An Investigation of the Macroeconomic and Monetary Effects of Dollarization in Eritrea

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Abstract

Most countries of the developing world have voluntarily or involuntarily been involved in using foreign currencies and trapped their economies for either the best or worst outcomes of dollarization. For those countries that have fully dollarized their economies, dollarization has provided some benefits in terms of bringing economic stability. However, the benefits in these economies came with costs that have worsened the income inequality and poverty that exist within their economies. Similarly, some countries that rely partially on their own currencies and partially on foreign currencies have seen different outcomes of partial dollarization.

This research has specifically examined the reliance of the Eritrean economy on hard currency. Despite numerous studies that have been conducted regarding the Eritrean economy, the dollarization of Eritrea is an important issue that has not been investigated. This research has uncovered what kind of dollarization the Eritrean economy has and also what factors drive the Eritrean dollarization. It has been found that there is partial dollarization with evidence of financial, sovereign liability and underground dollarization in the economy. Real dollarization is only manifested in the form of selling houses and lands in exchange for hard currency. It has also been discovered that banking practices, the structure of the interest rate, loans issued to the private sector relative to the government sector and the Eritrean monetary system, particularly the introduction of new currency, followed by the second war with Ethiopia in 1998, are some of the causative factors.

Furthermore, this research has investigated the impact of partial dollarization of the Eritrean economy on macro-economic variables with specific examination on the exchange rate volatility, inflation and the monetary policy transmission mechanisms. In each analysis, quarterly data starting from 1996 to 2008 is employed. The fundamental

reason for selecting this time period for the study is the inability to obtain the data for some of the variables outside the specified time period. Exponential Generalised Autoregressive Conditionally Heteroscedasticity in mean (EGARCH) model is applied over real official exchange rate and on both nominal as well as real black market exchange rates. Dollarization measured by a hard currency index is then augmented in the variance equation of EGARCH-M (1, 1). The results show that partial dollarization of the Eritrean economy enhances the volatility of the real official exchange rate, the nominal and the real black market exchange rates.

To see whether partial dollarization reduces or produces inflation in the Eritrean economy, Vector Error Correction Models together with Dynamic Ordinary Least Squares (DOLS) are employed. The results indicate that inflation increases as a result of an increase in dollarization. This applies regardless of whether official or black market exchange rate data are used in the estimation. In terms of the short-run dynamics involved in the long-run relationship between dollarization and inflation, the speed of adjustment towards long-run equilibrium ranges from 7.2-7.6 percent per quarter. Both error correction terms are negative. This indicates that the adjustment process is stable and convergent towards the long-run equilibrium which implies that there is a guaranteed long-run relationship between inflation and the remaining variables including dollarization.

To examine the effectiveness of the channels of the monetary policy, Vector Autoregressive (VAR), Structural Autoregressive (SVAR) and Toda and Yamamoto (TY) models have been used. The results suggest that there is an effective exchange rate channel through the black market, an ineffective credit channel through the credit issued to the private sector and an effective credit channel through the credit issued to the government.

In general, the contribution of this study can be summarized in three different areas: first, the measurement of dollarization; second, the determinants of dollarization; third, the effects of dollarization. Some of the policy implications of the findings are first, the Bank of Eritrea should address its exchange rate policy by revisiting the current official exchange rate and, at the same time, by addressing the growth of the black market foreign exchange. The Bank of Eritrea should also address its regulation on banking practices and the structure of interest rates. Second, the bank should create a conducive environment for the private sector to promote economic growth and minimise excessive government expenditure which requires fiscal discipline. Third, there should be an effort made to pave the ways for economic and financial cooperation with neighbouring countries.

Notes on Papers for Publication

From this thesis, the following papers have been submitted for publication. Some of these papers have also been presented at conferences.

PUBLICATION

- The Dollarization of Less Developed Countries: A Note on the Computation of a Hard Currency Index, *Journal of International Economics and Research (Published)*

PAPERS

- Does Dollarization Alleviate or Aggravate Exchange Rate Volatility? *Journal of Economic Development (Accepted)*

- Monetary Policy and its Transmission Mechanisms in Eritrea, *Journal of Policy Modeling (Accepted)*

- Does Dollarization Reduce or Produce Inflation? *Journal of Economic studies (Under Revision)*

- The How, Why and What questions of Dollarization, *Economic Notes (Under Review)*

- Dollarization and its Determinants in the Eritrean Economy, *Journal of African Development (Under Review)*

- On Dollarization and Monetary Policy Transmission Mechanisms (*to be submitted in the near future*)

CONFERENCES

- The 9th Biennial Pacific Rim Conference of the Western Economic Association International (WEAI), Brisbane, Australia (April, 2011) (Does Dollarization Alleviate or Aggravate Exchange Rate Volatility?)

- The 14th Annual Waikato Management School Student Research Conference, Hamilton (October, 2010) (Does Dollarization Alleviate or Aggravate Exchange Rate Volatility?)

- The 15th Annual Waikato Management School Student Research Conference, Hamilton (October, 2011) (Does Dollarization Reduce or Produce More Inflation?)

- The 16th Annual Waikato Management School Student Research Conference, Hamilton (October, 2012) (Dollarization and Monetary Policy Transmission Mechanisms)

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Variable Definitions

Chapter	Variable	Definition
	M_t^E	import expenditure
	FR_t^T	total foreign exchange reserves
	DS_t	debt service
	FR_t^R	foreign exchange reserves carried forward
Four	M_t^A	the actual imports of goods
	B_t	the amount of hard currency supplied by the black market
	FB_t	foreign borrowing
	$M2_t$	the money supply
	DCC_t	domestic currency in circulation
	DL_t	dollar loans issued by the Eritrean banks
	ε_t	the return on exchange rate
	h_t	a variable for the hard currency index
Five	rrom	real returns on official exchange rate
	rbm	the returns on black market rates
	rrbm	real returns on black market rates

Chapter	Variable	Definition
Six	ECT_{t-1}	the error correction term
	D^f	foreign money holding,
	D^l	local currency holding
	e	exchange rate
	y	gross domestic product
	p^f	inflation rate of foreign countries
	p^l	local inflation rate
	i^l	local interest rate
	MD_t^T	total money demand in the economy
	MS_t^T	the total money supply
	MS_t^F	foreign currency supply
	MS_t^L	domestic money supply
Seven	Z_t	vector of endogenous variables
	X_t	vector of exogenous variables.
	Y_t	gross domestic product
	P_t	consumer price index,
	R_t	reserves
	P_t^{us}	U.S. consumer price index
	FF_t	Federal Funds Rate
	GDP	gross domestic product
	DI	hard currency index
	PUS	U.S. consumer price index
	DC	domestic credit
	GL	credit issued to the government sector
	PL	credit issued to the private sector

Abbreviations

ARCH: Autoregressive Conditional Heteroscedastic

GARCH: Generalized Autoregressive Conditionally Heteroscedastic

EGARCH-M: Exponential General Autoregressive Conditional Heteroscedastic in mean

RROM: Real Return on the Exchange Rate of the Official Market

RBM: Return on the Exchange Rate of the Black Market

RRBM: Real Return on the Exchange Rate of the Black Market.

QTM: Quantity Theory of Money

DOLS: Dynamic Ordinary Least Square

PFDJ: People's Front for Democracy and Justice

BCPE: Banca Cooperativa Popolare Eritrea

BAO: Banca per l' Africa Orientale

AIDB: Agricultural and Industrial Development Bank

CBE: Commercial Bank of Eritrea

HCBE: Housing and Commerce Bank of Eritrea

BE: Bank of Eritrea

EIDB: Eritrea Investment and Development Bank

VAR: Vector Autoregressive

SVAR: Structural Vector Autoregressive

TY: Toda and Yammamoto

VECM: Vector Error Correction Model

OMR: Official Market Exchange Rate

BMR: Black Market Exchange Rate

HFS: Himbol Financial Services

NICE: National Insurance Corporation of Eritrea

SMCP: Saving and Micro Credit Program

SZSCS: Southern Zone Saving and Credit Scheme

ADF: Augmented Dickey Fuller

AIC: Akaike Information Criteria

KPSS: Kwiatkoski-Phillips-Schmidt- Shin

PP: Phillips Perron

Chapter 1- Introduction to the Research

1.1. Introduction

Developing countries in general and poorest countries of the world in particular, have been seeking ways to emancipate themselves from recurring low growth and insufficient economic performance. Most of these countries, however, have inadequate capital accumulation and underdeveloped financial systems which constrain the maximization of their development objectives. These countries have, therefore, been relying on foreign financial resources in the form of loans to fill the financial gap.

Unlike developed countries, however, the loans issued to developing countries are not in their own currency. The borrowing of foreign money in U.S. dollars has made most of these countries to dollarize their economies in order to enable them pay back their debts. The process of borrowing in dollars and servicing debts in dollars has, therefore, led most of these countries to rely on hard currency- a strong and highly valued currency.

Many scholars have studied the causes and effects of relying on hard currency under the term commonly referred to as "dollarization". The existence of high inflation, exchange rate volatility, domestic monetary instability, openness of the economy and close economic ties with the U.S. have been discussed as some of the determinant factors of dollarization (see, for example, Ize & Yeyati, 2003; Agenor & Khan,1996; Wessels, 2004 and Martnez & Werner, 2002).

With regard to the effects of dollarization, some researchers have shown its positive impact on the economies of Latin American countries. Dollarization

has helped these countries to reduce inflation, increase output growth and enhance international integration (see Gruben & McLeod, 2004; Edwards, 2001; and Soto, 2008). In respect to the Euro area, studies by Meller and Nautz (2009) also showed a decline in inflation volatility persistence as a result of common currency in the area. Similarly, Bleaney and Fielding (2002) and Elbadawi and Majd (1996) have noted lower average inflation rate in Franc Zone area.

Although dollarization can generate some benefits to the dollarized economy, several studies have found its negative impact on micro and macro-economic variables. Dollarization increases exchange rate and output volatility, lowers growth of economies with floating exchange rate systems, makes countries vulnerable to external shocks, increases financial risk and makes monetary policy less effective (see the studies by Akçay et al., 1997; Yinusa, 2008; Burnside et al., 2001; Aghion et al., 2000, 2001; Benhima, 2012; Chue & Cook, 2004; De Nicolo et al., 2003; and Domaç & Martinez Peria, 2003). Giving that these negative effects of dollarization can stifle developing economies, put them in a perpetual state of debt and dependence and adversely affect other aspects of national development, this research takes particular interest in investigating the effects of relying on hard currency (dollarization) in the Eritrean economy.

It has been observed that since the introduction of the new Eritrean currency (Nakfa) in 1997, the Eritrean economy has lost an average 43.02 million U.S. dollars in earnings from its exports to Ethiopia. The Eritrean economy has also been predominantly relying on imports of goods since the launch of its new currency. Importing goods from abroad, which formerly were mainly from Ethiopia, with import charges in birr (Ethiopian currency), required the country to settle transactions in hard currency. Settling import products in hard currency

coupled with the decline of export earnings led to the shortage of hard currency in the Eritrean economy. The economy continued to depend on foreign markets for most of its domestic supply. As such, the demand for hard currency continued to grow which ultimately resulted in a hard currency crisis in 2005. This study, therefore, aims to explore the outcomes of persistent reliance of the economy on hard currency by examining what drives its occurrence in the first place. More specifically, this study intends to identify the determinants of dollarization and also the effects of dollarization on exchange rate volatility, inflation and monetary policy transmission mechanism of the Eritrean economy. Moreover, this study endeavors to provide best policy implications based on its research findings. In doing so, a new measurement of dollarization has been constructed. By using money demand and money supply, an inflation model relevant to the Eritrean economy has also been developed.

The remaining part of this chapter has been organised to include Section 1.2, which deals with the background and statement of the research followed by motivation of the study. The relevance and significance of the study is covered in Section 1.4, and the objectives of the study are discussed in Section 1.5. The structure of the thesis is presented in Section 1.6.

1.2. Background and Statement of the Research

Eritrea inherited a war torn economy, underdeveloped financial systems and devastated infrastructures from the Ethiopian military regime in 1991. Right after its independence, the core policy objective of Eritrea was to build a strong foundation for its economic growth and development. Self-reliance was the main development strategy of the country without much expectation of external assistance. As a result, Eritrea had to build up its economy from scratch by

mobilizing its domestic resources, mainly the labour force, and relying on the contributions of its citizens residing abroad. To raise the domestic resources needed for reconstruction, the entire government starting from the president through to military soldiers worked for several years without getting paid salaries (Mckinley, 1996). In addition to this, the following measures of self-reliance were taken.

- High school students unpaid summer field work program.

- Compulsory one-year unpaid teaching program of university students to high school students.

- Extending working hours without raising salaries in governmental organisations.

- One-and-a-half year compulsory national service program that included road construction and other infrastructure projects.

- Unpaid working program for the ex-fighters for independence working in different departments of the government organisation.

- Sponsoring of children who lost their parents in the battle for independence by Eritreans living in foreign countries.

- Two percent tax levy for Eritreans living abroad and raising funds for disabled veterans from Eritreans living abroad.[1]

By doing so, the country showed remarkable economic growth and economic progress in a very short period of time. According to the IMF World Economic Outlook data, GDP of the country grew by 13 percent and 21 percent in 1993 and 1994. Although the country was successful in mobilising its domestic

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[1] These points are written based on the author's observation.

resources and raising its economic growth, the achievements of the development objectives were not sufficient. For this reason, more foreign capital was required for further development. A number of international organisations were willing to offer their assistance to help the country equip itself with the foreign capital. However, to enable its citizens develop the spirit and ethic of hard work and self-reliance, the country turned down all the international offers. From the beginning, since self-reliance was the basic principle of the country, as pointed out by Hansson (2001), Eritrea preferred National 'ownership' of the development projects by avoiding foreign aid. Therefore, in order to carry out its responsibility of self-owned development projects, Eritrea began to borrow foreign currency right after its international recognition as a state in 1993. As part of its self-reliance mission, the country also introduced a new currency of its own in 1997.

The introduction of the new currency, however, was not favoured by the Ethiopian regime and led both countries into disagreements in the settlement of trade transactions. As a result, Ethiopia preferred to settle trade transactions with Eritrea in hard currency (Haile, 2008 and Africa Research Group, 1999, as cited in Zondi & Rejouis, n.d.). Although Eritrea agreed to settle trade in hard currency, the introduction of new currency sent negative political signals to the Ethiopian regime and ultimately led both countries to a second war in 1998. The second war cost both countries economically, socially and politically. According to the World Bank group database, the military expenditure of Eritrea rose from 13 percent to 40 percent of its total GDP between 1997 and 1999. Exports also fell from 30 percent to 10 percent of its total GDP in the same time period. Moreover, Eritrea's foreign borrowing increased from 75 million U.S. dollars to 253 million U.S. dollars in the same time frame. A summary of export performance, military

expenditure and external debt, a proxy of foreign borrowing, is given in Table 1.1
below.

Table 1.1: GDP, Export, External Debt and Military Expenditure (1992-2007)

Year	GDP growth (Annual rate)	Exports (% of GDP)	External debt (in millions of U.S.$)	Military expenditure (% of GDP)
1992	..	11	..	..
1993	13	31	..	22
1994	21	28	29.1	13
1995	3	22	36.7	21
1996	9	29	44.3	22
1997	8	30	75.5	13
1998	2	15	146.1	35
1999	0	10	252.6	40
2000	-13	15	299.9	36
2001	9	12	395.7	24
2002	3	13	490.1	22
2003	-3	6	607.5	21
2004	1	6	705.7	..
2005	3	6	724.5	..
2006	-1	7	784.9	..
2007	1	7	859.8	..
2008	-10	4	961.4	..
2009	4	5	1018.9	..
2010	2	..	..	..

Source: data gathered from IMF World Economic Outlook and World Bank group database.

As can be seen from Table 1.1, Eritrea had nil external debt prior to 1994.
This shows that it had complete reliance on its own ways of mobilising the
resources needed for its rehabilitation and development. The country continued its
basic principle of self-reliance to restore its damaged economy as a result of the
second war. Accordingly, the Warsay-Ykealo plan was introduced to rebuild the
country. Based on the plan, the youth were made to work in the construction of
infrastructure, buildings and field works without any payment apart from
minimum pocket money.

