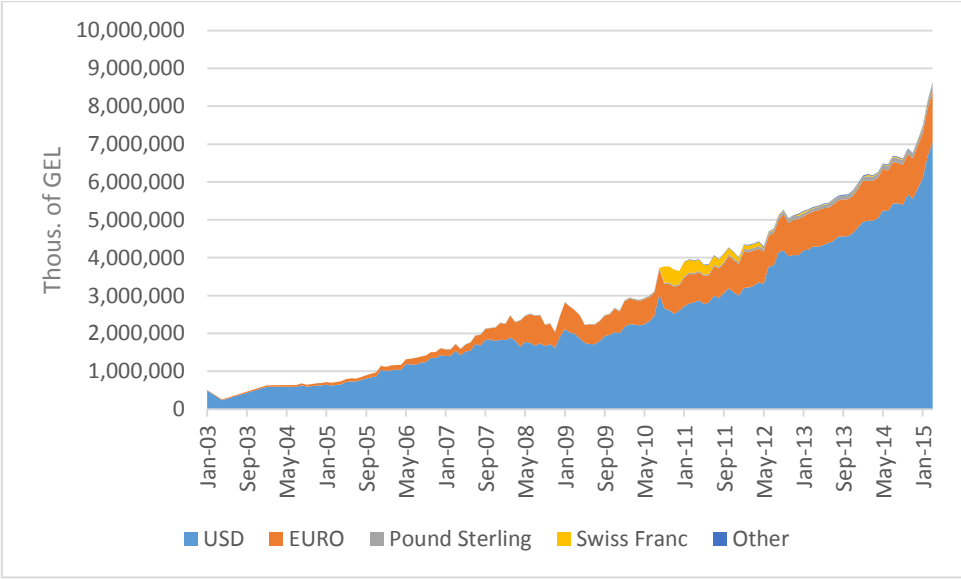
Figure 2. Foreign currency deposits composition by currencies used in 2003-2015
Source: National Bank of Georgia database and author's calculations

2.1.2. Loans Composition

In Figure 3, the composition of domestic and foreign currency loans by maturity is given allocating them to short-term (less than one year) and long-term (one year and more). It is clearly seen that in 2003-2005 residence of Georgia preferred neither domestic short-term (DSTL) nor domestic long-term loans (DLTL). From 2006, the amount of short-term loans is quite equally distributed between DSTL and FSTL. Furthermore, since 2012 more DSTL is preferred over FSTL. It can be considered as a paradox as in most of the time during this period foreign interest rate on short-term loans has been lower than domestic interest rate. The most recent interest rate differentials of time deposits are over 9%. However, always more foreign long-term loans (FLTL) have been demanded during the period of 2003-2015. It can be explained by continuously lower interest rates on foreign currency loans than domestic currency loans.
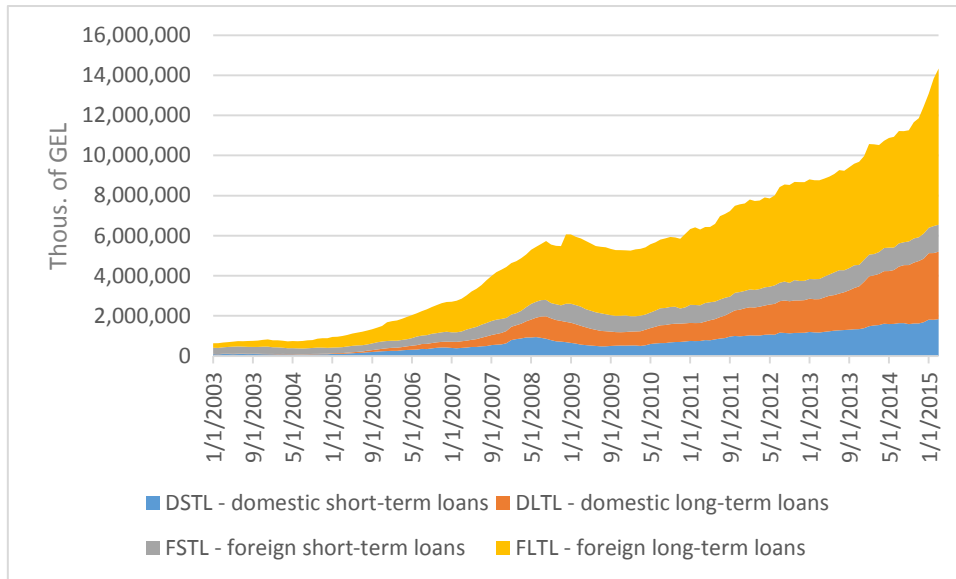
Figure 3. Domestic and foreign loans composition by maturity in 2003-2015

Source: National Bank of Georgia database and author's calculations

2.2. Dollarization Index Composition

There are several ways how to approach in order to measure dollarization in an economy. For the case of Georgia, the definition used by Feige *et.al.* (2000) is used. (Zoryan 2005, 43):

$$BM = DCC + DDD + DTD + FCD \tag{1}$$

where BM – broad money,

DCC – domestic currency is circulation,

DDD – domestic demand deposits,

DTD – domestic time and saving deposits,

FCD – foreign currency deposits.

In Figure 4, the composition of BM in Georgia is given for the period of 2003-2015. In 2003-2004, BM consists of mainly DCC and FCD which means that residents do not have a desire to hold domestic currency deposits. Nevertheless, the importance of DCC has decreased over time as locals prefer to make more and more transactions using financial services instead of cash holdings. This may explain the reason why DDD has recently become an important component for BM achieving the volume almost equal to DCC. FCD has always remained the most important component for BM being continuously approximately half of it. DTD is affecting BM the least throughout the analysed period which could refer to untrustworthiness of domestic currency for the purpose of storing value for longer periods.
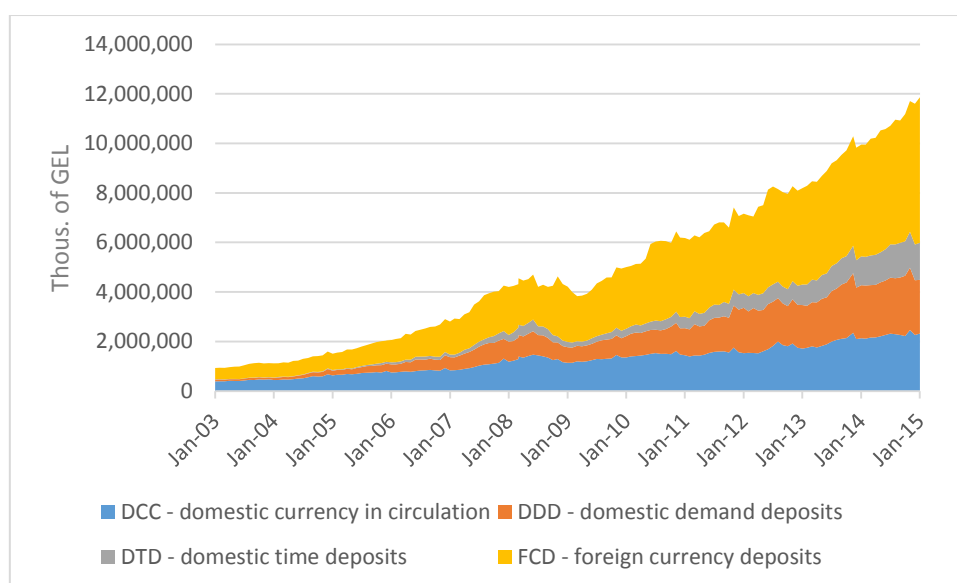
Figure 4. Composition of broad money in 2003-2015

Source: National Bank of Georgia database and author's calculations

Although one way of analysing dollarization is to use foreign currency in circulation (FCC), due to the lack of data on FCC, the author uses FDC as a proxy variable for dollarization. The common way of measuring dollarization is to use dollarization index (DI) which is widely used also by the IMF:

$$DI = \frac{FCD}{BM} \qquad (2)$$

In Figure 5, the percentage of FCD from BM in Georgia is given. It is seen from the graph that DI has fluctuated throughout the analysed period between 37.85% and 53.54% reaching its maximum in September 2010 and minimum in August 2008. In February 2015, FCD makes up 49.54% from BM. Based on the method used by National Bank of Georgia, dollarization coefficient is 60.9% (Ministry of Finance of Georgia 2015). The difference comes due to the fact that dollarization coefficient calculates FCD based on total deposits within the country while dollarization index used by author estimates FCD based on BM.
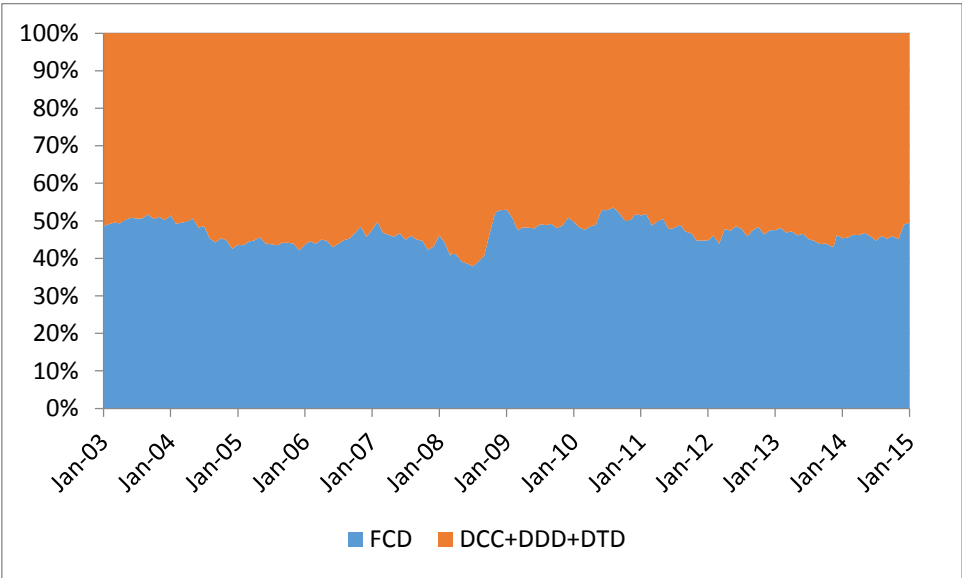

Figure 5. Dollarization index (the percentage of FCD from BM) in 2003-2015

Source: National Bank of Georgia database and author's calculations

2.3. Dollarization and Monetary Policy

The main objective of the monetary policy of the National Bank of Georgia is to maintain price level stability which implies the existence of predictable and controllable rate of inflation. In addition, financial system stability is supported as long as this objective is not in contradiction with the main aim – keeping price level stable. The inflation target and the main instruments of monetary policy can be found in the "Main Directions of Monetary and Exchange Rate Policies" which is approved by the Parliament of Georgia. (National Bank of Georgia 2015b)

In particular, for the years of 2015-2017 the inflation target is set at the level of 5% for 2016 and 4% for 2017. In order to meet this target, the main monetary policy instruments used are refinancing loans, operations with government securities, and foreign exchange interventions. (National Bank of Georgia 2015c) Therefore, all three possible factors discussed in the theoretical framework (inflation rate, exchange rate, interest rate differentials) influencing dollarization are considered by National Bank of Georgia. Nevertheless, the main emphasis is to keep the inflation rate deviations low.

2.3.1. Inflation Targeting

Inflation targeting regime reveals the settlement of an inflation target in advance which desired level in the long-run for Georgian economy is 3%. In order to maintain price stability, short-term interbank interest rates are used by the National Bank of Georgia as an operation target. The initial short-term effect is expected to be transmitted to the long-term impact as the interest rates of commercial banks influence aggregate demand in the economy. Additionally, National Bank of Georgia actively uses other instruments such as minimum reserve requirements, open market operations, and guaranteed refinancing loans. Nevertheless, changes in short-term interbank interest rates have an effect only on demand of domestic currency as the central bank cannot directly influence foreign interest rates. Consequently, in the case of high DI, National Bank of Georgia has only limited influence on aggregate demand and, therefore, price levels or inflation. (National Bank of Georgia 2015b)

In Figure 6, the relationship between DI and inflation rate for the period of 2003-2015 is given. It is visible that DI and inflation rate are not co-integrated as they do not have similar stochastic drifts. Similarly, obtained correlation coefficient for the whole analysed period of -0.15 applies a weak negative linear relationship between the two variables. However, in the

process of observing correlation coefficients for the specific periods, sometimes positive and stronger relationships are acquired. Therefore, the exact effectiveness of inflation targeting in order to control dollarization in Georgia is not possible to measure based on the analysed period. However, as volatile inflation rate has been a historical issue for National Bank of Georgia to deal with, there might be a time lag effect of inflation targeting on dollarization as it takes time to re-establish the trustworthiness of residents in terms of price stability and hence, domestic currency.
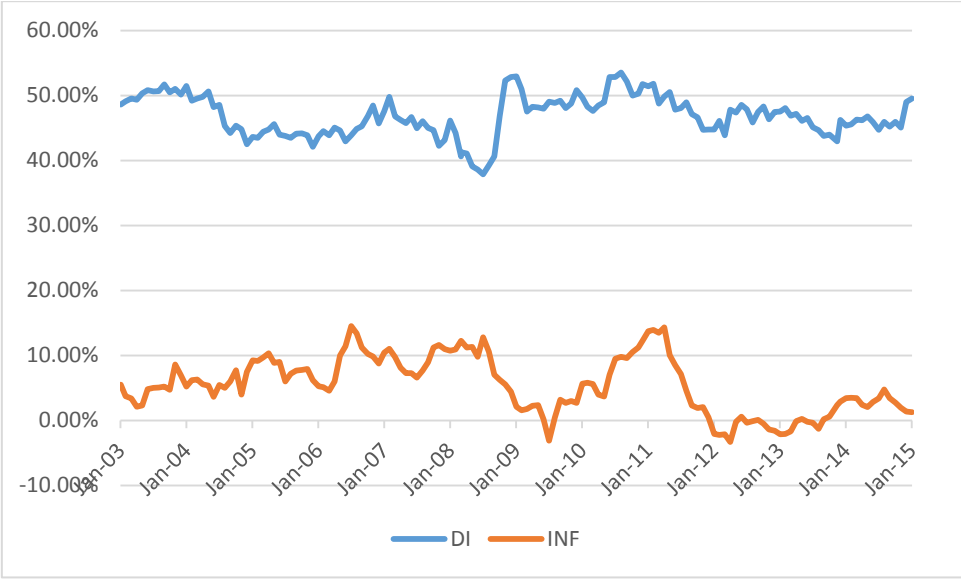
Figure 6. The relationship between dollarization index (DI) and inflation rate (INF) in 2003-2015

Source: National Bank of Georgia database and author's calculations

2.3.2. *Floating Exchange Rate Regime*

As Georgian monetary policy is based on inflation targeting, floating exchange rate regime in this regard is required. The economy is considered as a small open economy which does not have an optimal exchange rate policy with other countries and depends on conditions in the world economy. Consequently, National Bank of Georgia does not have exchange rate target itself. The only goal is to reduce excessive exchange rate fluctuations. In order to reduce the exchange rate volatility, National Bank of Georgia carries out foreign exchange interventions through exchange auctions. In the long run, such interventions are expected to be reduced and the exchange rates are left entirely on demand/supply interactions in foreign currency markets. Nevertheless, it is important to note that for highly dollarized countries, foreign exchange rate fluctuations are inevitable. (National Bank of Georgia 2015d)

In Figure 7, the relationship between DI and USD/GEL nominal exchange rate for the period of 2003-2015 is given. The author's decision to focus on this particular exchange rate is based on the fact that most of FCD are held in U.S. dollars (see Figure 2). It is visible that DI and USD/GEL exchange rate are co-integrated as they have similar stochastic drifts. Similarly, obtained correlation coefficient for the whole analysed period of +0.5 applies a strong positive linear relationship between the two variables. Therefore, USD/GEL exchange rate has had a significant impact on dollarization. In particular, as a result of an increase in USD/GEL exchange rate by 24.71% from December 2013 to February 2015, DI has increased by 6.60%.
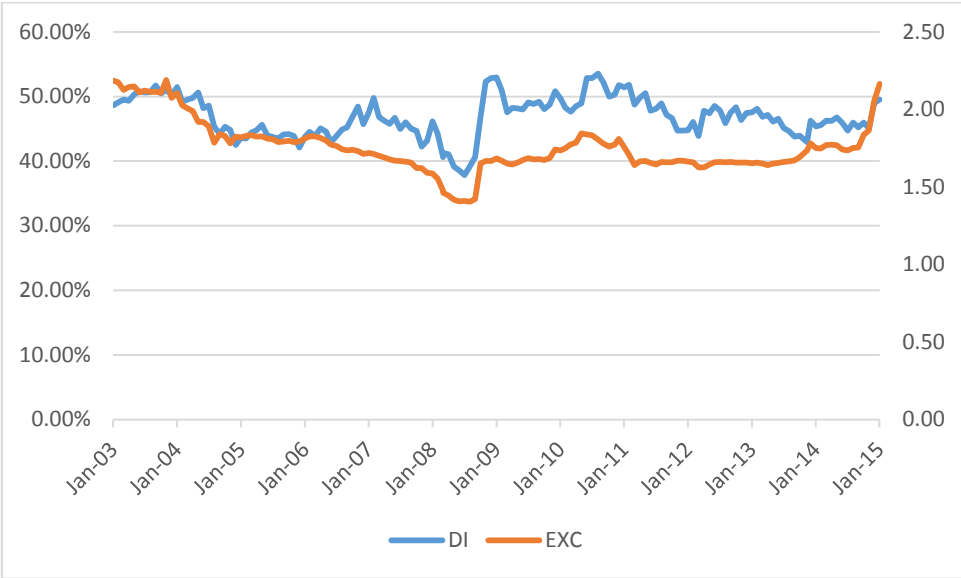

Figure 7. The relationship between dollarization index (DI) and USD/GEL nominal exchange rate (EXC) in 2003-2015

Source: National Bank of Georgia database and author's calculations

2.4. De-Dollarization

De-dollarization for the case of Georgia can be defined as *larization* which applies the tendency of using domestic currency instead of foreign currency. The main goal for National Bank of Georgia is to increase larization in the economy as it is significant for the country's economic development and improves the efficiency of monetary policy. Several measures have been carried out by the central bank in order to promote larization and increase the trustworthiness of domestic currency. However, changing economic agents' behaviour towards the higher use of domestic currency is a long process and its success is based on long-term financial and economic stability. (National Bank of Georgia 2015a)

In 2014, the Banker named Giorgi Kadagidze, the governor of National Bank of Georgia, as the best governor of the central bank in Europe. However, the Banker also points out the importance of de-dollarization process faced as a main challenge for the governor in coming years. (Netgazeti 2015) According to Head for Association of Banks of Georgia, de-dollarization policy has been the main priority of the central bank since 2012 along with the monetary policy relying on inflation targeting (Chigogidze 2015). De-dollarized economy helps to hedge for foreign exchange risk which leads to higher credit activity and economic recovery in the long-run. In particular, if an economic agent is paid in and takes out a loan in the same currency then such risk can be avoided.