As part of its self-reliance principle, Eritreans living in overseas were asked to sponsor old families of fallen heroes who did not have any local supporters. According to the programme, Eritreans living in all over the world were asked to donate 30 dollars a month for at least two years and to voluntarily continue afterwards. According to the Koser (2003) report, Eritreans in the UK were also asked to contribute an additional 1 pound a day, plus a one–off annual payment of 500 pounds. In Germany, the two percent tax charged on income of Eritreans living in overseas rose to 10 percent for one month and there was a request for a one-off payment of DM 1,000. In addition to this, Eritreans living in Sweden were made to donate one thousand dollars each to mobilize financial resources needed for reconstruction. Since the magnitude of the second war devastation was large, mobilizing financial resources from Eritreans living in overseas was not adequate. Consequently, foreign borrowing kept growing as can be seen from Table 1.1.

The rise of foreign borrowing and thereby the rise of its debt servicing requirement as well as the rise of military expenditure, together with the fall of export earnings, resulted in foreign currency reserve depletion. Figure 1.1 below shows the deterioration of foreign exchange reserves after the second war. The effect of constant decline in the foreign exchange reserves was manifested in the form of selling lands and houses in exchange for hard currency instead of local currency, as reported in People's Daily (2006). Non-local university students were also required to pay their tuition fees and admission fees in U.S. dollars or in a Euro equivalent to the stated U.S. amount instead of local currency. Eritrean citizens residing abroad were made to pay the processing fees of acquiring official transcripts from University of Asmara in U.S. dollars.

Figure 1.1: Foreign Exchange Reserves of Eritrea 1995 to 2009
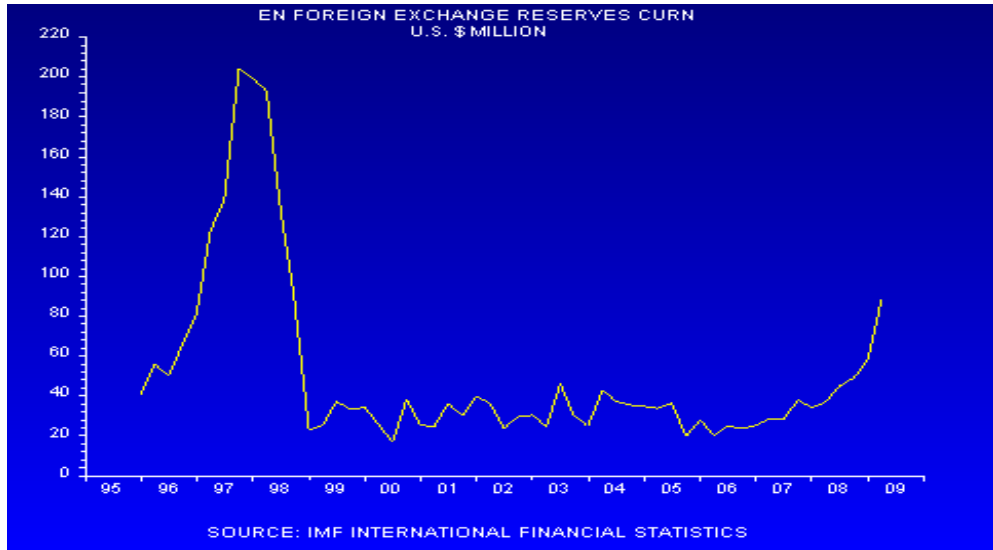
Furthermore, one dollar a day for two years was imposed on Eritreans living in foreign countries in addition to the two percent tax levy. Eritreans living in overseas were also made to buy interest free government bonds with several options of maturity days in exchange for hard currency. According to the Koser (2003)'s report, bonds scaling from 300 U.S. dollars to 1,000 U.S. dollars were sold. In total, 55 million U.S. dollars worth of bonds had been purchased in North America, the Middle East and Europe.

The decline of foreign exchange reserves further led to the introduction of strict regulations of Eritrea's foreign exchange market. The regulations in turn led to the hard currency crisis and the development of the black market. It also led to the shortage of basic consumer products and the rise in price of basic consumer products. This research is, therefore, designed to conduct a broad investigation by posing the following research questions:

1) Why is the Eritrean economy heavily reliant on hard currency (what are the main driving forces of looking for hard currency)?

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2) Where does an excessive reliance on hard currency lead the Eritrean economy towards?

3) What are the effects of relying on hard currency in the Eritrean macroeconomic variables?

4) How can the costs of relying on hard currency in the Eritrean economy be minimized?

This thesis addresses the first research question in Chapter 2 by examining the determinants of dollarization in Eritrea. Although the thesis mainly explores the third research question, the second question is implicitly covered as it discusses the effects. The fourth question has been dealt with in the last chapter which covers the conclusion and policy implications of the study. A short description of the statement of the research problem is represented in the form of a chart below. The chart summarizes the discussions of the origins of the research problem and how it was gradually built up.

Figure 1.2: The Origins of the Research Problem and how it has developed

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                        ┌─────────────────┐
                        │  Self-Reliance  │
                        └────────┬────────┘
                                 │
              ┌──────────────────┴──────────────────┐
              ▼                                      ▼
    ┌───────────────────┐                 ┌───────────────────┐
    │ Generate resources│                 │  The issuance of  │
    │ from within & by  │                 │   new currency    │
    │  your own means   │                 └─────────┬─────────┘
    └───────────────────┘                           │
                                                     ▼
                                          ┌───────────────────┐
                                          │  Conflict and War │
                                          └─────────┬─────────┘
                                                    │
              ┌─────────────────────────┬───────────┴─────────────┐
              ▼                          ▼                         ▼
    ┌──────────────────┐     ┌──────────────────┐      ┌────────────────────┐
    │  Increase of     │     │   Decrease of    │      │ Generating financial│
    │  external debt   │     │   export and     │      │ resources by your own│
    │                  │     │ Increase of import│      │       means        │
    └────────┬─────────┘     └────────┬─────────┘      └──────────┬─────────┘
             │                        │                           │
             └────────────────────────┼───────────────────────────┘
                                       ▼
                            ┌──────────────────┐
                            │ Relying on hard  │
                            │    currency      │
                            └──────────────────┘
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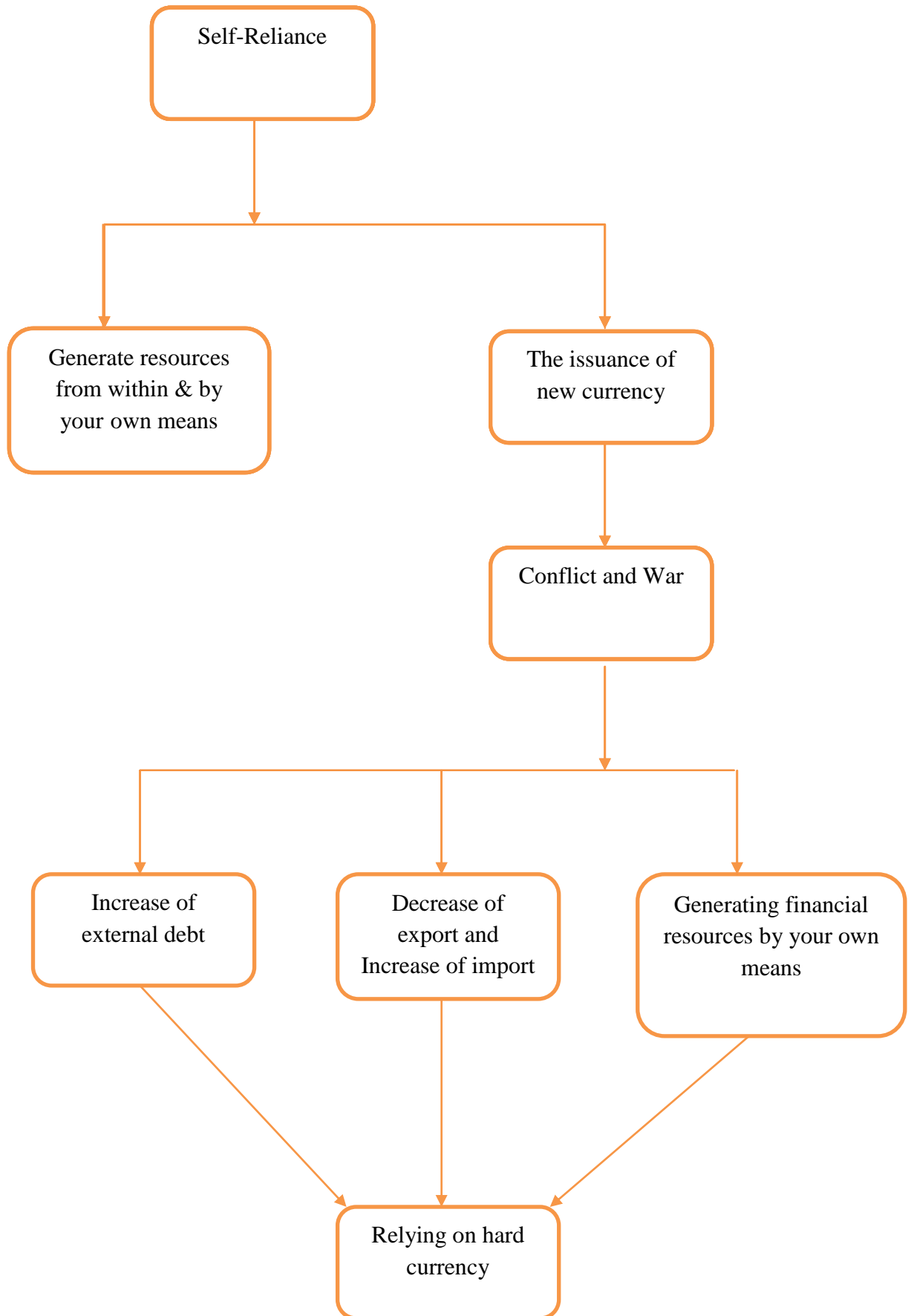
1.3. Motivation

As it is indicated in the study by Rena (2007),

> "The principal objective of the Bank of Eritrea is to manage money and credit in the economy. The bank shall pursue stability in prices, maintain sound exchange rate policy and foster economic growth, employment and overall development in the country. It shall promote a sound financial system in the country. The Bank in consultation with the government shall determine the exchange rate system for the Eritrean currency. "pp. 149.

If the principal objective of the Bank of Eritrea is as stated above, how does relying on hard currency constrain the bank from achieving its objectives? Does the bank still manage to control inflation and maintain stable inflation in the economy? Does the bank have absolute control over the exchange rate and can it stabilize the exchange rate? This research is motivated to address those questions based on the observation of poor Eritrean economic performance. The fundamental motivation of the study rests on the real economic hardship of the people related to the real economic problems of the country.

Since the introduction of the new domestic currency, the overall Eritrean economic performance has been dwindling and getting worse from time to time. The costs of having a new Eritrean currency were more than expected. As has been mentioned in the introductory section, the country lost access to the Ethiopian market where most of its products were exported. As a result, the country lost an average amount of 43.02 million U.S. dollars in earnings from its export to Ethiopia. Its nominal GDP growth continued to deteriorate and declined from an average of 10.8 percent prior to the introduction of new currency to an average of 0.2 percent over the period 1998 to 2007.[2] The new Eritrean currency

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[2] Average estimation is made from the data reported by IMF Country Report on Eritrea and World Bank group database.

(Nakfa) lost its value as investors lost their confidence in its competitiveness on the international market. Prior to its launch, the Ethiopian Birr, which was used as legal tender in Eritrea, had an average value of 0.25 against the U.S. dollar. The new currency (Nakfa), however, valued at an average of 0.08 against the U.S. dollar since its introduction.

Furthermore, the economy began to rely heavily on imported products even for some basic consumer goods. With the loss of access to the Ethiopian market, however, the country had to import products from other countries and settle transactions in hard currency. Due to the decline of export earnings and the requirement to settle trade in hard currency, the economy began to face the hard currency crisis which made it very difficult to import adequate products. As a result, shortage of basic products including fuel dominated the economy. This pushed the rate of inflation in the economy and jumped from 4 percent to 9 percent right after the introduction of (Nakfa). Since then inflation has continued to soar which ultimately reached 25 percent in 2004.

In addition to the rise in the rate of inflation, the fall in the rate of GDP growth and the fall in export earnings, the external debt of the economy is growing constantly. Prior to its new currency, Eritrea had moderate external debt. As shown in Table 1.1, in 1994 for instance, its external debt was 29.1 million dollars. After the introduction of the new currency, however, its external debt jumped to 151.3 million dollars. By 2006, its debt had grown up to 799.9 million dollars. The country which was once praised by the international aid organizations for its self-reliance policy now is facing a debt servicing burden for its excessive borrowing. This research is, therefore, motivated by the above discussed Eritrean economic facts and figures to undertake an in-depth investigation. As such, this

study tends to uncover what went wrong and thereby identify the economic remedies for the problems. The great motivation of the study is to make a difference not only in the Eritrean economy but also in economies similar to Eritrea.

1.4. Relevance and Significance of the Study

This research is original in its kind and in its overall approach of addressing the research questions. More specifically, a study on where relying on hard currency leads to, what economic outcomes it will have and how its costs can be minimized has not been done. As a result, it is expected to bring original and valuable contributions to various concerned institutes and individuals. Due to the unique Eritrean economic and financial structure, unique ways to examine the where, what and how research questions are required. In doing so:

- A new measurement of relying on hard currency or dollarization has been developed. This will provide an insight to the scholars on the existing problem of measuring hard currency index in countries similar to Eritrea.

- A different method of finding the impact of relying on hard currency or dollarization on inflation has been introduced. Based on theoretical justification and using money demand and money supply, an inflation model has been constructed.

This study has multi-dimensional coverage. Accordingly, a number of scholars, research institutes, organisations, individuals, and students are expected to benefit from this study. The Eritrean policy makers, decision makers, monetary authorities, and the government of Eritrea are also going to benefit from the findings and recommendations of this research.

1.5. Objective of the Study

The economic problems which have been discussed so far might lead the Eritrean economy in to further economic deterioration. Each research question has, therefore, been designed to help achieve certain objectives as shown below.

1) The first research question; that is, why the Eritrean economy is relying on hard currency or what factors drive the country to rely on hard currency is aimed at

   - Identifying the factors that cause the country to strive more to hard currency acquisition and thereby accumulate more foreign debt.

   - Showing to what extent the external debt servicing burden led the authorities to increase their demand for hard currency.

2) Where relying on hard currency will the Eritrean economy lead to is aimed at

   - Showing Eritrean policy makers how relying on hard currency constrains the Bank of Eritrea from achieving its objectives and what excessive reliance on hard currency leads to.

   - Helping Eritrean policy makers predict the economic fortune of Eritrea based on the research findings of the study.

3) What macroeconomic effects does relying on hard currency have on the Eritrean economy directs towards

   - Determining the impact of excessive demand for hard currency on exchange-rate and inflation rates of the country.

   - Analyzing the effects of relying on hard currency on monetary policy transmission mechanisms and thereby seeing if there is any room for improvement in the monetary policy instruments.

4) How the costs of relying on hard currency can be minimized is aimed at

- Helping Eritrean decision makers to make their decisions based on the findings of the study.

- Finding alternative techniques for acquiring foreign currency instead of borrowing and thereby raising the debt servicing burden.

This thesis addressed its first objective by uncovering the dollarization and its determinants in Eritrea. Furthermore, the study has covered the third research objective by analysing the impact of dollarization on inflation, exchange rate volatility, and monetary policy transmission mechanisms. In addition to this, the research has targeted the objectives related to the research questions two and four in Chapters 5, 6, 7 and 8 where it discusses the implications of the findings and also policy recommendations.

1.6. Structure of the Thesis

This study is structured in such a style that a reader will have a clear flow of what the research is about and an understanding of the subject matter. For this reason, the entire thesis is divided into eight chapters. The first chapter is mainly the introductory part of the thesis. It comprises a statement of the research, the objectives of the research, the significance of the research, the motivation for the research and the structure of the research.