The main measurements to induce de-dollarization by National Bank of Georgia has been improving the availability of domestic currency and therefore, promoting the issuance of loans in domestic currency by expanding both sides of its balance sheet through purchasing mortgage-backed securities (Netgazeti 2015). At the same time, additional risk weighting for foreign currency loans and higher reserve requirements for liabilities in foreign currency are implemented. National Bank of Georgia also encourages commercial banks to issue long-term domestic deposits. (International Monetary Fund 2013, 11) Therefore, the monetary authority concentrates on de-dollarization process mainly in the banking system.

Despite of above-mentioned policies, dollarization index in Georgia remains in a similar level throughout the recent decade. However, it is important to keep in mind that it takes time until measures of de-dollarization have a significant impact towards a reduction in the level of dollarization. Israel de-dollarization process can be considered in this case as the best example where it took twenty years before the monetary authority was able to decrease the percentage of foreign currency deposits from total deposits from 80% to 40%. (Chigogidze 2015)

For an effective de-dollarization process in the future, the International Monetary Fund (2014, 24-25) has made several recommendations to National Bank of Georgia in regards of macroprudential policy instruments to implement:

1. National Bank of Georgia should establish a Financial Stability Unit that is responsible for systemic risk analysis and macro prudential policy that helps to strengthen the institutional setting.
2. Additional risk weights to foreign currency loans to unhedged borrowers and further reserve requirements for foreign currency deposits should be applied. Additionally, more liquidity is needed in regards of non-resident deposits.
3. In order to support larization, the central bank needs to set limits in regards of lending in foreign currency to more risky borrowers. Additionally, targeted measures such as increasing the maturities of deposits, increasing the percentage of demand deposits in domestic currency and promoting lari-denominated time deposits should be carried out.

3. EMPIRICAL MODEL

3.1. Data and Methodology

3.1.1. Data

The analysis uses a monthly data taken from the database of National Bank of Georgia for the period of January 2003 to February 2015. DI is calculated for each month as the volume of FCD to BM. Based on the theoretical framework, three variables are considered having an influential effect on the existence of dollarization which are inflation rate, volatile exchange rate, and interest rate differentials. For the purpose of inflation rate, CPI percentage change over corresponding month of previous year is used. USD/GEL nominal exchange rate at the end of each month is decided to take as the most suitable exchange rate for the purpose of analysis as the majority of deposits held and loans outstanding are in U.S. dollars. Interest rate differential on time deposits are calculated where interest rate differential is defined as the weighted average interest rate on national currency deposits subtracted by the weighted average interest rate on foreign currency deposits.

3.1.2. Descriptive Statistics

In Figure 8, the plots of the variables described above are presented. It is seen from the graphs that all the series are potential $I(1)$ processes as they are not stationary. When analysing the trends of the variables, in the case DI, minimum level of 37.9% is reached in summer 2008. The main reasons for this are the outbreak of the global financial crisis and Russo-Georgian war which decreased the trustworthiness in regards of holding deposits in the commercial banks. Furthermore, USD/GEL nominal exchange rate had been decreased since 2006, making lari more valuable relative to U.S. dollar. At the beginning of 2009, however, DI sharply increased to its maximum level of 53.5% due to the increased USD/GEL nominal exchange rate.

When comparing the movements of DI and EXC, they appear closely related. In particular, the changes in EXC reflect sharper changes in DI due to residents' future expectations in regards of possible depreciation or appreciation of domestic currency. The extraordinary case is the end of 2014 when although EXC had a sharp increase, DI did not respond in the same way as it was in 2008.

Inflation in Georgia has large absolute deviations reaching its maximum of 14.5% in 2006 and 2011. Conversely, in 2009 and 2012, the economy faced a deflation of 3.3%. From 2013, it seems that inflation is not that high as it used to be before 2008 due to implementing inflation targeting regime. Although inflation targeting regime started since 2009, it takes time until its effect will be seen.

In the case of DIF, before 2010, it was mostly close to zero with few sharp movements. This applies no difference between interest rates on time deposits in foreign or domestic currency. However, the differential is relatively high since 2011 which might be connected to the de-dollarization policy of National Bank of Georgia to attract residents to hold their deposits in domestic currency.
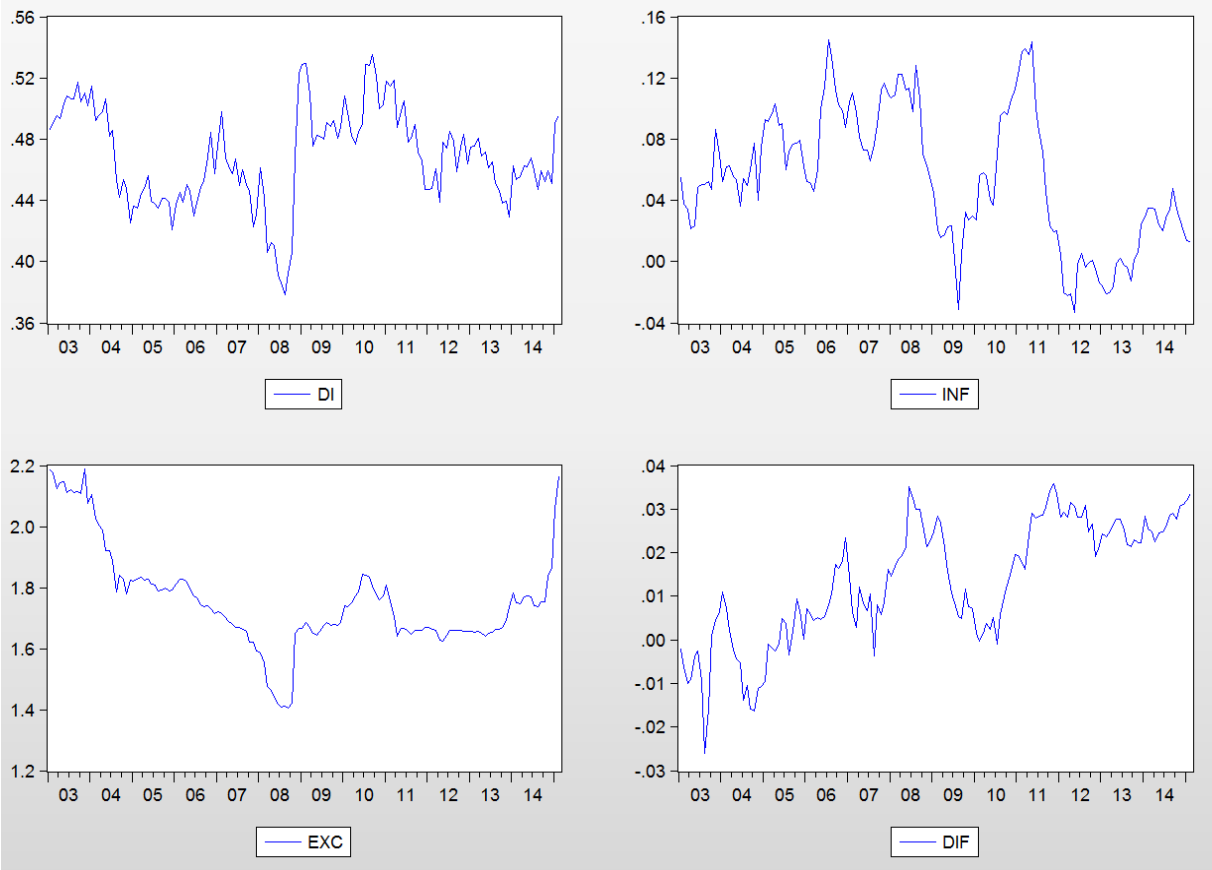
Figure 8. Plots of dollarization index (DI), inflation rate (INF), USD/GEL exchange rate (EXC) and interest rate differential on time deposits (DIF) in 2003-2015

Source: National Bank of Georgia database and author's calculations

In Table 1, descriptive statistics of the variables described above are presented. According to Jarque-Bera test, the null hypothesis that skewness and excess kurtosis are zero cannot be rejected in the case of DI and inflation rate (using 5% significance level) which suggests

normally distributed dataset. Having a normally distributed dataset of the dependent variable does not require a large sample size in order to make inference analysis.

Table 1. Descriptive statistics of dollarization index (DI), inflation rate (INF), USD/GEL exchange rate (EXC) and interest rate differential on time deposits (DIF)

	DI	INF	EXC	DIF
Mean	0.468	0.054	1.756	0.013
Median	0.467	0.053	1.736	0.015
Maximum	0.535	0.145	2.190	0.035
Minimum	0.378	-0.033	1.405	-0.026
Std. Dev.	0.031	0.043	0.165	0.013
Skewness	-0.227	0.052	0.791	-0.390
Kurtosis	2.930	2.126	3.936	2.264
Jarque-Bera	1.284	4.706	20.572	7.010
Probability	0.526	0.095	0.000	0.030
Sum	68.382	7.992	256.413	1.955
Sum Sq. Dev.	0.144	0.278	3.961	0.027
Observations	146	146	146	146

In Table 2, correlation coefficients between the variables used are shown. It is seen that DI and EXC are highly positively linearly correlated with each other. Therefore, any change in EXC is expected to cause the same directional change in DI. Between EXC and DIF exists negative linear correlation which implies that any change in DIF is expected to cause the opposite directional change in EXC. There are no other strong linear relationships presented in the correlation matrix.

Table 2. Correlation matrix

	DI	INF	EXC	DIF
DI	1.000	-0.154	0.497	-0.159
INF	-0.154	1.000	-0.071	-0.238
EXC	0.497	-0.071	1.000	-0.571
DIF	-0.159	-0.238	-0.571	1.000

Source: National Bank of Georgia database and author's calculations

3.1.3. Methodology

As the main aim of the empirical part is to statistically test for any causal effect between the variables, Granger causality test needs to be performed. Causality in general is framed in terms of predictability. Given two discrete time-series x and y, it is said that y Granger causes x if it is possible to forecast the current value of x using both past values of x and y better

than using past values of x alone (Goebel *et al.* 2003, 1252). Author's goal is to discover both, unidirectional and bidirectional causalities between the variables.

VAR models form a natural context in which measures of directed influence based on the concept of Granger causality can be defined (Goebel *et al.* 2003, 1252). Nevertheless, the standard linear Granger causality estimated through VAR in first differences will fail in the case of the long-run relationships. VECM has been introduced to capture both, short-term and long-term relationships as it uses the first differences of the non-stationary variables along with lagged error-correction term (Papana *et al.* 2014). In order to determine whether VECM can be used, it is necessary to determine whether variables are stationary in level or not.

For the purpose of testing stationarity, two different unit root tests, the Augmented Dickey-Fuller (ADF) and the Phillip-Perron (PP) test, are utilized. The aim of the tests is to ensure non-stationarity at the levels of the variables and stationarity at the first differences. According to the computed ADF and PP test results presented in Table 3 and 4, using 2% significance level, the hypothesis of a unit root cannot be rejected in the case on any variables. Therefore, it is necessary to take first differences in order to remove unit roots from the series.

Table 3. ADF unit root tests at the levels of the variables

Null Hypothesis: Unit root (individual unit root process)

Intermediate ADF test results

Series	Prob.	Lag	Max Lag	Obs
DI	0.031	0	12	145
INF	0.291	0	12	145
EXC	0.452	1	12	144
DIF	0.309	0	12	145

Source: Author's calculations

Table 4. PP unit root tests at the levels of the variables

Null Hypothesis: Unit root (individual unit root process)

Intermediate Phillips-Perron test results

Series	Prob.	Bandwidth	Obs
DI	0.023	2.0	145
INF	0.230	1.0	145
EXC	0.332	5.0	145
DIF	0.363	4.0	145

Source: Author's calculations

According to Table 5 and 6, ADF and PP tests indicate that the null hypothesis of non-stationarity can be rejected at the 1% significance level. Therefore, the variables are integrated of order one, $I(1)$ which is a necessary condition in order to use VECM and test for possible co-integration.

Table 5. ADF unit root tests at the first differences of the variables

Null Hypothesis: Unit root (individual unit root process)

Intermediate ADF test results

Series	Prob.	Lag	Max Lag	Obs
D(DI)	0.000	0	12	144
D(INF)	0.000	0	12	144
D(EXC)	0.000	0	12	144
D(DIF)	0.000	0	12	144

Source: Author's calculations

Table 6. PP unit root tests at the first differences of the variables

Null Hypothesis: Unit root (individual unit root process)

Intermediate Phillips-Perron test results

Series	Prob.	Bandwidth	Obs
D(DI)	0.000	4.0	144
D(INF)	0.000	4.0	144
D(EXC)	0.000	4.0	144
D(DIF)	0.000	8.0	144

Source: Author's calculations

The process is co-integrated if a linear combination of the variables is stationary. In order to determine possible stable long-run relationship between the variables, co-integration rank is estimated using Johansen methodology. If the rank is full, i.e. equal to the number of variables, then the process is stationary in mean whereas if the rank is zero, then the error-correction term disappears indicating no co-integration. (Papana *et al.* 2014) Therefore, in this empirical work, the rank should be between one and three in order to have co-integration. The main weakness of Johansen's co-integration test is its sensitivity to the lag lengths used in the VAR models. The purpose in this regards is not to find the correct lag length, but minimum lag length that would not produce autocorrelations of the residuals. (Ahking 2002)

At first, VAR model in level is estimated and the optimal lag length is obtained by comparing AIC (Akaike information criterion) and SIC (Schwarz information criterion) for each lag length up to 12 lags. AIC suggests to use three lags whereas SIC one lag in the estimation. In

order to test for possible autocorrelation, VAR residual Portmanteau tests are used. In particular, in the case of one lag, serial correlated residuals are produced whereas using three lags does not produce autocorrelations in residuals using 2% significance level. In order to obtain the lag order of co-integration test, it is necessary to deduct one lag from the optimal lag order of unconstrained VAR model (Huang and Li 2010, 77). Therefore, the lag order of co-integration test is two.

In the Johansen testing, two test statistics are used. The trace statistic tests the null hypothesis that there is a co-integrating rank of k against the alternative of r co-integrating ranks where k and r are real numbers between zero and four. The maximum eigenvalue test, however, takes into account the null hypothesis that co-integrating rank of k exists against the alternative of $k + 1$ co-integrating ranks. The results of unrestricted co-integration rank tests, using the lag order of two, are presented in Table 7. In the case of trace statistic, the null hypothesis cannot be rejected at the co-integration rank of one using 2% significance level. For the maximum eigenvalue test, similar result is obtained using 5% significance level. Consequently, both test statistics suggest one co-integrating vector between the variables which applies possible long-term equilibrium relationship between the variables.

Table 7. Unrestricted co-integration rank tests

Trend assumption: Linear deterministic trend
Lags interval (in first differences): 1 to 2

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None	0.181	52.590	47.856	0.016
At most 1	**0.084**	**23.926**	**29.797**	**0.203**
At most 2	0.073	11.292	15.494	0.194
At most 3	0.003	0.440	3.841	0.506

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None	0.181	28.663	27.584	0.036
At most 1	**0.084**	**12.634**	**21.131**	**0.486**
At most 2	0.073	10.851	14.264	0.161
At most 3	0.003	0.440	3.841	0.506

Source: Author's calculations

Based on the tests carried out above (stationarity testing, lag length criteria, Johansen test), the possible long-run relationship between the variables is obtained and the following VECM model is estimated:

$$\Delta DI_t = \sum_{i=1}^{2} \beta_{1i}\Delta DI_{t-i} + \sum_{i=1}^{2} \delta_{1i}I\Delta NF_{t-i} + \sum_{i=1}^{2} \phi_{1i}\Delta EXC_{t-i} + \sum_{i=1}^{2} \psi_{1i}\Delta DIF_{t-i} + \gamma_1 Z_{t-1} + c_1 + \varepsilon_{1t}$$

$$\Delta INF_t = \sum_{i=1}^{2} \delta_{2i}\Delta INF_{t-i} + \sum_{i=1}^{2} \beta_{2i}\Delta DI_{t-i} + \sum_{i=1}^{2} \phi_{2i}\Delta EXC_{t-i} + \sum_{i=1}^{2} \psi_{2i}\Delta DIF_{t-i} + \gamma_2 Z_{t-1} + c_2 + \varepsilon_{2t}$$

$$\tag{4}$$

$$\Delta EXC_t = \sum_{i=1}^{2} \phi_{3i}\Delta EXC_{t-i} + \sum_{i=1}^{2} \beta_{3i}\Delta DI_{t-i} + \sum_{i=1}^{2} \delta_{3i}\Delta INF_{t-i} + \sum_{i=1}^{2} \psi_{3i}\Delta DIF_{t-i} + \gamma_3 Z_{t-1} + c_3 + \varepsilon_{3t}$$

$$\Delta DIF_t = \sum_{i=1}^{2} \psi_{4i}\Delta DIF_{t-i} + \sum_{i=1}^{2} \beta_{4i}\Delta DI_{t-i} + \sum_{i=1}^{2} \delta_{4i}\Delta INF_{t-i} + \sum_{i=1}^{2} \phi_{4i}\Delta EXC_{t-i} + \gamma_4 Z_{t-1} + c_4 + \varepsilon_{4t}$$

Where, ΔDI stands for change in dollarization index calculated on a monthly basis, ΔINF is the change in inflation rate over corresponding month of previous year, ΔEXC is defined as the change in USD/GEL exchange rate at the end of each month, ΔDIF stands for the change in interest rate differential on time deposits based on weighted average interest rates in each month, and Z_t is the error correction term which introduces long-term stochastic trends between the variables.

Finally, Granger causality testing based on VECM is performed. As the series is found to be co-integrated, there must be either unidirectional or bidirectional causality between the variables. In particular, it is possible to distinguish between *Granger weak causality* and causality in regards of error correction term in Equation 4. The weak Granger causality is interpreted as short-run causality where the dependent variable responds to short-term shocks of another variable. In this case, it is necessary to test for significance of the coefficients on the dependent variables using a standard Wald test. The coefficients on the error correction term, however, indicate how fast the deviations from the long-run equilibrium are recovered. The significance of the coefficients on the error correction tern is estimated using a simple *t*-test. Furthermore, in order to test Granger causality, it is also important to estimate whether the two sources of causation are jointly significant or not. For this purpose, the null hypothesis is tested by using *F*-tests. (Oh and Lee 2004, 56-57)

The VECM is efficiently specified if the residuals of the model are stationary in level and exhibit no serial correlation (Papana 2014, 8). Accordingly, ADF and PP tests are used in order to conform no non-stationarity of residuals; VECM residual Portmanteau tests are used

in order to test for possible autocorrelation. Furthermore, impulse responses of the variables are computed in order to have an additional check of the co-integration test findings (Asari *et al.* 2011, 54). In particular, the author analyses the dynamic responses of DI to shocks in the other variables.