In Chapter 2, a brief review of the Eritrean profile is addressed first. The inclusion of the Eritrean profile is aimed at equipping a reader, who has very limited knowledge of Eritrea and its socio-economic structure, with some information of what the study is about so that the reader will have some picture in mind when reading through the remaining chapters. The chapter also covers what kind of dollarization the Eritrean economy is experiencing. It has been identified

that the Eritrean economy is a partially dollarized economy. Among the different types of partial dollarization, the existence of financial dollarization, sovereign liability dollarization and underground dollarization have been found.

Chapter 2 also discusses the role of Eritrean banks in the process of dollarizing the economy. It has been found that there are several ways through which the Eritrean banks can affect the dollarization process in the Eritrean economy. Among these are: the provision of loans to the private sector, the regulation of the financial system, the interest rate charged on export loans, foreign exchange policy and the construction and selling of houses in exchange for hard currency.

Chapter 3 discusses the methodology of the research. It is important to mention here that each chapter has its own methodology which is relevant to that specific section of the thesis. Although each chapter shows the kind of methodology that has been adopted specifically, immense discussion is carried out in Chapter 3. In particular, the chapter discusses on why certain data are collected, what type of data are collected, what are the sources of the data, when and how the data are collected, what type of models are used and why these models are selected over the other models. Moreover, the chapter has addressed what type of paradigm the study has and how the data are analysed as well as what type of resources that the researcher had.

Chapter 4 presents the arguments for using different types of measuring the extent of dollarization in the economy. The most commonly used measurement of dollarization is the ratio of foreign currency deposits to broad money in the economy. While this method is useful to measure the extent of

financial dollarization, other forms of dollarization are not captured by this measurement. Other researchers introduced the original sin index (based on the extent of liabilities contracted in foreign currencies) and composite index (based on the sum total of the ratios of foreign currency deposits to broad money, total external debt to GDP and domestic government debt denominated in dollars to total domestic government debt). However, neither the original sin index nor the composite index captures the overall dollarization of the economy. As a result, a new method that incorporates all forms of partial dollarization in the Eritrean economy is introduced in this chapter.

Chapter 5 provides the discussion of how dollarization affects the exchange rate volatility. In order to examine whether dollarization alleviates or aggravates exchange rate volatility, a hard currency index has been constructed. The index measures the degree of dollarization by including all forms of partial dollarization that exist in the economy. Both official and black market exchange rates have been used to measure exchange rate volatility.

The main reason for including the black market exchange rate in the analysis is the rigidity of the official exchange rate since almost 2003. Moreover, because there is a black market exchange rate, it is essential to see how the black market exchange rate behaves in the existence of dollarization. In examining the impact of dollarization on the official exchange rate, the official exchange rate was taken in its real form instead of nominal form.

The results of the analysis suggest that dollarization has a positive impact on the exchange rate volatility of the nominal and real exchange rate of the black market as well as the real exchange rate of the official market. This means that as

dollarization increases, the volatility of the exchange rate increases. It can, therefore, be concluded that partial dollarization of the Eritrean economy aggravates the volatility of the exchange rate.

Chapter 6 deals with the role that dollarization plays on inflation. In its initial section, the chapter discusses different views of economic thoughts on inflation. The purpose of the discussion is to show how the impact of dollarization was excluded in the analysis of inflation by different schools as well as to demonstrate the dynamics of other factors in the determination of inflation. Specific explanation on the state of inflation in the Eritrean economy both prior to and post 1991 has been made. The relationship between inflation and dollarization with respect to the Eritrean economy has also been examined in this chapter.

Prior to the econometric analysis, modelling inflation under partial dollarization of the Eritrean economy was conducted. The model is developed based on the assumptions relevant to the Eritrean economy and is derived from money demand and money supply. Cointegration analysis is then applied to the inflation model constructed in the chapter in order to examine whether inflation and dollarization are cointegrated or not. Furthermore, Vector Error Correction Modelling together with the Dynamic Ordinary Least Squares (DOLS) is employed.

The results indicate that there is cointegration in the model. It has also been found that the price level and inflation increase with the increase of dollarization both in the long-run and the short-run. The increment of inflation with the rise of dollarization applies regardless of the inclusion of either official or

black market exchange rate in the model. The sign of the error correction term is negative. This indicates that there is an adjustment back to the long-run relationship in successive periods to remove the discrepancy in the short-run. It also signifies that the adjustment process is stable and convergent towards the long run equilibrium. The error correction term results suggest that about 7.2 percent and 7.6 percent of the disequilibrium is corrected in the first period when official and black market exchange rates are used respectively to represent the exchange rate variable in the model.

In Chapter 7, the effect of dollarization on monetary policy transmissions mechanism is explored. The chapter deals with how monetary policy works, through what mechanisms its policy actions are transmitted, what factors affect its transmission mechanisms, which channels are most effective, why they are effective and what the monetary authorities should do under dollarization. The controversial findings of the scholars on inflation and the effectiveness of monetary policy has also been critically examined in this chapter.

This chapter also covers specific investigation on monetary policy and its transmission mechanisms of the Eritrean economy. In contrast with the existing literature, the results using VAR, TY and SVAR suggest that the credit channel is effective. After the examination of credit issued to the private sector and public sector separately, however, the source of the effectiveness is found in the credit issued to the government sector. Apart from the results of TY, the exchange rate channel is effective through the black market. In addition to this, the chapter also presents variance decomposition of the variables.

Chapter 8 discusses the conclusion and policy implications of the study. In summary, the novelty of this research is immeasurable. It has uncovered the existence of dollarization in the Eritrean economy that none of the existing research has addressed before. It has also constructed a new measurement method to capture the overall level of dollarization. It has developed an inflation model based on the money demand and money supply which is original in its setting instead of relying on the inflation model developed elsewhere. It has uncovered what the Eritrean monetary transmission mechanisms look like for the first time. It has investigated the impact of dollarization in the Eritrean economy. Moreover, the research in its entire journey has addressed the unanswered questions that are listed in the research questions. It has also addressed the controversy on whether dollarization reduces or produces inflation, whether dollarization alleviates or aggravates exchange rate volatility and whether dollarization facilitates or complicates the monetary policy transmission mechanisms.

Chapter 2- Dollarization and its Determinants in the Eritrean Economy

2.1. Introduction

Dollarization has been a widespread economic practice in the developing world since the 18th century. Although the degree and the nature of dollarization vary in these countries, they share some common process particularly in their initial stages of dollarization. Dollarization was introduced in developing countries initially in an effort to pursue their development objectives. Since most developing countries lack adequate financial resources and the capital accumulation needed for their development, they usually obtain foreign financial resources in the form of loans in order to fill the financial gap. Unlike developed countries, however, the loans issued to developing countries are not in their own currency. Foreign borrowing issued in dollars, therefore, is the fundamental foundation of dollarization which Eichengreen and Hausmann (1999) refer to as "*the original sin*".

Even though developing countries share common foundations in their dollarization, the magnitude and development of their dollarization varies depending on their socio-economic factors. Various scholars have investigated these factors. The majority of the scholars explain high inflation as a driving factor for dollarization. Uribe (1997), for instance, shows how high inflation decreases the demand for domestic currency by developing currency substitution model. Kamin and Ericsson (2003) also show the negative impact of high inflation on the demand for the domestic currency in Argentina. Similar to these scholars, Goujon (2006) and Bahmani-Oskooee and Domac (2003) find high inflation driven dollarization in Vietnam and Turkey respectively. Ize and Yeyati (2003) also found analogous results.

Another group of scholars find exchange rate volatility as a significant determinant of dollarization. Berg and Borensztein (2000), Yinusa (2008), Kesriyeli et al., (2011), Tobin and Macedo (1980), and Arteta (2002) are among others. Agenor and Khan (1996), for example, find parallel increases in the extent of dollarization and exchange rate depreciation by deriving the long-run currency ratio from an optimizing model. The study by Lindenberg and Westermann (2012) also find a shock on the exchange rate as a determining factor. By deriving the determinants of foreign currency holdings from utility maximization, Viseth (2001) also draws a similar conclusion in his case study of Cambodia. Similarly, by developing a small open economy general equilibrium model, Shi and Xu (2010) find that the determining factor for firms' decision to dollarize is the exchange rate policy. Like these studies, the studies of Ortiz (1983), Marquez (1987), Melvin (1988), Rojas-Suarez (1992), Clements and Schwartz, (1993) also find related results.

Some other literature shows domestic monetary instability as the reason for dollarization. Wessels (2004) also points out poor domestic monetary policy credibility as a determinant factor of high foreign currency holdings. In addition to these scholars, Zoryan (2005), Alvarez-Plata and Garcia-Herrero (2008) and El-Erian (1987) have all described unstable domestic monetary systems as a cause of less demand for domestic currency.

Apart from the above mentioned literature, the studies of Minda (2005), Edwards and Magendzo (2006), and Galindo et al., (2003) point out openness of the economy and close financial links with the U.S. as determining factors. Using the sample of Chilean firms, the study by Fuentes (2009) indicates debt dollarization driven by the size of the firm and exposure to foreign competition.

Likewise, Frieden et al., (2003) point out openness and size of the manufacturing sector as major factors of dollarization. Illicit drug trade has also been found in the dollarization of Bolivia in the study by Melvin and Ladman (1991). Gaston (2003) also find positive correlation between dollar debt and imports, exports and the size of the firm.

Different from the factors mentioned so far, Bahmani-Oskooee and Domac (2003), Edwards and Magendzo (2003) and Honig (2009) have explained weak institutional factors as a source of currency substitution. Honig (2009), for example, empirically shows that poor government quality that fails to promote long-run currency stability is the main cause of dollarization. Caballero and Krishnamurthy (2003) show that limited financial development triggers debt dollarization in emerging economies.

Of the reviewed literature, special emphasis was given to what drives financial dollarization. A number of scholars have attempted to address this issue though most of them do not present a holistic approach. Their analysis is limited to finding the determinants of either credit dollarization or deposit dollarization (see the studies of Honohan & Shi, 2002; Luca & Petrova, 2008; Yeyati, 2006; Barajas & Mendez Morales, 2003; Ize & Yeyati, 2003; Calvo, 2001, 2002; Bednarik, 2007; Neanidis & Savva, 2009 and Barajas & Mendez Morales, 2003).

It should be noted here that some of these studies have not captured the role of the banking sector. In the study by Ize and Yeyati (2003), for instance, the banking sector is passive and their model is restricted to the household sector's decision. Catao and Terrones (2000) have attempted to analyse financial dollarization on the banking side. However, they tend to focus on the demand side

of loan dollarization without considering the supply side which otherwise would have different results. Ize (2005) attempted to present a holistic approach to financial dollarization by combining deposit and credit dollarization. Nevertheless, the influence of banks on interest rate that determines the financial dollarization has not been considered in his model.

This chapter contributes to the scant literature of the determinants of dollarization on the banking side by analysing the impact of Eritrean banking practices and monetary system on dollarization. The chapter is different from the existing studies in that it addresses the overall dollarization that exists in the economy instead of presenting and discussing only some aspect of Eritrean dollarization. In contrast to the literature reviewed so far, this chapter analyses the structure of interest rate, loans issued to the private sector and the Eritrean monetary system. It finds that the structure of the interest rates, the fewer shares of loans issued to the private sector, the issuance of new currency, the selling of houses and lands by the Housing and Commerce Bank of Eritrea and the introduction of strict regulations on the foreign currency exchange have contributed to the reliance of the Eritrean economy on hard currency.

This chapter is organised as follows: the next section presents a brief review of the Eritrean profile followed by the historical development of the Eritrean financial system. Section 2.4 discusses the literature review and then the kind of dollarization that exists in the Eritrean economy is presented in Section 2.5. This is then followed by the discussion of whether the banking sector has contributed to the process of dollarization in the Eritrean economy. Section 2.7 presents the role of the mining industry on dollarization. At last, the conclusion of the chapter is presented.

2.2. A Brief Review of Eritrea Profile

Eritrea is one of the developing countries known for its less corruption and low crime rate (Gettleman, 2007). It is located in North East Africa along the Red Sea coast. It is bordered by Sudan to the north and west, by Ethiopia in the south, Djibouti to the south east and by the Red Sea to the eastern part. The total land area is 121,320 square kilometres with total land boundary of 1,630 kilometres. According to the Central Intelligence Agency (CIA) World Fact Book, its population size in July, 2011 was 5.9 million with a population growth rate of 2.4 percent, birth rate of 32.8 births/1,000 population, death rate of 8.08 deaths/ 1,000 population and total fertility rate of 4.48 children born/woman.

As reported in the (CIA) World Fact Book (2011), the economy of Eritrea is largely based on subsistence agriculture with 80 percent of the population involved in farming and herding. Its recent estimation, as per 2009, of the growth rate of real GDP is 2.5 percent per annum. The composition of GDP shows that 17 percent of the growth comes from agriculture, 29 percent from industry and 54 percent from service sector. There is, however, great expectation that the Eritrean economy will largely depend on the mining industry in the future. Eritrea is rich in mineral resources such as gold, copper, zinc, iron, potash, nickel-chromite and lead sulphide. A number of mining companies including Nevsun Resources, Sanu Resources, Rift Resources, Sub Saharan Resources and Sunridge Gold have found large deposits of the listed mineral resources in different regions of the country. In its news on "Bisha declares commercial production (2011)", Nevsun Resources Limited reported commercial production of gold and silver in February 2011.

The political structure of Eritrea is based on the existence of one party called the People's Front for Democracy and Justice (PFDJ). Eritrea has a long history of colonization. In its pre-colonial form, Eritrea was neither an independent state nor part of the Ethiopian empire. Eritrea was created at the end of the 19th century as a territorial-administrative unit by Italian colonialists. Its name, given by the Italians, is taken from the Greek description of the Red Sea (Arm the Spirit 1997). In the 16th century, the Ottoman Turks occupied the coastal regions of Eritrea. Before the Ottoman Turks, however, as Rena (2007) pointed out, Eritrea was ruled under the Axumite Kingdom (1st-9th century), the seven Beja Kingdoms (8th-13th century) and the Bellou Kingdom (13th-16th century).

Eritrea was an Italian colony between 1889 and 1941. During that time the Italians heavily invested in different sectors of the economy and brought dramatic economic development to the country. The construction of roads, railways, the introduction of Telefrica and the banking system, the installation of electricity supply as well as the introduction of telecommunication and mail services are some among others. According to the Hadas Eritrea's (1996) report, the construction of air-ports, water pumps, the introduction of irrigation systems, modern animal breeding, drainage systems and the establishment of different factories such as textile and shoe factories are also some of the developments that took place during the Italian colonization.

The Italian colonization, however, was over during World War II and Eritrea became under a British protectorate from 1941-52. During this period, the country's economic development began to deteriorate as the British authorities began to sell and transfer Eritrean industrial equipments and other

basic properties to foreign countries (Hadas Eritrea, 1996). The deterioration of the Eritrean economy convinced the United Nations that Eritrea was economically unable to be on its own. As a result, in December 1952, the United Nations passed a resolution which made Eritrea to be federated with Ethiopia.

During the federation period, the emperor of Ethiopia, Haile Selassie, dismantled the manufacturing sector and transferred the remaining industrial equipments to Addis Ababa, the capital city of Ethiopia. In November 1962, the emperor ultimately declared an end to the federation and illegally annexed Eritrea as 14th province of Ethiopia. The annexation of Eritrea by Ethiopia led to a 30-year struggle for independence which was finally completed in 1991. Ultimately, Eritrea's independence from Ethiopia became official in May 1993, through the United Nations-monitored referendum in which 99.8 percent of the voters opted for sovereignty (Arm the Spirit in the Kurdistan Report, 1997).

The successful completion of the 30-year of war for independence, however, did not last long. The country encountered another conflict and a second war with Ethiopia in 1998 which devastated its socio-economic infrastructures. The conflict has not still been resolved yet but the country is trying to rebuild its institutions and infrastructure. Moreover, the county is focusing on strengthening different sectors of the economy including its education, health and banking industry.