3.2. Estimation Results

The main estimation results are reported in Tables 8-11. The results of VECM include four equations for the each variable used and one co-integrating equation Z_{t-1} introducing long-term stochastic trends between the variables. According to R-squared values, three first VECM equations explain approximately 20% of the variation in the corresponding dependent variable with the exception of the fourth VECM equation which explains less than 10%. Accordingly, using F-statistics, the three VECM equations are considered significant at 5% level whereas the fourth VECM equation is not significant.

By looking at the first VECM equation, where ΔDI is the dependent variable, it is seen from the error-correction coefficient γ_1 that 2.18% of the equilibrium error is corrected in each period (significant at 10% level). Therefore, the adjustment back to its equilibrium takes long time. From the short-run coefficients (β_{1i}, δ_{1i}, ϕ_{1i}, and ψ_{1i}) it is obtained that ΔDI today depends negatively on the first lag of ΔDI (statistically significant at 1% level). Statistically significant variable at 1% level of significance is additionally ΔEXC which has a positive effect on dollarization today. The other two remaining variables (ΔINF and ΔDIF) should be neglected due to the extremely large standard errors.

The negative dependence of dollarization today on dollarization one period before can be explained by ongoing de-dollarization policies implemented by National Bank of Georgia. Additionally, positive dependence of dollarization today on USD/GEL nominal exchange rate in the previous month applies that residents prefer more U.S. dollar deposits as the value of GEL has decreased relative to USD. This result is theoretically consistent with Yinusa (2008) explanation who points out the importance of volatility in exchange rate in regards of preferring to hold more foreign currency.

The second VECM equation, where ΔINF is the dependent variable, reveals that 4.92% of the equilibrium error is corrected in each period (according to the error correction coefficient γ_2 which is significant at 1% level). Therefore, similar to ΔDI, the adjustment back to its equilibrium takes a long period. Short-term coefficients (β_{2i}, δ_{2i}, ϕ_{2i}, and ψ_{2i}) show that ΔINF today depends positively on the first lag of ΔDIF (significant at 5% level) and the second lag of ΔDIF (significant at 1% level). Additionally, ΔINF today positively reacts to ΔINF in the previous month. Furthermore, negative dependence of ΔINF today on the second

lag of ΔEXC is obtained (significant at 5% level). The variable ΔDI should be disregarded due to a large standard errors of the coefficients.

The positive dependence of inflation rate today on inflation rate one period before is consistent as inflation can be in general referred to as a persistent economic variable. Additionally, positive dependence of inflation today on the interest rate differential on time deposits is also anticipated. In particular, short-term interbank interest rates are increased by National Bank of Georgia in the existence of high inflation which also increases the gap between domestic and foreign interest rates. Negative relationship between ΔINF today and ΔEXC two periods before is not consistent with the theory as depreciation in the exchange rate should cause inflation rate to increase due to a phenomenon of the exchange rate pass-through. Nevertheless, two variables can be correlated without having a direct causal relationship between each other.

The third VECM equation, where ΔEXC is the dependent variable, reveals that 0.82% of the equilibrium error is corrected in each period (according to the error correction coefficient γ_3). Therefore, there is almost no adjustment back to its long-run equilibrium. Short-term coefficients (β_{3i}, δ_{3i}, ϕ_{3i}, and ψ_{3i}) show that ΔEXC today depends positively on ΔEXC one month before (significant at 2% level) and ΔEXC two months before (significant at 1% level). Additionally, negative relationship between ΔEXC today and ΔINF in the previous month is obtained which is significant at 1% level. Furthermore, negative dependence of ΔEXC today on the first lag of ΔDI is found (significant at 5% level). The variable ΔDIF should be disregarded due to a large standard errors of the coefficients.

The positive dependence of USD/GEL nominal exchange rate today on USD/GEL nominal exchange rate one period and two periods before can be explained due to the persistence exhibited by changes in nominal exchange rates (Mussa 1986, 118). Negative relationship between ΔEXC today and ΔINF one period before is not consistent with the theory as high inflation should reduce the value of domestic currency. Therefore, there can exist a correlation between ΔEXC today and ΔINF one period before, however, the changes in the variables could be caused by another economic variables or exogenous shocks.

By looking at the first VECM equation, where ΔDIF is the dependent variable, it is seen from the error-correction coefficient γ_4 that 0.43% of the equilibrium error is corrected in each period. Therefore, similar to ΔEXC, there is almost no adjustment back to its long-run

equilibrium. From the short-run coefficients (β_{4i}, δ_{4i}, ϕ_{4i}, and ψ_{4i}) it is obtained that ΔDIF today depends negatively on the second lag of ΔDIF (significant at 10% level). The other variables (ΔDI, ΔINF and ΔEXC) should be neglected due to the extremely large standard errors.

Table 8. Estimation results

Vector Error Correction Estimates
Sample (adjusted): 2003M04 2015M02
Included observations: 143 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1			
DI(-1)	1.000000			
INF(-1)	-2.805856 (0.56161) [-4.99610]			
EXC(-1)	-0.380888 (0.18448) [-2.06470]			
DIF(-1)	-6.888463 (2.29397) [-3.00285]			
C	0.445421			

Error Correction:	ΔDI	ΔINF	ΔEXC	ΔDIF
CointEq1	-0.021834 (0.01144) [-1.90866]	0.049151 (0.01074) [4.57703]	0.008241 (0.02747) [0.30003]	-0.004325 (0.00350) [-1.23400]
ΔDI(-1)	-0.261392 (0.09830) [-2.65909]	0.007032 (0.09228) [0.07620]	-0.474623 (0.23602) [-2.01091]	0.029352 (0.03012) [0.97458]
ΔDI(-2)	-0.086169 (0.09448) [-0.91206]	0.103999 (0.08869) [1.17265]	-0.194845 (0.22684) [-0.85894]	0.013156 (0.02895) [0.45450]
ΔINF(-1)	-0.059550 (0.08534) [-0.69776]	0.155142 (0.08011) [1.93649]	-0.709449 (0.20492) [-3.46216]	0.037458 (0.02615) [1.43257]
ΔINF(-2)	-0.051227 (0.08881) [-0.57681]	-0.011134 (0.08337) [-0.13356]	0.159509 (0.21323) [0.74804]	0.000620 (0.02721) [0.02280]
ΔEXC(-1)	0.161297 (0.04048) [3.98467]	-0.003006 (0.03800) [-0.07911]	0.247870 (0.09719) [2.55031]	-0.010075 (0.01240) [-0.81234]
ΔEXC(-2)	0.083413	-0.083828	0.307167	0.011607

	(0.04517)	(0.04240)	(0.10845)	(0.01384)
	[1.84671]	[-1.97704]	[2.83232]	[0.83876]
ΔDIF(-1)	-0.146644	0.570482	0.104936	-0.027590
	(0.29287)	(0.27492)	(0.70318)	(0.08973)
	[-0.50072]	[2.07507]	[0.14923]	[-0.30749]
ΔDIF(-2)	-0.396456	0.731354	-0.040942	-0.174914
	(0.29206)	(0.27416)	(0.70125)	(0.08948)
	[-1.35744]	[2.66758]	[-0.05838]	[-1.95478]
C	0.000408	-0.000613	0.001032	0.000379
	(0.00128)	(0.00120)	(0.00307)	(0.00039)
	[0.31896]	[-0.51036]	[0.33589]	[0.96718]
R-squared	0.150197	0.177123	0.161139	0.071717
Adj. R-squared	0.092691	0.121439	0.104374	0.008901
Sum sq. resids	0.030715	0.027066	0.177069	0.002883
S.E. equation	0.015197	0.014265	0.036488	0.004656
F-statistic	2.611872	3.180887	2.838695	1.141695
Log likelihood	400.9701	410.0134	275.7171	570.1311
Akaike AIC	-5.468113	-5.594592	-3.716323	-7.834001
Schwarz SC	-5.260921	-5.387401	-3.509131	-7.626809
Mean dependent	1.07E-06	-0.000149	0.000283	0.000304
S.D. dependent	0.015954	0.015219	0.038555	0.004677

Source: Author's calculations

In order to conform the efficiency of VECM, ADF and PP tests are used for the purpose of testing stationarity of the residuals. According to Table 9 and 10, neither ADF nor PP find non-stationarity in residuals as the null hypothesis of having a unit root is rejected using 1% significance level in both cases.

Table 9. ADF unit root tests in level of the residuals

Null Hypothesis: RESID has a unit root

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-14.19677	0.0000
Test critical values:	1% level	-3.476472	
	5% level	-2.881685	
	10% level	-2.577591	

Source: Author's calculations

Table 10. PP unit root tests in level of the residuals

Null Hypothesis: RESID has a unit root

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-14.49903	0.0000
Test critical values:	1% level	-3.476472	
	5% level	-2.881685	
	10% level	-2.577591	

Furthermore, for the efficiency of VECM, no serial correlation between the residuals is required. Accordingly, the author uses Portmanteau tests where the null hypothesis of no residual autocorrelations up to lag 12 is tested. Based on the results in Table 11, no serial correlation between the residuals is found as the null hypothesis cannot be rejected in the case of any lags using 1% significance level.

Table 11. VECM residual Portmanteau tests for autocorrelations

Null Hypothesis: no residual autocorrelations up to lag h

Lags	Q-Stat	Prob.	Adj Q-Stat	Prob.	df
1	1.611983	NA*	1.623335	NA*	NA*
2	3.559409	NA*	3.598384	NA*	NA*
3	14.72498	0.9812	15.00322	0.9784	28
4	27.87877	0.9723	28.53554	0.9657	44
5	54.74682	0.6675	56.37706	0.6089	60
6	69.18982	0.6968	71.45261	0.6263	76
7	76.93354	0.8703	79.59490	0.8184	92
8	85.35586	0.9471	88.51631	0.9145	108
9	94.63732	0.9769	98.42116	0.9562	124
10	109.2622	0.9745	114.1456	0.9465	140
11	117.2020	0.9912	122.7471	0.9771	156
12	154.6871	0.8239	163.6660	0.6630	172

In order to determine the causal relationships between the variables, Granger causality testing based on VECM is performed. In particular, the author's aim is to determine *Granger weak causality* using a standard Wald test, long-term causality using a simple *t*-test, and the two sources of causation jointly using *F*-tests. The results of the tests are given in Table 12, where the test statistic of each variable's causal effect on another variable is presented.

Based on the testing of *Granger weak* i.e. short-run causality between the variables, three Granger causes are obtained. In particular, there exists one-directional causal effect from ΔEXC to ΔDI (significant at 1% level). This empirical finding is consistent both the theory that explains the importance of exchange rate volatility in regards of diversifying the portfolio of liquid money assets with foreign currency. In addition, similar result was obtained by Loiseaus-Aslanidi (2012) who modelled the effect of inflation, exchange rate, and time deposit interest rates on dollarization in Georgia in 1996-2007.

In addition, one-directional causal effect from ΔDIF to ΔINF is obtained (significant at 1% level). The causality can be explained by the monetary policy of National Bank of Georgia

that uses short-term interbank interest rates as an operation target. In particular, it is expected that increasing short-term interbank interest rates also increases the domestic interest rate on time deposits which as a result, increases interest rate differential on time deposits. Consequently, initial short-term effect is transmitted to the long-term impact transmitted influencing aggregate demand in the economy and, therefore, price levels or inflation.

Furthermore, another one-directional causal effect from ΔINF to ΔEXC is obtained (significant at 1% level). This result is theoretically consistent as increasing inflation rate should reduce the value of domestic currency. Specifically, as a result of higher price of Georgian goods, export decreases which also decreases the demand for GEL. Additionally, imported goods are preferred which increases the supply of GEL and reduces the value of GEL even further.

Based on the testing of the two sources of causation jointly i.e. long-term causality, four Granger causes are obtained. In particular, three one-directional causal effects described above are repeated. However, one-directional short-term causal effect from ΔINF to ΔEXC becomes bi-directional in the case of long-term (significant at 1% level). This result is theoretically consistent as a depreciation in the exchange rate should cause an increase in the inflation rate. Alvarez-Plata and Garcia-Herrero (2008) has explained this through a phenomenon of the exchange rate pass-through which points out the side effect of the relatively higher change in prices of imported goods as a respond to the exchange rate change.

Additonally, one-directional long-term causal effect from ΔDI to ΔINF is obtained (significant at 1% level). It can be theoretically justified as the in the presence of dollarization, the money supply is only partially determined and controlled by the monetary authority which also makes the inflation not entirely controllable. The result is also consistent with the empirical finding from the case of Lebanon where Ghalayini (2011) finds one-directional Granger causality running from dollarization to inflation and not the other way.

Table 12. Granger causality tests

**Significant at 1% level				Source of causation (independent variable)					
	Short run				Long run				
Dependent variable	ΔDI	ΔINF	ΔEXC	ΔDIF	Z_{t-1}	$Z_{t-1}/$ ΔDI	$Z_{t-1}/$ ΔINF	$Z_{t-1}/$ ΔEXC	$Z_{t-1}/$ ΔDIF
ΔDI		0.937	18.211**	1.991	-1.908		1.396	8051.367**	1.409
ΔINF	1.384		3.915	10.554**	4.577**	7.382**		7.666**	7.653**
ΔEXC	4.369	12.081**		0.027	0.300	1.523	4.114**		0.040

| ΔDIF | 1.049 | 2.095 | 1.484 | | -1.234 | 0.921 | 1.321 | 0.952 | |

In Figure 9, the generalized impulse responses of the variables are computed. The author prefers to use the generalized impulse responses as they fully take into account the historical patterns of correlations observed amongst the different shocks and are invariant to the reordering of the variables (Pesaran and Shin 1997, 3-4). It is seen that the initial response of DI to a unit shock in DI is positive and gradually decreasing within 12 months. It is consistent as a positive shock in dollarization increases the amount of foreign currency deposits in the economy, however, the effect slowly disappears. The response of DI to a unit shock in EXC is also positive, however, gradually increasing until it gets stable from the sixth month. It can be explained by the fact that the exchange rate depreciation lowers the value of domestic money in the portfolio of assets. The response of DI to unit shocks in INF and DIF are both considered as insignificant.

In regards of the generalized impulse responses on the inflation rate, it can be seen that the response of INF to a unit shock in INF is positive and gradually dies out. It can be explained by the persistence in inflation rate as it takes time for the economy to recover from exogenous shocks. The initial response of INF to a unit shock in DIF is insignificant, however, gradually becomes negative and stronger. It is consistent with the theory as the short-term interbank interest rates are used by National Bank of Georgia as an operation target. Nevertheless, it is important to notice that it takes time until the initial short-term effect is expected to be transmitted to the long-term impact. The response of INF to unit shocks in DI and EXC are both considered as insignificant.

In regards of the generalized impulse responses on USD/GEL nominal exchange rate, a positive, gradually increasing, and stable from the fifth month response of EXC to a unit shock in EXC is obtained. The response of EXC to unit shocks in DI, INF and DIF are all considered as insignificant.

Finally, the generalized impulse responses on interest rate differential on time deposits are described. In particular, a positive and relatively stable response of DIF to a unit shock in DIF is computed. In regards of the response of DIF to unit shocks in DI, INF and EXC, all of them are considered as insignificant.
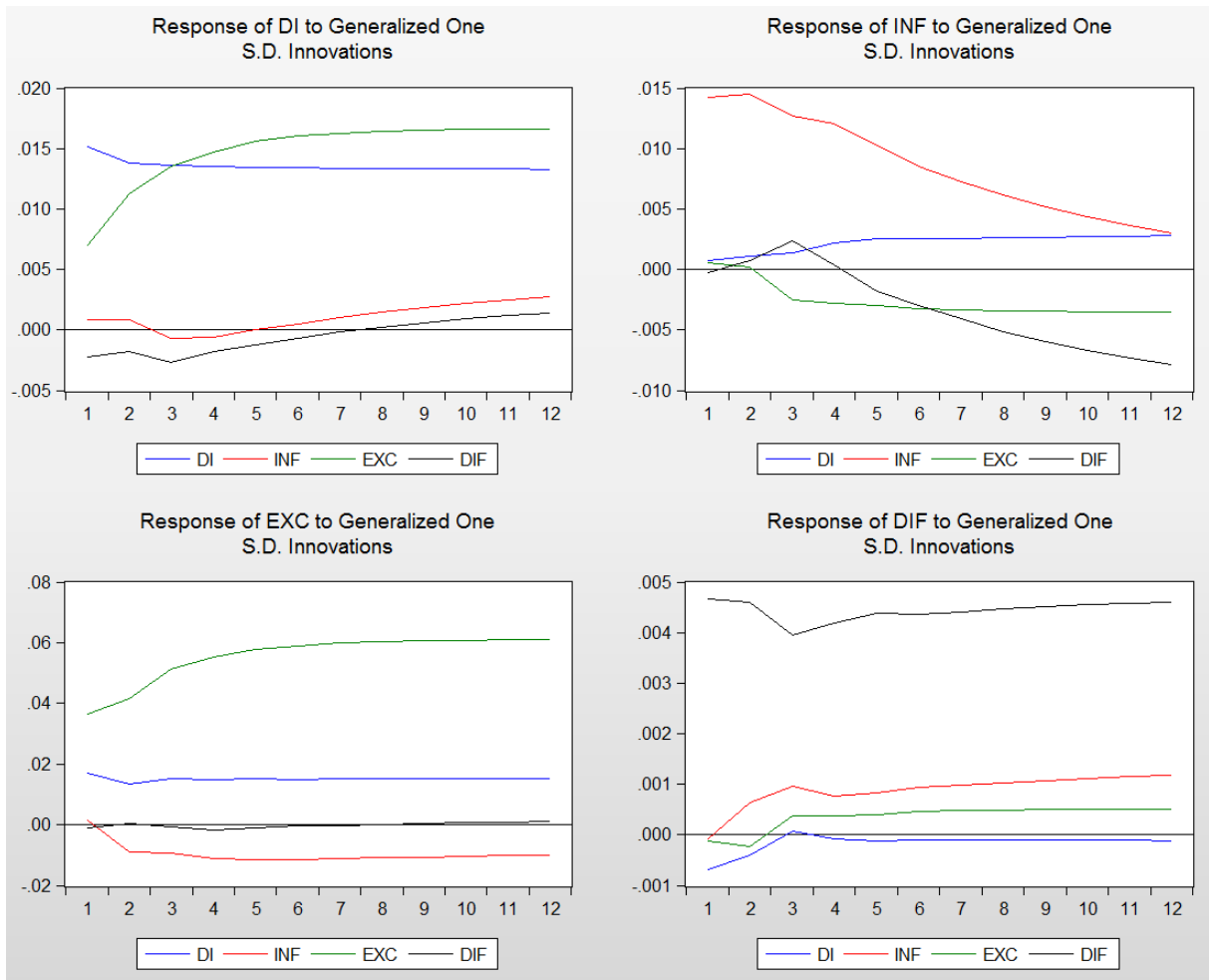
Figure 9. Generalized impulse responses