2.3. Historical Development of the Eritrean Financial System

The Eritrean financial system has a long history dating back to the colonization of the country by the Italians starting from 1889. Prior to the establishment of an official banking system, money lenders, indigenous saving and credit associations as well as pawn brokers were operating in the economy.

The Italian Postal Administration was also providing deposit services and money transfer services without providing credit services in the economy. To meet the growing demand of the economy for credit during that period, the Bank of Italy decided to open branches in Asmara and Massawa in 1914.

The branches were providing credits to businesses with a 40 percent collateral requirement. They were also providing insurance services and deposit services with interest rates of 2.5 percent. Moreover, the branches were collecting three months, six months and one-year fixed term deposits with interest rates of 3 percent, 3.5 percent and 4 percent respectively.[3] The branches, however, were not providing services to small scale businesses. As a result, Banca Cooperativa Popolare Eritrea (BCPE) was established later on in 1915 with 312 shareholder members. BCPE targeted small scale traders and craftsmen who were not considered by the Bank of Italy.

Alongside the BCPE, Banca per l' Africa Orientale (BAO) was established in 1917 in Massawa and it began providing services in 1918. The main function of this bank was to provide short-, medium- and long-term credits, exchange equities and hold shares of companies in different sectors of the economy.[4] The functions of BAO and BCPE did not last long as they had to be liquidated due to the banking crisis. In 1935, however, Banco Nazionale del Lavoro and Banco di Roma opened their branches in Asmara, Massawa and Dekemhare. By 1936, another private bank, Banco di Napoli, was created in Asmara. Before the end of Italian colonization, Bank of Italy, Banco di Roma, Banco Nazionale del Lavoro,

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[3] See Mauri (2004), "Eritrea's early stages in monetary and banking system".
[4] See Mondaini (1919) as indicated in the study of Mauri (2004).

Banco di Napoli and Cassa di Credito Agrario e Minerario were operating in the economy, as mentioned by Mauri (2004).

After the completion of Italian colonization, the banking development was not progressive, although there was an establishment of Barclays Bank in the country. Both Banco Nazionale del Lavoro and Banco di Italia were closed during British administration. However, some of the natives who were denied to have access to the banking services during the Italian colonization were able to have access to the banking services during British administration.[5] After 1952, during the federation of Eritrea with Ethiopia, Barclays Bank was closed and the State Bank of Ethiopia set up its branch offices in Eritrea.

The State Bank of Ethiopia was responsible for supervising the remaining banking institutions and for providing commercial banking services. In 1963, however, this dual function of the bank was divided in to two which led to the creation of the National Bank of Ethiopia and the Commercial Bank of Ethiopia. The National Bank of Ethiopia then began to play the role of central bank alone while the Commercial Bank of Ethiopia was left with the role of commercial banking services. Alongside these banks, the Addis Ababa Private Bank was established in 1963. These banks were providing facilities for stock exchanges, credit and deposit facilities. In 1970, the Agricultural and Industrial Development Bank (AIDB) was created with the aim of providing short-, medium- and long-term credits to the agricultural and industrial sectors.

The Derg regime defeated the Haile Selassie regime and claimed national ownership of all the private banks in 1974. As a result, Banco di Roma, Banco di

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[5] See Mehreteab (2005), "Eritrean Financial Institutions" and Rena (2007), "Historical Development of Money and Banking in Eritrea from Axumite kingdom to the present."

Napoli and Addis Ababa bank were nationalised and liquidated into Commercial Bank of Ethiopia. In 1975, Housing and Saving Bank was opened to provide mortgage services. The financial institutions in Eritrea then shrank in to the Commercial Bank of Ethiopia, Housing and Saving Bank, AIDB and Ethiopia Insurance Corporation at the end of the regime. Following the independence of Eritrea, these institutions have been replaced by Commercial Bank of Eritrea, Housing and Commerce Bank of Eritrea, Eritrea Investment and Development Bank, National Insurance Corporation of Eritrea. All these financial institutions are still state-owned enterprises apart from the House and Commerce Bank of Eritrea which is owned by the People's Front for Democracy and Justice (PFDJ) Party, as pointed out in the studies by Mehreteab (2005).

2.4. Literature Review

The study of relying on hard currency is broad in its scope and could relate to the studies of foreign aid, foreign borrowing, foreign direct investment and currency substitution or dollarization. Based on the relevance of Eritrea's case of relying on hard currency, this study concentrates on the literature that covers currency substitution or dollarization. The reviewed literature covers the reasons for dollarization and also the consequences of dollarization in different parts of the world. While the literature on the consequences of dollarization is reserved for the chapters that follow, what drives dollarization particularly from the banking side is covered in this chapter.

It has been a common practice in most developing countries for banks to hold foreign currency deposits and issue foreign currency loans. Though there is cross country variation in the level of deposit dollarization and loan dollarization, there is an upward trend in general. According to the study by Luca and Petrova

(2008), loan dollarization averaged 38 percent and 39 percent of total loans in transition economies and Latin American economies respectively over the period 1990-2001. The study by Bass et.al., (2007) also shows that deposit dollarization averaged 40 percent of the total deposit in transition economies over the period 1993-2006. In line with this study, Honohan and Shi (2002) found that deposit dollarization in 25 emerging economies rose from 37.1 to 44.2 percent of total deposits over the period 1995-1999.

The rise in the level of deposits and loan dollarization has raised serious concerns for policy makers as they have an impact on macro- as well as micro-economic variables of an economy. Their impacts are manifested on the exchange rate, the inflation rate and the balance sheet of firms as well as banks of the dollarized economy. As a result, what drives deposit and loan dollarization has become a vital field of discussion in the area of dollarization. This chapter, therefore, presents the theoretical and empirical review of the literature on what drives deposit and loan dollarization. In doing so, the definition of dollarization is first presented to give a clear picture of the remainder part of the chapter.

2.4.1. Definition

Before getting into the discussion of what drive dollarization, it is worthwhile to present the definition of dollarization. The word dollarization has different meanings and has been used by different scholars to denote different interpretation in their studies. The studies on the dollarization of Latin American countries such as the studies by Ortiz (1983), Melvin and Peiers (1996), Clements and Schwartz (1993), Melvin and de la Parra (1989) and others define dollarization as the use of dollars within these countries. Other studies such as the

studies of Wessels (2004), Viseth (2001) and Zoryan (2005) interpret dollarization as the use of foreign currency in the domestic economy.

Dollarization has also been defined as official or full (de jure), unofficial or partial (de facto), financial, real and liability dollarization. Gulde et.al., (2004), Minda (2005), Ize and Yeyati (2003), Reinhart et.al., (2003), Berkmen and Cavallo (2010) and Wessels (2004) have provided several definitions of these types of dollarization. In their studies, official or full (de jure) dollarization is defined as the adoption of another country's currency as a legal tender. Unofficial or partial (de facto) dollarization, however, is another form of dollarization where the domestic currency stays as an official legal tender but foreign currency can also be used for some transactions with or without legal approval. Financial dollarization, on the other hand, refers to the holdings of foreign currency denominated financial assets and liabilities by the residents. Slightly different from these forms of dollarization, real dollarization refers to the indexing of prices and wages to the dollar. Conversely, liability dollarization stands for the foreign currency denominated debt held by residents as well as the government.

The literature reviewed so far has focused on the dollarization of transition and emerging economies. As such, the definition of dollarization reflects the practices of these economies. In the literature, less effort and emphasis is given to the practices of most developing countries including the African economies. Considering the economies where large volumes of dollars circulate in the black market to either settle transactions or to gain profit from the exchange currency will enrich the study of dollarization. For this reason, this study terms the dollarization of such economic activities as underground dollarization.

Dollarization, which refers to the use of U.S. dollars or any other foreign currency within the domestic economy, as has been defined, has become a contemporary economic feature of many countries from the developing world. Some of these countries are fully dollarized while others are partially dollarized. Fully dollarized cases include Ecuador, El Salvador, Panama, Micronesia and the Marshall Islands where the U.S. dollar is a legal tender; the Cook Islands, which uses the New Zealand dollar; Kiribati and Nauru which use the Australian dollar; Montenegro, Monaco, Kosovo, San Mario and Vatican City which use the Euro and so on. Partially dollarized economies include Angola, Malawi, Zimbabwe, Nigeria, Bolivia, Uruguay, Peru, Cambodia, Vietnam, South Korea, Armenia and Turkey among others.

2.4.2. Theoretical Argument of What Drives Dollarization

To identify the role of the banking sector in the determination of dollarization, a specific review on financial dollarization has been made. In general, the reviewed literature points out that the interaction of the banking sector with the household, business and government sectors has crucial impact on financial dollarization. The studies have shown that the behavior of each sector affects the decision of another sector and hence affect the level of financial dollarization in the economy. The level of deposit dollarization, for instance, increases as households prefer to hold foreign currency denominated deposits in their portfolio to hedge against macroeconomic volatility. An increase in the level of deposit dollarization then raises the level of bank's loan dollarization.

By deriving an optimal portfolio allocation model, Luca and Petrova (2008) theoretically have shown that the higher the supply of *dollar deposit*, the larger the supply of dollar loans by the bank. They have also shown that the more

dollarized the liabilities of the banks are, the more dollarized their credits will be. Similarly, by developing a simple portfolio model, Ize and Yeyati (2003) explain how households react to the volatility of inflation and real exchange rate depreciation in terms of their decision in minimizing the variance of currency holdings in their portfolio. The study by Ize (2005) also explains that households prefer to hold dollars to maximize the security of their portfolio on one hand. On the other hand, the study explains that firms prefer dollar loans and then goes on to explain how the interaction of the behaviour of households and firms determines the level of financial dollarization in an economy.

Other scholars have captured the impact of *banking regulation, deposit insurance* and *bank insurance* on financial dollarization. Calvo (2001, 2002) discusses the impact of institutional factors and asymmetric information on foreign bank lenders' decisions. In his paper, he points out that the existence of regulation encourages banks to avoid a large mismatch between the currency denomination of their assets and liabilities. They do so by raising the lending rate on domestic currency higher than the lending rate on dollar loans. This then makes dollar borrowing more attractive which raises the level of liability dollarization.

According to Calvo (2001), the existence of *asymmetric information* on exchange rate policy between domestic firms and the foreign bank lenders does have similar impact on liability dollarization. Domestic firms are more informed about the status of the exchange rate in the future than the foreign bank lenders. Since domestic governments have a higher tendency to devalue domestic currency, if the loans provided by foreign bank lenders are denominated in domestic currency, better informed domestic firms would prefer to acquire

domestic currency denominated loans. However, foreign bank lenders prefer to issue dollar loans to hedge themselves against currency risk.

Likewise, Yeyati (2006) shows that dollarization is influenced by the existence of safety net schemes such us loss-sharing policy, deposit insurance and bank insurance. His study points out that full deposit insurance, for instance, raises the return to dollar deposit relative to domestic deposit in the case of default when the domestic currency depreciates. This then generates more dollarization. In addition to these studies, Catao and Terrones (2000) have theoretically analysed the determinants of dollarization from the banking side. They find interest rates, exchange rate risk, credit market imperfections and availability of tradable collateral to be determining factors of deposit and loan dollarization.

Apart from the scholars mentioned so far, some studies have pointed out the impact of *financial underdevelopment* and *financial market incompleteness* on financial dollarization. In their study of why dollar debt is in the best interest of borrowers in emerging market economies, Caballero and Krishnamurthy (2003) showed that financial underdevelopment can drive dollarization. They point out that financial underdevelopment incapacitates domestic firms from purchasing insurance that can be afforded by borrowing in domestic currency. Due to financial constraints, domestic firms undervalue this insurance and tend to take more dollar debts. Moreover, financial underdevelopment limits the availability of foreign credit lines in domestic currency as foreign bank lenders prefer to issue dollar debts. Eichengreen and Hausmann (1999) pointed out the incompleteness of the financial market as a source of dollarization. In their studies, they indicate that dollarization rises in a case where domestic currency cannot be used by

domestic firms or governments to borrow abroad or to borrow long term, even domestically.

2.4.3. Empirical Evidence

It has been noted in the theoretical argument that the interactions of the banking sector with the household, business and government sectors play key roles in the determination of financial dollarization. However, whether the rise in the level of financial dollarization in most transition and emerging economies is due to the decision of households, businesses, banks or governments is an empirical matter. Different scholars find different factors in their empirical investigation of what causes financial dollarization in different countries of the world. The majority of the reviewed literature so far indicate that the level of deposit dollarization and the banking matching practices are the main keys in the determination of credit dollarization. The study by Bednarik (2007) on the determinants of loan dollarization in the Czech Republic, Slovakia, Poland and Hungary shows the positive impact of deposit dollarization on loan dollarization. The results of generalised method of moments in a panel analysis by Vieira et al., (2012) indicate that default risks that cause inflation risks explain financial dollarization better than the inflation rate.

Luca and Petrova (2008) have also empirically investigated the determinants of credit dollarization of twenty one transition economies from Central and Eastern Europe and Central Asia. They find that credit dollarization is driven by domestic deposit dollarization and the decision of banks to have currency matched portfolio in their balance sheet. Similarly, in their empirical study of the short-run determinants of financial dollarization in transition economies, Neandis and Savva (2009) find that loan dollarization is positively

correlated to deposit dollarization. They find that the banks' decision of currency matching of assets and liabilities as the main factors in the short-run loan dollarization.

It has been noted that the theoretical argument in the existing literature on financial dollarization shows the positive impact of the level of deposit dollarization on loan dollarization. In line with this theoretical argument, the empirical findings mentioned above also suggest the positive correlation between loan and deposit dollarization in most transition and emerging economies. Different from these findings, an empirical study by Bass et al., (2007) reveal opposite results.

By including interest rate differentials and the existence of foreign banks in the domestic financial sector in their model, Bass et al., (2007) find negative correlation between the share of foreign currency loans and the share of foreign currency deposits. They could not find the matching practice of banks in matching the dollarization of deposit with the dollarization of loans. Instead they find that the existence of a wider range of interest rate differentials increases credit dollarization but lowers deposit dollarization in transition economies. They also find that access to foreign fund increases credit dollarization but decreases deposit dollarization. Like the study by Bass et al., (2007), the study by Honohan and Shi (2002) on deposit dollarization and the financial sector in emerging economies has similar results. They find that an increase in deposit dollarization reduces credit dollarization. However, they find positive correlation between deposit dollarization and offshore deposits of the banks.

As well as the empirical evidence of the above factors, financial development, bank insurance, institutional factors and openness have been found to be vital determinants of dollarization (see Minda, 2005; Edwards & Magendzo, 2006; Galindo et al., 2003; Bahmani-Oskooee & Domac, 2003; Edwards & Magendzo, 2003; Honig, 2009; Caballero & Krishnamurthy, 2003). In their analysis of what causes deposit dollarization, using a sample of one hundred countries, Nicolo et.al., (2005) find that administrative restrictions and a minimum variance portfolio are significant determinants. They find that a shift from restricted to unrestricted administration increases dollarization by about 37 percentage points. Their studies show that an increase of 2 percentage points in the minimum variance portfolio will increase actual dollarization by 1 percentage point. Minimum variance portfolio is measured from variance and covariance of prices and exchange.

In their studies on the dollarization of liabilities, Barajas and Morales (2003) explore empirically what causes credit dollarization in Latin American countries. They have investigated whether deposit dollarization, financial development, access to foreign banks as well as banking bail out expectations causes credit dollarization. Their findings show that credit dollarization increases as deposit dollarization rises. They also find that financial development and access to foreign banks have positive impact on credit dollarization. However, banking bail out expectations do not significantly affect credit dollarization in their model.

2.4.4. Critical Argument and Contribution of the Chapter

In their analysis, some of the literature reviewed so far has focused only on either the deposit side or credit side of financial dollarization determination. Some other studies have considered only the behaviour of the household or

business sector in the determination of what drive financial dollarization. In the model of Ize and Yeyati (2003), for instance, the banking sector is passive and the model is restricted to the household sector's decision as it explains how the behaviour of both borrowers and depositors determines financial dollarization. Moreover, in their model, nominal deposit and lending rates are assumed to be fixed and hence have no impact on the level of dollarization. Although nominal deposit and lending rates are fixed during the short-run, it is important to consider their fluctuation after certain periods of time. Lack of such consideration will certainly fail to explain their impact on dollarization.