Source: Author's calculations

3.3. Implications on Monetary Policy Decisions

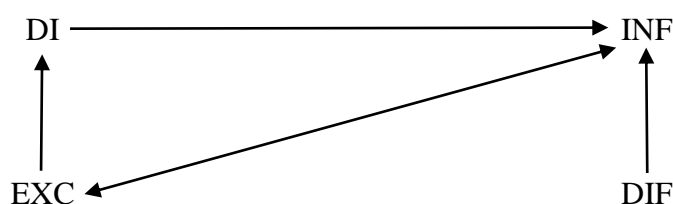The causal channels obtained from VECM can be summarized as below:

Figure 10. Causal channels based on Granger causality tests
Source: Author's calculations

In Figure 10, the pool of direct and indirect causal effects is presented. The author's main aim is to detect the driving factors causing dollarization in Georgian economy and determine the main monetary tools available to the National Bank of Georgia to control for dollarization. In this regard, USD/GEL nominal exchange rate can be considered the only direct driver of dollarization in Georgia. This is consistent with the theory as the change in exchange rate affects the value of domestic currency and therefore which may cause untrustworthiness of GEL by the economic agents.

The main indirect channel through which dollarization in Georgian economy can be explained, is the causal effect running from the interest rate differential on time deposits to the inflation rate, from the inflation rate to USD/GEL nominal exchange rate and finally, from USD/GEL nominal exchange rate to the dollarization index. Similar to the direct channel, also the indirect channel starting from the interest rate differential on time deposits and ending at the dollarization index can be considered consistent with the theory. In particular, if the change in the interest rate differential on time deposits is caused by the change in domestic interest rate then it should also change savings of the residents in domestic currency. Afterwards, the change in savings also changes the consumption which eventually affects aggregate demand and therefore, price levels or inflation. The inflation rate affects USD/GEL nominal exchange rate as a result of, for example, higher price of Georgian goods which decreases exports and therefore, the demand for GEL. Furthermore, imported goods are preferred by the locals which increases the supply of GEL and reduces the value of GEL even further.

However, the channels described above work only in the short-run as two extra causal effects need to be added in the long-run. Specifically, the causal relationship between the inflation

rate and USD/GEL nominal exchange rate becomes bidirectional. The causal effect running in the long-run from USD/GEL exchange rate to the inflation can be explained by the exchange rate pass-through. Moreover, in the long-run, the inflation rate is Granger caused by the dollarization index. This causality between the variables is important to consider by National Bank of Georgia in regards of the efficiency of inflation targeting. In particular, changing the short-term interbank interest rates affects only the demand of domestic currency and therefore, in the case of high dollarization index, the central bank has only limited influence on price levels or inflation.

Ortiz (1983) has pointed out that there is a greater incentive to diversify the portfolio of liquid money assets with foreign currency under floating than in the case of fixed exchange rate regime. Based on this phenomenon and the findings from Granger causality testing, the author would recommend to consider adopting from floating exchange rate regime to fixed exchange rate regime as the uncertainty in regards of the fluctuating value of domestic currency increases the dollarization index in Georgia. Furthermore, Reinhart *et al.* (2003) emphasizes the issue of higher exchange rate pass-through with more volatile exchange rate which reduces also the central bank's control of inflation. However, a thorough assessment of effects of fixed exchange rate regime should be carried out in order to evaluate its potential positive and negative economic consequences.

Nevertheless, the empirical research by Lin and Ye (2013) about 13 targeting countries has shown that the adoption of inflation targeting induced to reduce financial dollarization by over 8 pp. Hence, the findings suggest that inflation targeting is an effective policy tool to deal with the issue of dollarization in developing countries. In particular, as currency substitution should increase the exchange rate volatility, according to the empirical study by Ozsoz *et al.* (2010), in the dollarized economy with controlled inflationary processes, the central bank would still have an incentive to intervene in the foreign exchange markets to control for exchange rate variations. Accordingly, the main objective of National Bank of Georgia to focus on inflation targeting cannot be considered completely inaccurate approach as through foreign exchange market interventions also exchange rate as the main direct driver of dollarization in 2003-2015 is controlled for. However, due to "*hysteresis effect*" it can be a long-way approach as it is not easy to substitute foreign currency with domestic currency due to raised additional costs associated with currency substitution.

CONCLUSIONS

The objective of this master thesis is to research dollarization and its implications on monetary policy decisions in Georgia. It is empirically seen that from time to time some currencies become stronger compared to other currencies. In the presence of dollarization, the total money supply in the economy is not entirely controlled by the central bank and therefore, conducting monetary policy is less effective. In Georgia, dollarization index measured by percentage of foreign deposits to broad money has recently increased from 45.08% (in December 2014) to 49.54% (February 2015). Taking into account the importance of dollarization in the context of conducting monetary policy, the central research questions in this thesis are to analyse the significance of dollarization in Georgia, to determine the driving factors causing dollarization, and to identify the main monetary tools available to the National Bank of Georgia to control for dollarization.

At first, the author aims to analyse other author's articles and research papers in order to obtain the main understandings of the term of dollarization and its essence in several countries including both developed and developing ones. Most of the empirical work has focused on developing countries where currency substitution is expected to be caused by changing inflation and where correlation between the two variables is positive. However, different empirical studies find opposite outcomes where clear evidence is given that dollarization does not respond to inflation in a manner that is predicted by the theoretical literature. Additionally, the impact of exchange rate volatility on dollarization has been investigated. The empirical results suggest that an increased currency substitution leads to increased volatility in exchange rate. Furthermore, the theory suggests that the difference between domestic and foreign interest rates have an important role in influencing the level of dollarization where empirical testing have also yielded consistent results.

Connections between dollarization and monetary policy are discussed focusing, in particular, on inflation targeting and exchange rate regimes. In the case of inflation targeting, decisions on monetary policy are based on the deviations of forecasts of future inflation from the announced numerical target. The empirics have found contradictory results in regards of effectiveness of controlling for dollarization. In particular, one empirical study has shown that

the adoption of inflation targeting induced to reduce financial dollarization whereas another research points out the phenomenon of a *"hysteresis effect"* which implies high dollarization even if there has been a decrease in inflation. In addition to inflation targeting, monetary policy also relies on either fixed or floating exchange rate regime. Using fixed exchange rates should reduce uncertainty in regards of the fluctuating value of domestic currency and therefore, inducing de-dollarization, however, it limits the ability to use domestic monetary policy to stabilize the economy. In contrast, if the country operates with a floating exchange rate, the monetary authority can design a countercyclical policy that responds optimally to economic disturbances in the country. However, the main draw-back of such policy can be an excessive volatility and deviations from the equilibrium rate which can induce dollarization.

After establishing the theoretical framework of dollarization and its determinants, the general overview about dollarization phenomenon in Georgia and its change over time is given. In order to analyse the significance of dollarization in Georgia, the composition of total deposits and dollarization index over time are examined. It is concluded that in the period of 2003-2015 more foreign time deposits (FTD) are held relative to domestic time deposits (DTD). Until 2006, neither domestic demand deposits (DDD) are preferred, however, after that period DDD contributes equally with foreign demand deposits (FDD). In regards of currencies used for deposit holdings, U.S. dollar has dominated throughout the period. The composition of broad money (BM) in 2003-2004 reveals that domestic currency in circulation (DCC) and foreign currency deposits (FCD) are the main components. After 2005, the importance of DDD starts increasing and eventually reaches to the level equal to DCC. FCD identified as dollarization index (DI) has always constituted approximately 50% of BM.

In the empirical part, a four-variable VECM focusing on the possible relationship and Granger causes between dollarization and its three possible driving factors are estimated. The findings of Granger causality testing based on VECM provide two main channels through which dollarization is affected by. First, a direct channel, running from USD/GEL exchange rate to the dollarization index; second, an indirect channel starting from the interest rate differential on time deposits and ending at the dollarization index. The findings of the empirical study, in general, provide two main results. First, based on the composition of deposits and broad money, one of the main components creating dollarization is foreign time deposits denominated in U.S. dollar. The result can be explained by the fact that U.S. dollar still exists as a store of value for the long-term purposes. Second, the main direct driver causing dollarization in Georgia is the USD/GEL nominal exchange rate. This is proved by

both, preliminary correlation analysis and Granger causality testing where unidirectional relationship is obtained. The result is consistent with the common believe that the elasticity of substitution of domestic currency with foreign currency is likely to increase in periods when the exchange rate is floating.

The following recommendations are offered for further research:

1. Based on the empirical finding of exchange rate Granger causing dollarization, it can be recommended for Georgian economy to deliberate adopting fixed exchange rate regime as a monetary policy tool. However, a thorough assessment of both, potential positive and negative effects of fixed exchange rate regime should be carried out in Georgian economic context in order to test the suitability of new monetary policy approach.

2. The possible determinants causing dollarization can also be unstable political situation and other historical factors such as being a post-soviet country. Therefore, the political economy approach can be considered to analyse possible causes and tendencies in dollarization in Georgia which has not been taken into account in carrying out the research in this thesis.

3. In order to have a better understanding about the incentives to use U.S. dollar as a store of value for the long-term purposes, a detailed microeconomic analysis of domestic residents' preferences in regards of choosing foreign currencies should be performed.

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Appendix A

Table 13. Datasets used for the empirical research

obs	DI	INF	EXC	DIF
2003M01	0.486140	0.055073	2.1850	-0.002066
2003M02	0.491019	0.037500	2.1751	-0.006172
2003M03	0.495277	0.034061	2.1250	-0.009944
2003M04	0.493342	0.021137	2.1450	-0.009198
2003M05	0.503056	0.023072	2.1475	-0.003989
2003M06	0.508136	0.048120	2.1100	-0.002582
2003M07	0.506033	0.050321	2.1212	-0.009377
2003M08	0.506609	0.050511	2.1125	-0.026030
2003M09	0.517137	0.052034	2.1130	-0.015806
2003M10	0.504586	0.047384	2.1069	0.001043
2003M11	0.510426	0.086218	2.1900	0.004542
2003M12	0.501493	0.069527	2.0750	0.006505
2004M01	0.514395	0.051980	2.1051	0.011088
2004M02	0.491927	0.062107	2.0275	0.007091
2004M03	0.495260	0.062734	2.0050	0.002141
2004M04	0.497739	0.055562	1.9900	-0.002343
2004M05	0.506024	0.053656	1.9200	-0.004463
2004M06	0.482050	0.036371	1.9200	-0.005369
2004M07	0.485680	0.054531	1.8900	-0.013856
2004M08	0.453108	0.049935	1.7850	-0.010509
2004M09	0.442230	0.060064	1.8400	-0.015990
2004M10	0.453408	0.077179	1.8275	-0.016423
2004M11	0.448003	0.039823	1.7800	-0.011211
2004M12	0.425049	0.074831	1.8250	-0.010597
2005M01	0.436252	0.092763	1.8201	-0.009551
2005M02	0.434800	0.091507	1.8290	-0.000955
2005M03	0.444349	0.096807	1.8340	-0.001817
2005M04	0.447764	0.103405	1.8250	-0.002578
2005M05	0.456200	0.088717	1.8270	-0.000878
2005M06	0.439623	0.090298	1.8125	0.004957
2005M07	0.437555	0.060137	1.8075	0.003682
2005M08	0.434805	0.072016	1.7900	-0.003365
2005M09	0.441400	0.076685	1.7925	0.002031
2005M10	0.441543	0.077529	1.7975	0.009360
2005M11	0.438941	0.079399	1.7900	0.006621
2005M12	0.420979	0.061790	1.7925	0.000157
2006M01	0.437236	0.052472	1.8125	0.007057
2006M02	0.445300	0.050995	1.8265	0.005869
2006M03	0.438584	0.045799	1.8270	0.004432
2006M04	0.450497	0.060123	1.8169	0.005093
2006M05	0.446000	0.099998	1.8000	0.004609
2006M06	0.429538	0.114172	1.7730	0.005246
2006M07	0.438605	0.145193	1.7650	0.008159
2006M08	0.448511	0.134073	1.7440	0.010637
2006M09	0.452326	0.112397	1.7355	0.017240
2006M10	0.468404	0.102287	1.7390	0.016390
2006M11	0.484448	0.098392	1.7315	0.017949
2006M12	0.457143	0.087780	1.7135	0.023308
2007M01	0.475689	0.104379	1.7199	0.014704

2007M02	0.497767	0.110372	1.7130	0.006264
2007M03	0.467829	0.097474	1.7000	0.002893
2007M04	0.462625	0.081219	1.6900	0.012223
2007M05	0.457715	0.072815	1.6780	0.008410
2007M06	0.466864	0.072633	1.6695	0.006751
2007M07	0.449483	0.065735	1.6680	0.010519
2007M08	0.460222	0.076987	1.6625	-0.003636
2007M09	0.450038	0.089689	1.6580	0.007936
2007M10	0.446762	0.112177	1.6225	0.005693
2007M11	0.422671	0.116396	1.6210	0.008722
2007M12	0.431237	0.109747	1.5916	0.016198
2008M01	0.461486	0.107073	1.5870	0.014592
2008M02	0.442216	0.109188	1.5540	0.016914
2008M03	0.406126	0.122504	1.4760	0.018453
2008M04	0.412726	0.122243	1.4620	0.019358
2008M05	0.410709	0.112353	1.4440	0.021420
2008M06	0.391173	0.113366	1.4180	0.035122
2008M07	0.385964	0.098035	1.4080	0.032338
2008M08	0.378524	0.127986	1.4100	0.029895
2008M09	0.392340	0.106051	1.4050	0.029997
2008M10	0.406150	0.070203	1.4210	0.026420
2008M11	0.468646	0.062666	1.6500	0.021465
2008M12	0.523231	0.055477	1.6670	0.022474
2009M01	0.528499	0.044409	1.6670	0.024688
2009M02	0.529572	0.020945	1.6840	0.028324
2009M03	0.509818	0.015720	1.6700	0.026847
2009M04	0.475283	0.017850	1.6501	0.021239
2009M05	0.482510	0.022425	1.6450	0.015696
2009M06	0.481550	0.023470	1.6579	0.010809
2009M07	0.479763	0.001413	1.6746	0.008394
2009M08	0.490682	-0.031061	1.6858	0.005387
2009M09	0.488516	0.004402	1.6771	0.004832
2009M10	0.491848	0.032032	1.6790	0.011712
2009M11	0.480558	0.026972	1.6743	0.007539
2009M12	0.487393	0.029862	1.6858	0.007247
2010M01	0.508232	0.026930	1.7415	0.001512
2010M02	0.497022	0.056332	1.7360	-0.000381
2010M03	0.482528	0.058204	1.7494	0.001407
2010M04	0.476436	0.056119	1.7738	0.003800
2010M05	0.484803	0.040063	1.7847	0.002450
2010M06	0.489557	0.036891	1.8442	0.005175
2010M07	0.528630	0.070479	1.8391	-0.000873
2010M08	0.528386	0.095120	1.8330	0.005841
2010M09	0.535422	0.097942	1.8064	0.009825
2010M10	0.521349	0.095760	1.7780	0.012594
2010M11	0.499798	0.105424	1.7593	0.015762
2010M12	0.502585	0.112413	1.7728	0.019529
2011M01	0.517640	0.122604	1.8089	0.019387
2011M02	0.514360	0.137474	1.7568	0.017666
2011M03	0.518307	0.139359	1.7059	0.016286
2011M04	0.487433	0.134991	1.6408	0.024172
2011M05	0.498397	0.143316	1.6658	0.029023
2011M06	0.505293	0.100338	1.6665	0.027966
2011M07	0.478114	0.084990	1.6549	0.028301
2011M08	0.480811	0.071544	1.6457	0.028625
2011M09	0.489370	0.045618	1.6610	0.030360
2011M10	0.471439	0.023182	1.6592	0.034004
2011M11	0.466537	0.019171	1.6583	0.035778
2011M12	0.447171	0.020411	1.6703	0.033567
2012M01	0.447447	0.004785	1.6690	0.028209

2012M02	0.447804	-0.020545	1.6636	0.029379
2012M03	0.460827	-0.022109	1.6600	0.028134
2012M04	0.438660	-0.021049	1.6268	0.031550
2012M05	0.478100	-0.033003	1.6258	0.030650
2012M06	0.473899	-0.001800	1.6451	0.028234
2012M07	0.485325	0.005648	1.6592	0.028069
2012M08	0.478494	-0.003592	1.6606	0.030807
2012M09	0.458397	-0.001209	1.6593	0.024660
2012M10	0.474895	0.000783	1.6607	0.026507
2012M11	0.483244	-0.004872	1.6565	0.019062
2012M12	0.463574	-0.013734	1.6567	0.021506
2013M01	0.474658	-0.016000	1.6574	0.024296
2013M02	0.475300	-0.021170	1.6537	0.023633
2013M03	0.480723	-0.020694	1.6577	0.024498
2013M04	0.468791	-0.016780	1.6508	0.026580
2013M05	0.471650	-0.001120	1.6411	0.027747
2013M06	0.460995	0.002414	1.6509	0.027695
2013M07	0.465461	-0.002123	1.6540	0.025231
2013M08	0.451088	-0.003528	1.6615	0.021842
2013M09	0.446458	-0.012941	1.6644	0.021276
2013M10	0.437904	0.001728	1.6707	0.022866
2013M11	0.439529	0.006071	1.6920	0.022280
2013M12	0.429431	0.023723	1.7363	0.022320
2014M01	0.462393	0.029197	1.7819	0.028372
2014M02	0.453489	0.034608	1.7495	0.025403
2014M03	0.455421	0.034918	1.7477	0.024807
2014M04	0.462817	0.034291	1.7709	0.022471
2014M05	0.461945	0.024048	1.7719	0.024530
2014M06	0.467687	0.020417	1.7691	0.024768
2014M07	0.459090	0.028499	1.7418	0.025840
2014M08	0.447268	0.033766	1.7360	0.028651
2014M09	0.459538	0.047518	1.7524	0.028946
2014M10	0.452263	0.034414	1.7544	0.027713
2014M11	0.459423	0.027644	1.8368	0.030520
2014M12	0.450795	0.019516	1.8636	0.030995
2015M01	0.489929	0.013938	2.0557	0.032070
2015M02	0.495430	0.012726	2.1654	0.033525

Source: National Bank of Georgia and author's calculations