Calvo (2002) concentrates on the tendency of governments to devalue currency if loans are denominated in domestic currency. This analysis, however, is more suitable to the economic situation where there is sovereign dollarization rather than private loan dollarization. Governments tend to devalue their currency if their loans are denominated in domestic currency rather than if private sectors' loans are denominated in domestic currency.

Catao and Terrones (2000) have attempted to analyse financial dollarization on the banking side. In their analysis, however, they assume that banks are risk neutral which contradicts with the practical behaviour of banks in most transition and emerging economies. Banks tend to be more risk averse and overlooking this assumption will likely lead to different conclusions which might lack empirical evidence. Honohan and Shi (2002), for instance, could not find empirical evidence to support the conclusions made by the analysis of Catao and Terrones (2000). In their proposition and corollary, Catao and Terrones (2000) tend to focus on the demand side of loan dollarization where borrowers tend to borrow more as the external rate of interest declines. They have neglected the

supply side which would otherwise have the opposite result. Although their analysis has covered the determinants of dollarization from the banking side, their analysis is mainly concentrated on financial dollarization. The impact of banking practices on the determination of underground dollarization has not been addressed.

Although Ize (2005) has attempted to present the holistic approach of financial dollarization by combining deposit and credit dollarization, banks are implicitly considered as financial facilitators. The influence of banks on interest rate determination, that can determine the financial dollarization, is missing in the model of Ize (2005). This chapter contributes to the scant literature on the banking side of the determinants of dollarization by analysing the impact of Eritrean banking practices and monetary system on dollarization. There are two key points to consider here. Whether it is the banking practice that makes the Eritrean economy exposed to a higher demand for hard currency or the underdevelopment of the banking system that causes the problem of relying on hard currency. This chapter is different from the existing studies in that it has addressed what determines the overall dollarization of Eritrea instead of focusing on what determines certain aspects of the Eritrean dollarization. In contrast to the literature reviewed so far, this chapter analyses the role of the structure of interest rates, loans issued to the private sector and the Eritrean monetary system.

A study on the role of Eritrean banking and monetary system on the dollarization of Eritrea is new in its kind. Mauri (2004), Mehreteab (2005) and Rena (2007) have attempted to address the Eritrean banking system. Their studies, however, are limited to the historical development and challenges of the banking

industry in Eritrea. How the Eritrean banking practices and the monetary system contributed to the reliance of the economy on hard currency has not been covered.

2.5. What Kind of Dollarization Does Eritrea Have?

It has been pointed out that dollarization of an economy can take the form of financial dollarization, real dollarization, underground dollarization and liability dollarization. An extreme case of dollarization is full dollarization where local currency is officially replaced by foreign currency. The Eritrean economy cannot be classified as having full dollarization because the domestic currency is still being used as the dominant means of payment and store of value. Hard currency, however, has been used alongside the domestic currency which shows the existence of partial dollarization. Before analyzing the role of the banking sector in the contribution of dollarization in the Eritrean economy, it is essential to address what kind of dollarization the country has. Identifying whether the Eritrean dollarization has financial, real, underground or liability dollarization would, therefore, be the next step of the study. To do so, investigating the level of dollar deposits, dollar loans, black market exchange rate trend and prices indexed by dollars are needed.

2.5.1. Financial Dollarization

Households and firms in developing countries are highly engaged in holding dollar deposits and borrowing in dollars. The share of dollar deposits in Cambodia, for instance, amounted to more than 70 percent of the total currency over twelve years.[6] Similarly, more than 62 and 41 percent of the dollar loans were issued to Korean firms and Thai firms respectively between 1992 and mid-

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[6] See Kang (2005) in his study of "Is Dollarization good for Cambodia?"

1997.[7] This shows that their economies are open and the private sector is active in these countries. Unlike these countries and most developing countries, the private sector is not as active as it should in the Eritrean economy. The Eritrean banks seldom issue loans in hard currency to the private sector. It has, therefore, not been found a record of dollar loans to domestic firms in the Eritrean economy. There is, however, a record of claims on foreign commercial banks in the balance sheets of the Bank of Eritrea (BE) and Commercial Bank of Eritrea (CBE) as can be seen in Figure 2.1 below.

Figure 2. 1: Claims on Foreign Commercial Banks by BE and CBE
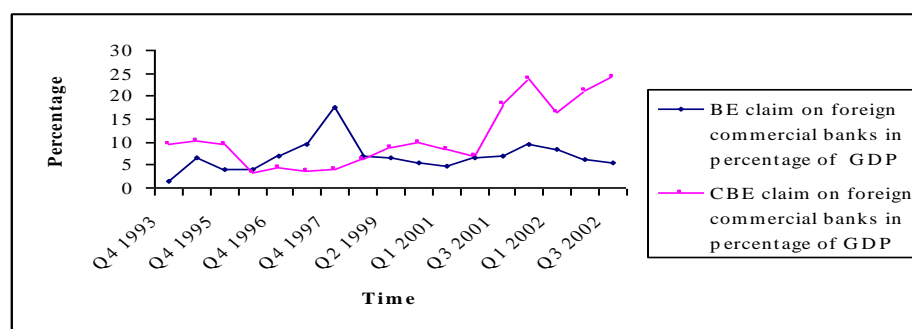
Source: Data gathered from IMF Staff Country Report (1998, 2000 and 2003), IMF Eritrea file no. 643 and also World Economic Outlook.

The graph shows that, prior to 1996, the level of Commercial Bank of Eritrea (CBE) claims on foreign commercial banks was above the level of the Bank of Eritrea (BE) claims on foreign commercial banks. The claim, however, dropped between 1996 and 1997, though it continued to rise from 1997 onwards. The overall claims of the banks on foreign banks (dollar loans) are shown in Figure 2.2. On average, dollar loans were high during 2001 and 2004. After the first quarter of 2005, however, the figure shows that there is a decline in the level of dollar loans expressed in the form of claims on the foreign banks. One of the potential reasons for this could be that there was an emergency hard currency

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[7] See Choi and Cook (2004) in their study of "Liability dollarization and the Bank Balance Sheet Channel.

remittance provided by Diasporas to support the country after 1999. The remittance to support the country, however, dropped due to the decline in the economic performance which required the Diasporas to support their own families and relatives. The hard currency that was given directly to the government-owned banks and perhaps used by the banks in the form of lending to the foreign banks then flowed into the country mainly via *franco valuta* system. Moreover, the drop might have been driven by the prolonged and unresolved issue of the border conflict with Ethiopia.

Figure 2.2: Dollar Loans Issued to the Foreign Banks
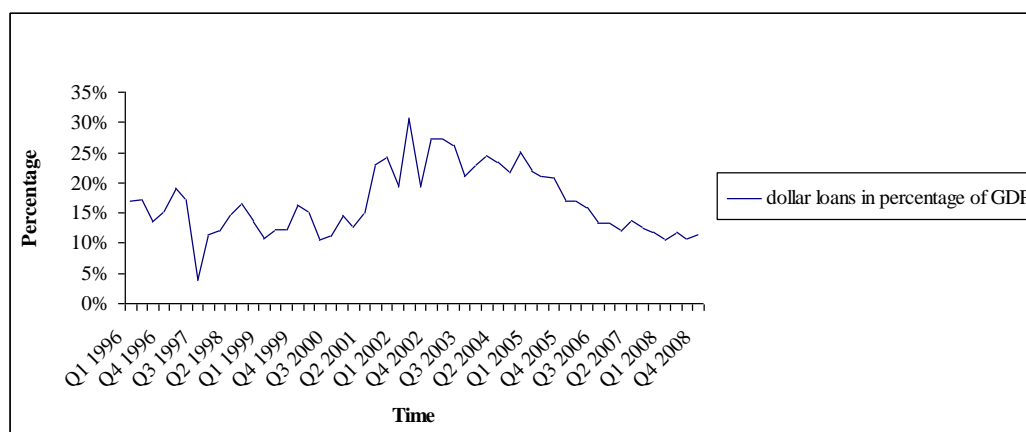
Source: Data gathered from IMF Eritrea file no. 643 and also World Economic Outlook.

On the dollar deposits side of financial dollarization, although it is not as high as those countries mentioned above, there is a record of private sectors dollar deposits. The share of dollar deposits relative to the total deposits shown in Figure 2.3 suggest that, on average, there is an increase in the dollar deposits, particularly from 2003 onwards. The rise, however, looks steady without large fluctuations. Based on the existence of dollar deposits and dollar loans discussed so far, it can be concluded that there is financial dollarization in the Eritrean economy.

Figure 2.3: Shares of Dollar Deposits
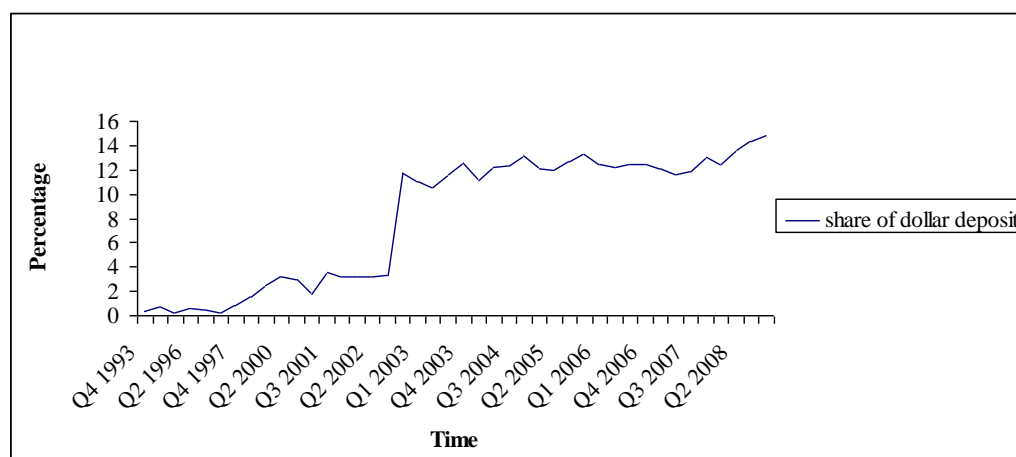
Source: Data gathered from IMF Staff Country Report, 1998, 2000, 2003 and also World Economic Outlook.

2.5.2. Sovereign Liability Dollarization

The current account deficit has been a common problem for most developing countries including Eritrea. The Eritrean economy has suffered from low export earnings and large import expenditure. It can be seen from Figure 2.4 that the economy has always been in deficit ever since 1992. The inability to finance their current account deficit makes most developing countries to survive on foreign savings. In countries where the public sector is actively involved in the domestic economy, the deficit in the current account is financed by sovereign foreign borrowing. Unlike developed countries, however, the loans issued to developing countries are denominated in dollars. If the dollar loans are issued to governments, dollarization can then be named as sovereign liability dollarization. The sovereign liability dollarization has been increasing ever since 1994 in the Eritrean economy as is evident from Figure 2.5.

Figure 2.4: Export, Import and Net Export of Eritrea
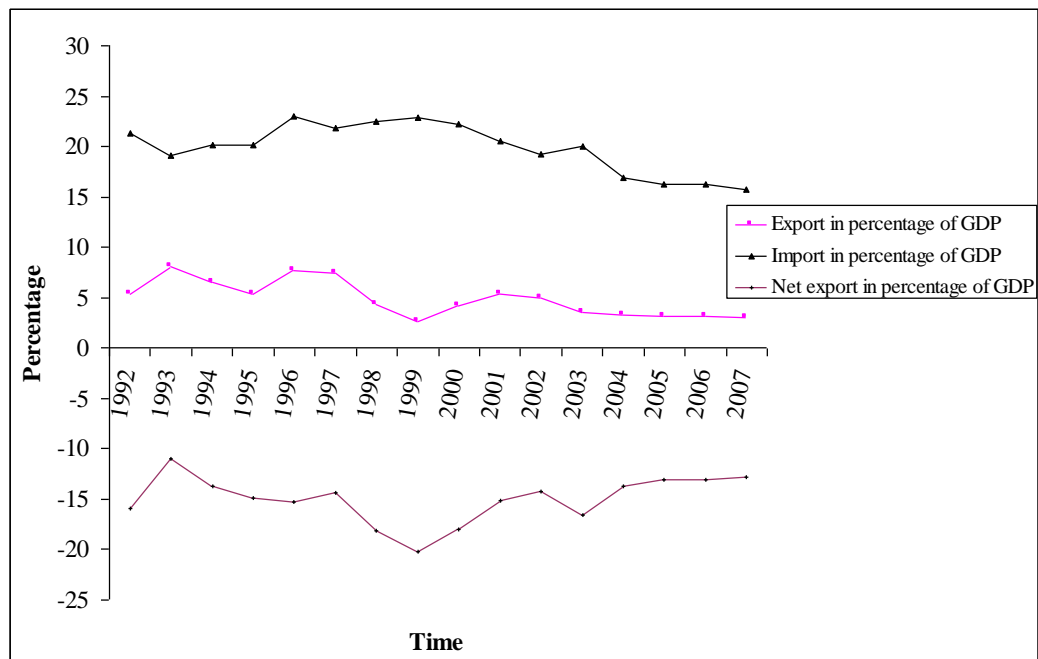
Source: Data collected from World Bank World Development indicators database and also World Economic Outlook.

It can be seen from the graphs that the rise in trade deficit has been financed by the rise in the external debt which is denominated in dollars. It can be seen from this that like most developing countries, there is sovereign liability dollarization in the Eritrean economy.

Figure 2. 5: External Debt of Eritrea
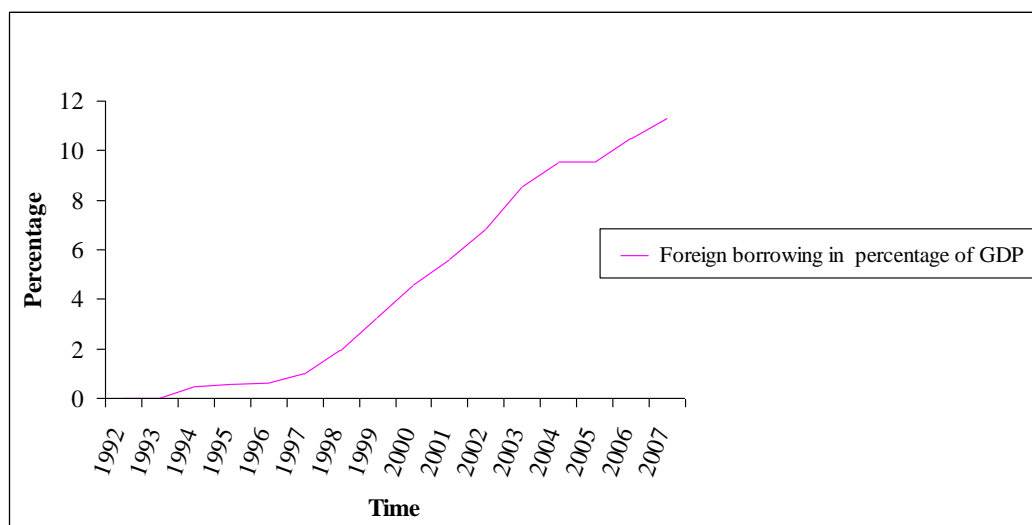
Source: Data collected from World Bank World Development indicators database and also World Economic Outlook.

2.5.3. Underground Dollarization

Although it is not easy to quantify the volume of dollarization in the black market, the gap between the official and black market exchange rates shows the magnitude of activities in the black market which implicitly shows the extent of its dollarization. The higher black market rate indicates that there is higher demand for dollars in the black market. Higher demand for dollars in turn indicates the existence of higher underground dollarization in the economy.

Figure 2.6: Comparison of Black Market and Official Exchange Rate
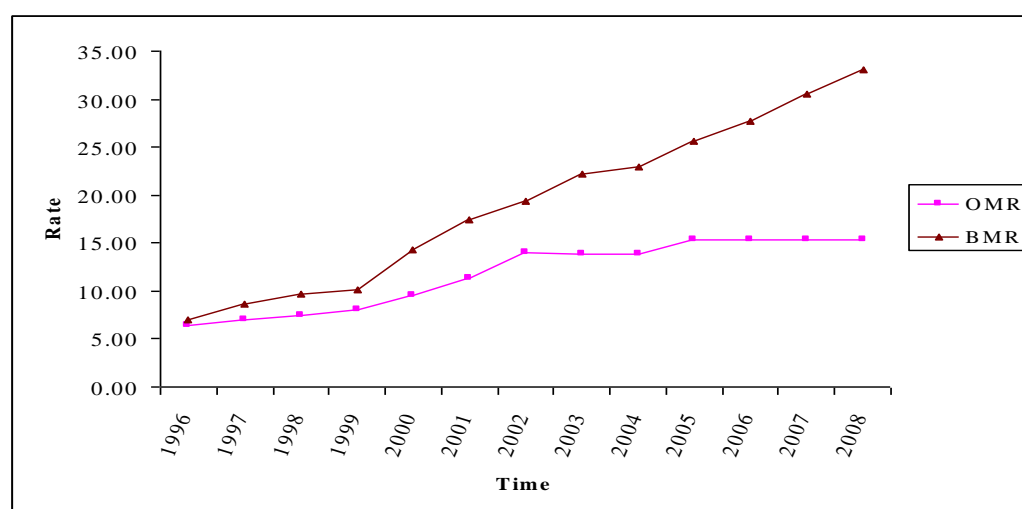
Source: Data on Official Exchange Rate are from IMF International Financial Statistics. Data on Black Market Rate are from different Eritrean black market dealers' records.

The black market rate in the Eritrean economy has been increasing, as can been seen from Figure 2.6. Prior to 1997 there was minor gap between the black market rate and official exchange rate. This shows that there was less underground dollarization prior to 1997. The gap, however, has grown larger ever since 1997 which implies that the underground dollarization has also grown larger. Dollars circulate in the Eritrean black market either to settle transactions for imported goods, as Eritrea relies more on imported goods, or to gain profits through exchanging currencies.

2.5.4. Real Dollarization.

By regulation, all domestic transactions are only allowed to be settled in domestic currency in the Eritrean economy.[8] Prices of domestic goods and services as well as wages are not indexed to foreign currency. Nevertheless, the Housing and Commerce Bank of Eritrea (HCBE) had a practice of selling houses in dollars after the construction of its first housing projects with a Korean company. Although the HCBE made the payment system of house purchase optional in its initial projects, it set a system that gives priority to those Eritreans living in overseas who can afford to purchase the houses in dollars rather than in Eritrean Nakfa. In 2006, the HCBE officially made the purchase of houses and land in dollars instead of the domestic currency. Settling transaction on property in exchange for dollars shows the existence of semi-real dollarization in the Eritrean economy.

2.6. Does the Eritrean Banking Sector Contribute to the Dollarization of the Economy?

It has been discussed in the literature review that banks do influence the level of dollarization in an economy. It has been seen that in transition and emerging economies, financial dollarization is affected by either the banks' decision to match dollar deposits with dollar loans or to shift dollar deposits offshore. Unlike some of the transition and emerging economies, however, the financial dollarization of the Eritrean economy is low. How do then Eritrean banks influence the level of dollarization in the Eritrean economy?

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[8] Unless the Bank of Eritrea specially authorizes receipt in foreign currency, all transactions in Eritrea shall be settled in Nakfa. Any other settlement in violation of these Regulations shall be punishable under the Penal Code of Eritrea (Shabait, 2005).

There are three main ways that the Eritrean banks can affect the level of dollarization in the Eritrean economy. The Eritrean banks can have an impact on the level of dollarization through *the provision of loans to the private sector*, *the regulation of the financial system* and *the interest rate charged on export loans*. How do these three banking practices determine the level of Eritrean dollarization? The banking practices affect the level of Eritrean dollarization as follows. First, the less credit available to the private sector, the higher the financial constrain for the private firms, which reduces the level of domestic production. The lower the level of production means the higher the reliance of the economy on imported goods. As the economy relies more on imported goods, its demand for hard currency will rise as it needs to settle import transactions in hard currency.

Second, if banks restrict the supply of dollars for businesses, they indirectly contribute to the growth of the black market and hence its activity. The lower the supplies of dollars in the official market due to banks' restrictions, the higher the demand for dollars in the black market and therefore the higher the level of underground dollarization. Third, the higher the interest rate charged on loans for the export sector, the lower the volume of loans demanded by the export sector. The disinclination of the export sector to borrow money from the banks shows its effect in the economy in the form of less export activities and lower export earnings. The reduction in export earnings then reduces the supply of hard currency available in the economy and promotes the problem of obtaining hard currency in the economy. To find out whether these three banking practices really matter in the Eritrea economy or not, it is essential to assess the Eritrean financial and monetary systems.

2.6.1. The Financial System

The existence of a sound financial system is important for an economy to secure its economic growth and development. The Eritrean financial system has assisted the economy by facilitating the financial needs of the sectors in the economy. Although the Eritrean financial system plays a key role in providing financial services in the economy, the system is not strong enough to promote growth and meet expectations. As has been noted by the IMF, as indicated in the study by Mehretab et al., (2005), the Eritrean financial system is comparatively underdeveloped and supplies an inadequate range of services. The following reproduced data of M2 to GDP ratio from Mehretab et.al., (2005) shows that the ratio is extremely low relative to other countries. This signifies that the Eritrean financial system is not fully developed.

Table 2.1: The Ratio of M2 to GDP across Some Countries

Countries	1993	1994	1995	1996	1997	1998
Australia	0.57	0.6	0.6	0.64	0.64	0.67
USA	0.6	0.57	0.57	0.58	0.58	0.6
Korea	0.4	0.41	0.41	0.43	0.45	0.48
Italy	0.54	0.51	0.47	0.45	0.47	0.47
Sweden	0.49	0.45	0.43	0.46	0.46	0.45
Ethiopia	0.28	0.32	0.28	0.25	0.25	0.21
Tanzania	0.24	0.25	0.25	0.22	0.2	0.18
Kenya	0.17	0.16	0.15	0.15	0.14	0.13
Sudan	0.12	0.24	0.14	0.11	0.1	N/A
Eritrea	0.02	0.01	0.01	0.01	0.01	0.01

Source: Data are reproduced from Mehreteab (2005).

Since M2 to GDP ratio might be high or low if GDP is low or high, this method might lead to imprecise conclusion. One might conclude that higher M2 to GDP ratio indicates the existence of a more developed financial system, though the fact may be due to low level of GDP. For this reason, another way of assessing the financial development using the share of loans issued to the private sector

relative to the public sector has been adopted. As can be seen from Figure 2.7, the share of loans issued to the private sector is low relative to the share of loans issued to the public sector. Low share of loans issued to the private sector shows limited financial services provision to the private sector which is key in the economy to promote competition and growth. It also indicates that if the private sector is not getting adequate financial services there will be an adverse multiplier effect which will shrink the development of the financial system in the economy.

The Eritrean economy become prone to relying on imported goods as a result of less competition and low growth driven by the existence of low share of loans issued to the private sector. Moreover, if the private sector does not get enough loans, it will not have enough financial resources to carry out its business. This then reduces the level of production in the economy. Having inadequate domestic products coupled with relying on imported goods promotes the demand for hard currency to settle transactions of imported goods.

Figure 2.7: Loans Issued to the Government versus the Private Sector
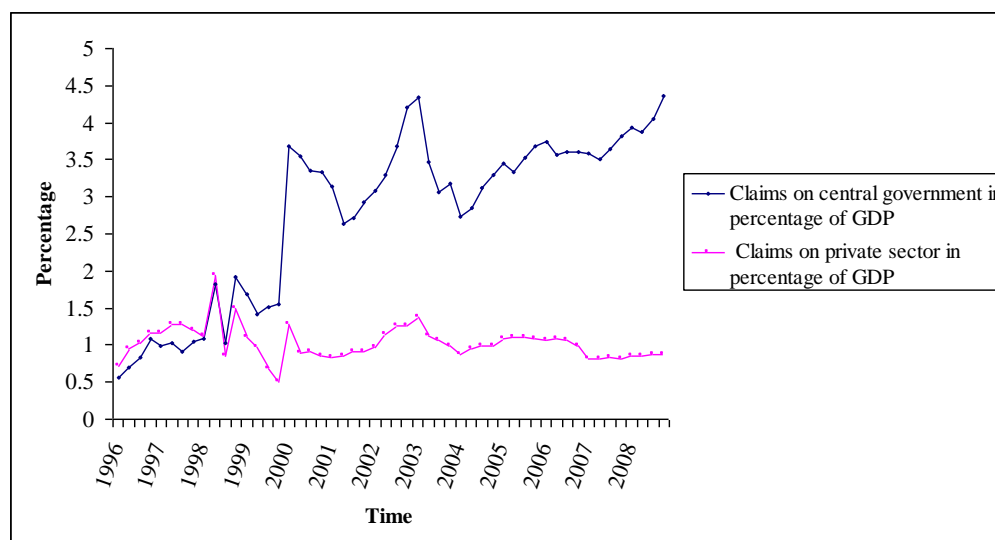
Source: data are collected from financial statistics and World Economic outlook of IMF. GDP is disaggregated using INTER procedure.

Apart from the above indicators of the development of financial system in Eritrea, the number of financial institutions available in the economy could also be another indicator. There are only three commercial banks, one official foreign currency exchange bureau and one insurance company in the entire economy. These are: Commercial Bank of Eritrea (CBE), Housing and Commerce Bank of Eritrea (HCBE), Eritrea Investment and Development Bank (EIDB), Himbol Financial Services (HFS) and National Insurance Corporation of Eritrea (NICE). As indicated by Graeub and Kraehenbuehl (2004), there are also two micro finance enterprises, the Saving and Micro Credit Program (SMCP) as well as the Southern Zone Saving and Credit Scheme (SZSCS), which provide saving and credit services to small scale entities,

It is crucial to raise one important question here: how can the number of financial institutions affect the degree of dollarization? If there are only a few financial institutions, competition is limited and therefore the development of the financial system is hindered. The growth of the economy is also constrained by the lack of adequate numbers of financial institutions. The weakness of the economic growth in turn is likely to weaken the value of the currency which encourages domestic agents to hold more hard currency than domestic currency in their portfolios. The next section discusses how these institutions, in particular the banking institutions, affect the dollarization process.

2.6.1.1. The Bank of Eritrea and its Role in the Dollarization Process

The Bank of Eritrea was one of the regional branch offices of the Central Bank of Ethiopia before the independence of Eritrea. As a branch, the bank was confined its functions on providing notes to the remaining banks, collecting depreciated notes, keeping government accounts, and providing local money

transfer services. Right after independence, the bank was restructured and began to act as a central bank of Eritrea. The bank had autonomous right to set its foreign exchange rate policy, supervise the banks and restructure the interest rates that suit the economy. However, the bank was not absolutely free to conduct its monetary policy autonomously as the country was in a de facto currency union with Ethiopia. For this reason, the bank began to print its own currency in 1997 with the objectives of having independent management of money and credit as well as independent management of macroeconomic policy in the economy.

The Bank of Eritrea now influences the economy by independently conducting monetary policy and setting regulations to the banks in the economy. One of the responsibilities of the bank is to set interest rate on loans and deposits for the reaming banks of the country. The rate of interest on the public sector security is fixed at 2.5 percent.[9] The remaining structure of interest rates set by the bank is presented in Table 2.2.

Table 2.2: The Structure of Interest Rate on Loans and Savings

	1992 -1993	1994	1995	1996	1997	1998	1999 - 2002	2002 -2010
Savings Deposits	8	6	6 - 8	6	6	6	4 - 6	3-4
Loans								
Agriculture								
Commercial	…	8	8.5 - 9.5	8.5 - 9.5	8.5 - 9.5	8.5 - 9.5	8.0 -12	8.0 -10
Small scale	…	7.5	7.5 - 8.5	7.5 - 8.5	7.5 - 10	7.5 - 8.5	8.0 -12	8.0 -10
Industry	12	8.5	8.5 - 9.5	8.5 - 9.5	9.5 - 12	8.5 - 9.5	8.0 -12	10.0 -12
Domestic trade	12.5	9	12	12	12	12	8.0 -12	12
Export trade	10	8	8.5	8	9 -12	8	8.0 -12	8.0 -12
Import trade	12	9	12	9 -12	12	9 -12	8.0 -12	12

Source: Data from 1992 to 2002 are from IMF Staff Country Report (1998, 2000 and 2003). Data from 2002 to 2010 are from the Eritrean banks.

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[9] See (Yamauchi, 2004), " Fiscal Sustainability: the case of Eritrea."

Prior to 1992, the rate of saving deposit was 4 percent and lending rate was 6 percent according to the IFS database on Ethiopia's interest rates. As can be seen from the table, however, the rates jumped dramatically to 8 percent on saving deposits and more than 10 percent on most of the loans in 1992. Charging high interest rate would obviously discourage borrowing and the growth of businesses that need loans to start off their activities. Charging high interest rate also prolongs the debt pay-back period of the business sector including the export sector. As a result, the economy gradually moved towards relying more on informal means of financing business activities which eventually paved the way to underground dollarization.

It can also be seen from the table that the rate of interest charged on loans for industrial activity and export trade jumped in the year the bank began to print new currency, 1997. Theoretically, it would be suitable to raise interest rates if the economy had an increase in its inflation rate. However, the rate of inflation for that period was 4 percent which was lower than the previous periods according to the World Bank's World Development Indicator database. Raising the rate of interest on the sectors in general and on the export sector in particular had an adverse effect in the economy which in turn contributed to the dollarization of the economy.

The biggest role that the Bank of Eritrea played in the dollarization process of the Eritrean economy is through its foreign exchange policy. Right after independence the bank made it legal to exchange currency outside the banks. After the introduction of the new currency in 1997, however, the bank made it illegal to exchange currency outside the banks. Not only did the Bank of Eritrea make the exchange of foreign currency outside the banks illegal, but it also

restricted the provision of hard currency to business activities by the banks. As has been discussed earlier, if banks restrict the supply of dollars for businesses, they indirectly contribute to the growth of the black market and hence its activity. The less the supply of dollars in the official markets due to the banks restrictions, the higher is the demand for dollars in the black market and the larger is the volume of dollarization in the black market.

2.6.1.2. Commercial Banks of Eritrea

CBE and HCBE are the two largest commercial banks in the country. Both these banks were operating prior to the independence of the country under the name of Commercial Bank of Ethiopia and Housing and Saving Bank. Although the CBE continued its operation right after the completion of the first war in 1991, the HCBE was disrupted which later began its full operation in 1994. Both banks are engaged in the provision of international money transfer, foreign exchange services and collecting of demand, saving, time and foreign currency deposits. Both banks also provide short- and long-term credits to different sectors of the economy. Both banks require collateral from creditors; in particular, the CBE requires 100 percent collateral to provide loans to borrowers. Unlike the CBE, the HCBE is specialised in mortgage service provision as well as the construction and selling of houses.

With the aim of generating enough hard currency in the economy, the HCBE together with a Korean company built and sold most of the houses in dollars in the 1990s. Moreover, the HCBE has introduced a new scheme of selling buildings and lands exclusively in hard currency to the Eritreans living abroad since 2006. The bank provides mortgages to those Eritreans willing to purchase a

house and service their debts in hard currency. It can be seen from this that the HCBE has played great role in the dollarization steps of the economy.

Another indicator of the banking practice which will also implicitly hint the traces of dollarization is the gap between the level of deposits and loans issued in the economy. As can be seen from Table 2.3, although both deposits and loans issued by the CBE and HCBE have increased since 1993, they are not proportional. The level of deposits is higher than the level of loans issued by the banks. The shares of un-invested deposits as indicated in the table are above 20 percent each year apart from 1998 and 2000. After the deduction of the 10-20 percent reserve requirement, the banks still have a certain percentage of un-invested deposits.

This shows that the banks are not forwarding enough loans which would ease the financial constraints of the business sector. It also shows that the banks are suffering from excessive liquidity. Whether this is due to their strict regulations in their lending system or other factors, the existence of excessive liquidity will affect the banks' profitability. The inability of making profit by the banks would reflect its impact on the economy. Not issuing enough loans coupled with not making a profit by the banks weakens the economic growth of the country and hence enhances its reliance on foreign made goods as well as on foreign borrowing.

Table 2.3: Total Deposits versus Total Loans from 1993 to 2007

Year	Total Deposits (ERN in ml)	Total Loans (ERN in ml)	Gap (ERN in ml)	Share Percentage
1993	1925	269	1657	86%
1994	2925	585	2340	80%
1995	3631	1326	2305	63%
1996	4158	2028	2131	51%
1997	4514	2076	2438	54%
1998	5188	4573	615	12%
1999	6731	5281	1450	22%
2000	7784	6440	1344	17%
2001	10854	7578	3276	30%
2002	13306	8767	4539	34%
2003	15084	9447	5637	37%
2004	16797	11807	4990	30%
2005	18507	13946	4561	25%
2006	19886	15483	4403	22%
2007	22049	17390	4659	21%

Source: Data gathered from IMF Staff Country Report, 1998, 2000 and 2003.

Sectorial analysis of the loans issued by the CBE, as shown in Table 2.4, indicates that the share of loans issued to the agricultural sector is less than the share of loans issued to the import sector. Restricting loans to the agricultural sector reduces agricultural outputs in the economy. This could be one of the reasons that the economy relies on food imports for food security. Wheat imports, for instance, amounted to 46 percent of all imports in 2001 (Aquastat, 2005). It can be seen from this that the expenditure of food imports is financed by either foreign borrowing or by hard currency obtained from the black market in the economy.

Table 2.4: Sectorial Distribution of the Commercial Bank Loans

Year	Agriculture	Manufacturing	Domestic Trade & Services	Export	Import	Building & Construction	Others
1994	7.2%	9.8%	28.7%	1.2%	10.7%	9.8%	32.6%
1995	6.4%	14.4%	40.2%	2.4%	12.0%	7.9%	16.6%
1996	7.6%	16.3%	46.9%	2.6%	13.5%	6.3%	6.8%
1997	7.2%	19.2%	45.4%	3.5%	14.0%	6.3%	4.4%
1998	8.2%	20.9%	45.0%	2.0%	14.8%	5.6%	3.4%
1999	7.8%	14.9%	45.0%	0.4%	10.2%	2.8%	18.9%
2000	7.6%	15.3%	36.3%	0.3%	13.1%	2.5%	24.9%

Source: Data gathered from IMF Eritrea: selected issue, IMF Staff Country Report (1998, 2000, and 2003).

2.6.1.3. Himbol Financial Services

Himbol Financial Services was created after independence to provide competitive financial services in the economy. It is owned by the PFDJ party and is specialized mainly in international money transfer and foreign currency exchange. It provides services for exchanging foreign currency cheques such as travellers' cheques and drafts or prepaid cheques without any commission charges. In collaboration with the Western Union and the Eritrean Embassies in all over the world, it also provides fast money transfer services to Eritreans living in overseas.

Like the other financial institutes in the country, Himbol Financial Services is under close supervision by the Bank of Eritrea. Unlike in an economy where market determines the equilibrium of the exchange rate, the Bank of Eritrea sets the exchange rate for the institutions to operate with. The institutes then simply work on the exchange rate set by the bank. The Bank of Eritrea has fixed

the exchange rate since 2005 and Himbol Financial Services has been using this fixed exchange rate in its services. The institute has restricted the selling of hard currency to individuals. The limitation of the supply of hard currency by the institute contributes to the increase in demand for hard currency in the black market. While the restriction contributes to the growth of the demand for hard currency outside the institute, it has also fostered the development of underground dollarization.

2.6.2. Monetary System.

One of the factors that affect the households' decision in their portfolio holdings is the credibility of monetary policy. In most transition and emerging economies, households tend to hold foreign currency denominated deposits due to the lack of confidence in the monetary system of the economies. As a result, their actions foster the dollarization process in these economies. Unlike in most transition and emerging economies, Eritrean households tend to hold very limited foreign currency denominated deposits in the bank. How then do the Eritrean monetary systems influence the dollarization process of the Eritrean Economy? To answer this question, examining the Eritrean monetary system with particular emphasis on the post-independence period is crucial. Before that, however, the following section examines the pre independence situation of the Eritrean monetary system.

2.6.2.1. Pre-Independence of Eritrea

Prior to its independence, the Eritrean monetary system had different forms during its different colonization periods. Although there was no formal and autonomous monetary system before the Italian colonization, metropolitan currency was circulating in the economy. Coins made of gold, silver and bronze

were minted with Greek and Ge'ez (indigenous Semitic language) writing by the Axumite kingdoms to be used as a medium of exchange in the country. After the collapse of the Axumite kingdoms, however, the minting and usage of these coins had terminated and primitive money became the dominant means of payment.[10]

Later on, the Maria Theresa Thaler began to circulate alongside the barter exchange. Maria Theresa Thaler was a coin made of 0.8333 silver content metal.[11] The coin was minted in Austria and was widely used in different countries of the world.[12] Maria Theresa Thaler, as pointed by Pankhurst (1980), was mainly used as a payment for slaves in the coastal area of Massawa, Eritrea. It was also used to settle local transactions as well as international transactions. Besides its monetary function as a medium of exchange, it was used as a store of value and also as a jewel when it melted down. It can be seen that there was dollarization in Eritrea back during those days as the Maria Theresa Thaler was international money and commonly used by a wide range of countries though its supply was under the supervision of Austria.

In addition to Maria Theresa Thaler, as indicated by Mauri (2004), Egyptian currency and Indian rupee were used in Massawa and Assab respectively. With the introduction of Italian colonization, a formal monetary system was introduced and Maria Theresa Thaler was replaced by Tallero Eritreo currency. The Tallero Eritreo was similar to Maria Theresa Thaler but its silver content was 0.800 which is less than the silver content of the Maria Theresa

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[10] The commodities that have been used as a medium of exchange, as listed in the studies by Rena (2007) and Mauir (2004) are brass bracelets, salt bars, cloth, cattle, cowry shells, glass beads, cartridges and salt bars.

[11] Mauri (2004) has written about the silver contents of all the coins circulating during the Italian colonization.

[12] Among these countries were Albania, Algeria, Bahrain, Borneo, Cameroon, Central African Republic, Chad, Djibouti, Egypt, Eritrea, Ethiopia , Ghana, Kuwait, Lebanon, Libya, Malta, Mauritius, Moldavia, Morocco, Niger, Nigeria, Palestine, Saudi Arabia, Serbia, Somalia, Sudan, Syria, Tanganyika, Togo, Tunisia, Turkey, Uganda, the United Arab Emirates, Walachia, Yemen and Zanzibar (Tschoegl, 2001).

Thaler. About 200, 000 of the new currency was minted by the Italian colonials to circulate in the Eritrean economy.[13]

Since the silver content of the newly introduced currency was less than the Maria Theresa Thaler, the new currency was not widely accepted. For this reason, the Italian authorities introduced another currency, Tallero d' Italia, which had higher silver content than both currencies. Settling trade with the neighbouring countries using Tallero d' Italia, however, was not easy. As a result, the colonials allowed the usage of metropolitan currencies that were circulating in the economy. It can be noted so far that the Eritrean monetary system was highly determined by the monetary systems of Austria and Italy as the currencies that were circulating in the economy was mainly of these countries.

When the Italians were overpowered by the British army, the British authorities attempted to replace the Maria Theresa Thaler by printing similar coins in India. They were, however, not successful in doing so. They then introduced East African Shillings and allowed the Indian rupee, English pound and the Maria Theresa Thaler to circulate legally. Although these currencies were made legally acceptable currencies, the British authorities later on proclaimed the East African Shillings to be the only legal tender in the economy. The function of the East African Shillings as a money was interrupted by Birr when Eritrea was federated with Ethiopia. The monetary system was also replaced by the Ethiopian monetary system.

2.6.2.2. Post-Independence of Eritrea

Although Eritrea had to formulate a new economic system right after its independence, its monetary system was highly influenced by the Ethiopian

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[13] The figures are as indicated in the study of Tschoegl (2001).

monetary system as Birr was still the only currency used in the economy. For this reason, the Bank of Eritrea was not able to conduct monetary policy independently. Its management was limited to the setting of interest rates and reserve requirement. To have an independent monetary system and to be able to manage monetary affairs independently, the Bank of Eritrea introduced a new Eritrean currency (Nakfa) in 1997. How does the introduction of new currency affect the dollarization process of the economy?

The introduction of new currency was not in the best interests of the Ethiopian regime which eventually led both countries into disagreements in how their trade transactions should be settled. Since Ethiopia disagreed to the proposal of a one-to-one exchange rate between the new Eritrean currency (Nakfa) and the Ethiopian currency, it suggested to settle any kind of transaction in hard currency ((Haile, 2008) and (Africa Research Group, 1999, as cited in Zondi & Rejouis, n.d.). Although Eritrea agreed to settle trade in hard currency, the Ethiopian regime regarded the introduction of new currency as a negative political indication. The disagreements, together with other socio-political factors, ultimately led both countries to the second war in 1998.

The second war costs both countries economically, socially and politically. According to the World Bank group database, the military expenditure of Eritrea rose from 13 percent to 40 percent of its total GDP between 1997 and 1999. Since military expenditure is financed by hard currency, the economy had to find ways of financing the expenditure. One of the ways was foreign borrowing which pushes the level of liability dollarization in the economy. Foreign borrowing increased from 75 million U.S. dollars to 253 million U.S. dollars in the same time frame. Exports also fell from 30 percent to 10 percent of its total GDP in the

same period of time which contributed to the reliance of the economy more on foreign borrowing to generate hard currency. A summary of export performance, military expenditure and external debt, a proxy of foreign borrowing, is given in Table 2.5.

Table 2.5: GDP, Export, External Debt and Military Expenditure[14]

Year	GDP growth (Annual rate)	Exports (% of GDP)	External debt (in millions of U.S.$)	Military expenditure (% of GDP)
1992	..	11	..	..
1993	13	31	..	22
1994	21	28	29.1	13
1995	3	22	36.7	21
1996	9	29	44.3	22
1997	8	30	75.5	13
1998	2	15	146.1	35
1999	0	10	252.6	40
2000	-13	15	299.9	36
2001	9	12	395.7	24
2002	3	13	490.1	22
2003	-3	6	607.5	21
2004	1	6	705.7	..
2005	3	6	724.5	..
2006	-1	7	784.9	..
2007	1	7	859.8	..
2008	-10	4	961.4	..
2009	4	5	1018.9	..
2010	2	..	..	..

Source: World Bank World Development Indicators.

Since the introduction of new domestic currency, the overall Eritrean economic performance has been insufficient. The introduction of new currency cost Eritrea more than expected. The country lost access to the Ethiopian market and thereby an average amount of equivalent to 43.02 million U.S. dollars in earnings from its exports to Ethiopia. With the loss of access to the Ethiopian

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[14] Data are from World Bank world Development Indicators.

market, the country had to import products from other countries and settle transactions in hard currency.

Settling import products in hard currency, this used to be mainly in Ethiopian Birr when importing from Ethiopia, coupled with the decline of export earnings led the economy to rely more on foreign borrowing. Its GDP growth rate continued to deteriorate and declined from an average of 10.8 percent prior to the introduction of new currency to an average of approximately 0.2 percent over the period 1998 to 2007, which is after the introduction of its own currency.[15] The new currency lost its value as investors lost their confidence on its competitiveness in the international market. Prior to the launch of the new currency, the Ethiopian Birr, which was used as legal tender in Eritrea, had an average value of 0.25 against U.S. The new currency, however, valued at an average of 0.08 against the U.S. dollars since its introduction. The conversion rate between Birr and Nakfa was proposed to be one-to-one, although it was not come to work due to the eruption of the war. The loss in the purchasing power of the domestic currency indirectly contributed to the higher demand for hard currency.

2.7. The Role of the Mining Industry on the Dollarization.

According to the information from ("Organization of Sunridge Gold Corp.", n.d.), the Eritrean mining industry began its exploration in 2003 and started its production in 2011. As mentioned in the brief review of Eritrea's profile, there are a number of mining companies involved in the business of exploring, producing and exporting minerals. Among other minerals, the production of gold has been the main focus although silver, copper and zinc have

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[15] Average estimation is made from the data reported by IMF Country Report on Eritrea and World Bank group database.

been targeted for the upcoming production in different areas of the country. Great expectation has been put on the Eritrean mining industry to bring radical economic change in the country in terms of better cost of living, improved exchange rate deals, employment opportunities and technological transfer. Moreover, it is expected to improve the current account deficit, foreign exchange reserve, bring economic growth, spill-over effect of the growth and thereby reducing poverty.

It is vital to address some important questions here: to what extent does the development of the mining industry affect the dollarization dynamics of the country? Will the production and exportation of the minerals somehow make the local currency competitive and strong? Does it help reduce the dollarization level of the economy? To answer these questions, it is essential to explore a number of issues which are fundamental to the dollarization process and are linked to the questions posed earlier.

First, it has been noted that the Eritrean economy has been accumulating external debt since the beginning of 1994. It has also been observed that the economy has responsibly been servicing its debt. Since the loans issued to the economy are not in its local currency but in dollars, the economy has to generate enough hard currency to be able to pay-back its debt. Second, the local currency has not gained strong recognition in the international market since its introduction as a new currency. Although it has had some hikes and spikes at some stages since its inception as a new currency, its comparative value with the Birr, the former Ethiopian currency used as a local currency in the Eritrean economy, on average is weak.

The requirement to complete the debt servicing in hard currency together with the lack of recognition of the local currency in the international market resulted in exporting the production of the mining industry in exchange for hard currency instead of the local currency. The settlement of the transaction in hard currency instead of local currency is likely to reduce the sovereign liability dollarization as the economy is now generating enough hard currency to pay its debt. On the other hand, it is likely to encourage financial dollarization as the banks' claim on foreign banks in hard currency is likely to increase because the banks are owned by the government which has certain shares in the mining industry.

With the control of the mining industry by the government and foreign shareholders, it is likely to see the leakage of hard currency to the rest of the world. Despite the settlement of the mining transactions in hard currency, the supply of hard currency is less likely to remain within the economy as a result of the leakage. The less demand for local currency by the international market together with the less supply of the hard currency within the economy is less likely to bring dynamic change on the value of the local currency in the short run. The local currency will, therefore, remain weak for some time.

Provided that the economy still relies largely on imports, weak local currency will have its pass-through effect on the local inflation. The growth of inflation in addition to the undermined currency is most likely to promote underground dollarization. It can, therefore, be seen that although the government and foreign shareholders will benefit from the production and exportation of the mines through the generation of the hard currency, its role in the reduction of dollarization is less likely to be significant in the short run. It can also be noted

that its trickledown effect in terms of poverty reduction and better life is minimal as inflation remains high.

2.8. Conclusion

The rise of dollarization in transition and emerging economies together with its consequences inspired a number of scholars to address what causes dollarization, in particular financial dollarization. Both theoretical and empirical arguments of the existing literature point out that the level of deposit dollarization plays a vital role in the determination of loan dollarization. In addition to this, it has been found that dollarization can be affected by institutional factors, financial underdevelopment, financial market incompleteness, bank insurance and openness (Yeyati, 2006; Eichengreen & Hausmann, 1999; Calvo, 2001; 2002 among others). This chapter covers what kind of dollarization the Eritrean economy has before examining what determines its dollarization. It has been identified that Eritrea has partial dollarization with the evidence of financial dollarization, liability dollarization and underground dollarization. The trace of real dollarization is manifested only through the selling of houses and lands in exchange for hard currency instead of local currency. Other than land and houses, wages and prices of goods are not indexed to dollars.

This chapter addresses the role of the Eritrean banking and monetary system on the dollarization process of the Eritrean economy. The chapter is different from the existing studies in that it has addressed the overall dollarization of Eritrea instead of a certain aspect of the Eritrean dollarization. In comparison to the literature reviewed so far, this study analyses the structure of interest rates, loans issued to the private sector and the Eritrean monetary system.

It has been found that the Eritrean banking practices have played a great role in the dollarization process of the Eritrean economy. The structure of interest rates set by the Bank of Eritrea to the remaining financial institutions and the less share of loans issued to the private sector have directly or indirectly contributed to the reliance of the economy on hard currency. Easing foreign exchange controls during certain periods of time and imposing strict regulation at other times has promoted the growth of underground dollarization. The pursuit of an independent monetary system and the introduction of new currency have contributed to the growth of foreign borrowing and the growth of settling import transactions in hard currency.

Chapter 3- Methodology

3.1. Introduction

It has been mentioned in Chapter 1 that some of the objectives of this research are to identify the factors that cause the Eritrean economy to rely more on hard currency and show to what extent the external debt servicing burden led the authorities to increase their demand for hard currency. This research is also aimed at determining the impact of relying on hard currency on exchange rate volatility, inflation and monetary policy transmission mechanisms. Furthermore, the study sets out its goal to show Eritrean policy makers how relying on hard currency constrains the Bank of Eritrea from achieving its objectives and what excessive reliance on hard currency leads to. In order to achieve these objectives, therefore, it is very important for this study to identify which research methodology and research methods are relevant to its research questions.

Before proceeding further to the discussion of what kind of methodology this research has used to address its research questions, it is worth pointing out the difference between the word methodology and method. The word method refers to the techniques and procedures of different forms of data gathering, regression and mathematical analysis that are used in carrying out the research (Ethridge, 2004). The word methodology, however, refers to the overall approach to the research process, starting from the theoretical underpinning or paradigm to the collection and analysis of the data (Hussey, 1997). Research methodology is, thus, mainly concerned with why certain data are collected, what type of data are collected, what type of models are used, the sources of the data, when and how the data are collected and finally the basic theory behind collecting the data and how the data are analysed. This chapter, therefore, deals with the philosophical approach and

data collection procedure needed to answer the research questions of the study. Among different research paradigms available for the study, a Functionalist approach has been adopted as it is most relevant to answer the research questions.

The next section of the chapter deals with the research paradigm followed by research strategy and design. Section 3.2 discusses model specifications of the research. Section 3.5 provides an explanation of data collection. Section 3.6 presents the disaggregating method followed by data analysis and resources used in the research.

3.2. Research Paradigm

According to Collis and Hussey (2009), research paradigm refers to the philosophies and assumptions that the researchers have about the world and nature of knowledge. To identify which paradigm or approach is relevant to address the research questions of the study, it is essential to briefly review the four research paradigms namely: Radical Humanist, Radical Structuralist, Functionalist and Interpretivsit. According to Burrel and Morgan (1979), the Radical Humanist paradigm is defined by its concern to develop sociology of radical change from a subjectivist view point. The Structuralist paradigm, on the other hand, advocates sociology of radical change from an objectivist stand point.

The Functionalist paradigm is another form of paradigm that aims at testing theories in order to increase the predictive capacity of a model. Functionalist research emphases on the formal propositions of the relationships of variables, quantifiable variables, hypothesis testing and drawing of inferences about a phenomenon from a sample of the stated population (Orlikowski & Baroudi, 1991). The Interpretivist paradigm is based on the assumption that people create their own subjective and inter-subjective meanings as they interact

with the world around them. According to the Interpretivist paradigm, the world is conceived as it is but is an emergent social process - as an extension of human consciousness and subjective experience (Burrel & Morgan, 1979).The researchers who have an interpretivist paradigm approach employ meaning focused methodology, which depends on a subjective relationship of the researcher and the subjects, relative to measurement oriented. They use interviewing and sometimes participant observation techniques. Prior to conducting their research, the researchers do not define the dependent and independent variables (Kaplan & Maxwell, 1994).

Among the different research paradigms available for this study, the functionalist approach is the most relevant research paradigm. The reason for choosing this research paradigm is mainly due to its similarity with the nature of this study. Like the functionalist paradigm, the proposed study deals with testing whether dollarization alleviates or aggravates exchange rate volatility, whether dollarization reduces or produces inflation, whether dollarization facilitates or complicates monetary policy transmission mechanisms. Bearing the functionalist paradigm in mind, this research identifies the causes of dollarization in the Eritrean economy. It also deals with measuring the extent of dollarization in the Eritrean economy by employing a new technique of measurement that incorporates all forms of dollarization in the economy.

Dollarizing the Eritrean economy might have positive as well as negative effects. On the positive aspect, relying on hard currency or dollarizing the economy might

- help the country pay back its debt which might make the country credit worthy for the next round of foreign borrowing.

- enable the country to have access to the global market as its imports are mainly from countries that demand hard currency rather than Eritrea's local currency.

On the negative side, nevertheless, relying on hard currency or dollarizing the economy has restricted the Bank of Eritrea's

- ability to monitor the exchange rate effectively as relying on hard currency has encouraged the black market activities where hard currencies are exchanged for a more attractive and competitive price than the rates offered in the official market.

- ability to control inflation which has been growing continually and now become far beyond the Bank of Eritrea's reach. (Hinders the effectiveness of monetary policy).

Like the functionalist paradigm's identification of the relationship between variables and quantifying the variables, therefore, this study deals with identifying the effects listed above and also quantifying the variables so as to be able to test and examine the impact of one variable over anther variable.

3.3. Research Strategy and Design

Research strategy simply stands for the scheme of addressing the research topic alongside the research questions and objectives. The design of the research, however, mainly focuses on the structure of the research. This research is classified as both descriptive and analytical. In order to have clear understanding, it is vital to describe what descriptive and analytical research are all about. Ethridge (2004) pointed out that descriptive research endeavours to determine, describe, or identify *what it is* whereas analytical research tries to find out *why it is*. While descriptive research aims at synthesising, analytical research aims at

analysing. Descriptive research gathers information together, while analytical research takes information apart and examines why, how it has happened and what will be its effect.

As a descriptive research, this study shows the growth of some economic variables such as the domestic credit, inflation, reserve requirements, credit issue to the government sector versus the private sector, dollarization, demand deposit and money supply measured by M1. A relative comparison within and among the variables has also been made to discuss their implications.

As analytical research, this study analyses how the Eritrean dollarization come to prevail in the economy. It also analyses how dollarization affects the Eritrean economy and why the key economic variables of Eritrea have changed over time. Furthermore, different econometric techniques such as Exponential General Autoregresive Conditional Heteroscedastic in mean (EGARCH-M (1, 1)), Vector Error Correction and Vector Autoregressive method have been used in carrying out the analysis. More on these will be discussed in detail in the model specification and data analysis section. Different forms of unit root tests namely Augmented Dickey Fuller and Phillip Peron have been applied to see the stationarity of the variables such as the domestic credit, exchange rate, inflation rate and GDP. In addition to the unit root test, the stationarity test using Kwiatkowski-Phillips-Schmidt-Shin has been implemented to examine the stationarity of the variables of interest. A cointegration test using Johnsen has also been conducted to examine the existence of cointegration among the variables in investigating the impact of dollarization on the inflation of the Eritrean economy.

This research can also be classified more as quantitative research than qualitative research which focuses on words instead of quantification in the

collection and analysis of data as Bryman and Bell (2003) point out. As quantitative research, it has quantified the degree of relying on hard currency or the level of dollarization in the Eritrean economy. As quantitative research, it has also measured the effects of dollarization on the volatility of the exchange rate, inflation, and the transmission mechanisms of different channels such as the credit channel and exchange rate channel. Although more focus has been given to the quantitative aspect, brief qualitative information on the Eritrean financial sector has also been included in the second chapter of the study. The fundamental reason for choosing quantitative research over qualitative research is mainly due to the nature of the research topic as well as the effectiveness and suitability of the quantitative research to address the research questions posed in the study.

The research is design in such a way that each chapter is set out to examine the effect of dollarization on the Eritrean macro-economic variables with specific investigation on the exchange rate volatility and inflation. Its influence on the real macro-economic variables, such as gross domestic product and unemployment, has not been addressed mainly due to lack of data availability. In addition to its effect on exchange rate volatility and inflation, its impact on the effectiveness of the monetary policy transmission mechanisms has been examined carefully. Before going in to an in-depth examination of the impact of dollarization on the macro-economic variables of the Eritrean economy, however, what determines the Eritrean dollarization has first been addressed in a separate chapter. Besides, how the extent of dollarization in the Eritrean economy should be measured has been dealt within a different chapter which developed a new method of measuring a hard currency index that includes all forms of dollarization in the Eritrean economy.

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It is important to note here that this research is designed in a way that each chapter has to have its own literature review and methodology which are relevant to that particular chapter. Even though each literature review and methodology is specifically relevant to a particular chapter, overall they convey consistent reflection of the general research topic and addressed the research questions in specific ways. The purpose of this kind of research style is to have a detailed and clear investigation on how dollarization affects the Eritrean economy more specifically and thoroughly. Furthermore, it gives a clear picture of how the research questions have been addressed. Another advantage of this style is that it is handier to edit, synthesise and submit each chapter to journals for publications in an article format.

The research has also been designed to present first what kind of dollarization that the Eritrean economy is experiencing and whether the financial sector has contributed in the process of dollarization or not. For this reason, Chapter 2 is designed to deal with this issue before conducting specific investigation on the impact of dollarization on the exchange rate volatility, inflation and the transmission channels. The identification of what kind of dollarization exists in the Eritrean economy provides vital information for classification and comparative studies which facilitate the comparison of the outcome with the experiences of other similar economies. Moreover, it has helped in the process of constructing the dollarization index, on which the entire analysis relies on, which measures all kinds of dollarization that exist in Eritrea.

3.4. Model Specification

As Boumans (2005) discusses, economic phenomenon are better understood through mathematical representations of the models. In most economic research, models are devices through which economists explore the 'what' and 'how' research questions. In this research, mathematical representations of the relationship between dollarization and different macroeconomic variables are shown. Due to the broad scope of the research topic, however, multiple models are adopted to answer each research question proposed in the statement of the problem. To address the first research question of the proposed study; that is: "Does dollarization alleviate or aggravate exchange rate volatility?", the following EGARCH-M (1, 1) model is used.

$$\varepsilon_t = \alpha + \phi \ln \sigma_t^2 + u_t \tag{3.1}$$

$$u_t = \sigma_t \times \upsilon_t$$

$$\ln \sigma_t^2 = \omega + \delta h_t + \varphi \frac{|u_{t-1}|}{\sqrt{\sigma_{t-1}^2}} + \gamma \frac{u_{t-1}}{\sqrt{\sigma_{t-1}^2}} + \Psi \ln \sigma_{t-1}^2$$

Where ε_t is the return on exchange rate at time t. This is obtained from $\ln \frac{e_t}{e_{t-1}} \, or \ln e_t - \ln e_{t-1}$. The $\ln \sigma_t^2$ is the logarithm of the conditional variance at time t. u_t is the random error term at time t. $\upsilon_t \sim N$ (0, 1) and is an i.i.d. h_t is a variable for the hard currency index which is a measurement of dollarization at time t. The structure of the error term is assumed to have a generalized error distribution. $\alpha, \phi, \omega, \delta, \varphi, \gamma, \Psi$ are the parameters to be estimated. The parameter α captures the conditional mean. The parameter γ captures the asymmetry effect of the positive and negative shock on the exchange rate volatility.

It should be noted here that there are other alternative techniques of measuring exchange rate volatility such as the standard deviation and GARCH (1, 1) available for the study. The main reasons for selecting EGARCH-M (1, 1) over the alternative techniques are: first, the distribution of the exchange rate is found to be non-normal. Using the standard deviation to measure exchange rate volatility in the presence of non-normal distribution leads to inconsistent and misleading results, as Rana (1981) points. Second, it should be noted that to trace the impact of dollarization on exchange rate volatility measured by using the standard deviation requires the inclusion of other factors that affect exchange rate volatility. Some of the data on the factors, however, were not available for the study. EGARCH (1, 1), however, overcomes the problem by simply focusing on the relationship between dollarization and the exchange rate volatility while technically measuring the exchange rate volatility. The special econometric technique employed in the study does not measure by how much dollarization is affecting the exchange rate volatility so as to worry about the rest of the factors. The econometric technique employed in the study is simply helping to test whether dollarization affects the exchange rate volatility or not.

If we were to measure by how much dollarization affects volatility, we could have said what about other factors by how much are they affecting the exchange rate volatility and would not the results be different? Of course, in that case we need to employ different econometric techniques to be able to identify by how much volatility is affected due to war; loss of export earnings and the decline in GDP growth. As such, we would be able to measure the extent of the impact of dollarization on the exchange rate volatility. The aim of this study, however, is to identify whether dollarization affects the exchange rate volatility positively,

negatively or not at all and by employing the special econometric technique the research has identified the impact of dollarization on the exchange rate volatility.

Third, EGARCH (1, 1) is selected over GARCH (1, 1) as the latter fails to capture the asymmetric effect of the shocks on the return to the exchange rate volatility. Moreover, unlike the EGARCH-M (1, 1) specification, GARCH (1, 1) uses unlogged conditional variance which makes the conditional variance, σ_t^2, positive even though the parameters are negative, as Brooks (2002) points out.

To capture the degree of relying on hard currency in the Eritrean economy, a hard currency index has been constructed. The detailed discussion on this can be found in Chapter 5 titled "Does dollarization alleviate or aggravate exchange rate volatility?"

To address the second research question that is: Does dollarization reduce or produce more inflation? First, inflation model based on money demand and money supply was constructed. Second, a cointegration approach is applied to the inflation model. In particular, a Vector Error Correction Model (VECM) together with Dynamic Ordinary Least Square method is used. VECM can be specified as follows:

$$\Delta Y_t = \theta + \sum_{i=1}^{k} \Gamma_i \, \Delta Y_{t-i} + \Pi Y_{t-1} + u_t \tag{3.2}$$

where Y_t is a vector of endogenous variables. The parameter Γ_i represents the parameters of the independent variables in the short run and it goes from $\Gamma_1,.....,\Gamma_k$ where k is the lag length. $\Pi=\alpha\beta'$ where α represents the speed of adjustment to the long run equilibrium and β includes r cointegrating vectors. u_t is a vector of the error terms which are assumed to be normally distributed with zero mean and constant variance.

The reason for choosing cointegration over ordinary least squares regression is that it provides more room for analysing the long- and short-run effects of dollarization on inflation and also other possible cointegration equations at once. Moreover, cointegration techniques can help identify the existence of cointegrating vectors in an advanced way relative to the ordinary least squares techniques. Due to the possibility of the existence of more than one cointegrating vectors, VECM is selected to estimate the long run coefficients first. The coefficients are then used in the determination of the error correction term using the dynamic ordinary least squares (DOLS). The reason for using DOLS is because it avoids the problem related with endogeneity of the variables as pointed by Kiltgaard (1999).

In order to analyse whether dollarization facilitates or hinders the transmission mechanism of the monetary policy in Eritrea, the vector autoregressive model (VAR) given below has been used.

$$Z_t = A(L)Z_{t-1} + B(L)X_t + u_t \qquad (3.3)$$

where A (L) and B (L) are the polynomial matrices expressed in lag operator L. Z_t is a vector of endogenous variables and X_t is a vector of exogenous variables. u_t stands for random error term. The baseline model includes consumer price index, gross domestic product, and reserves and can be expressed as:

$$Z_t = [Y_t \; P_t \; R_t \;] \qquad (3.4)$$

The exogenous variable X_t includes U.S. consumer price index and Federal Fund Rate and can be expressed as.

$$X_t = [P_t^{us} \; FF_t] \qquad (3.5)$$

where P_t^{us} stands for U.S. consumer price index and FF_t represents Federal Fund Rate. The rationale behind using the VAR model to address the last research question is because VAR models are commonly and widely used techniques in examining the transmission mechanism. Moreover, it provides ways of detecting the responses of the channels to a given shock on the policy variables. It enables the researcher to see whether or not there are significant responses of the channels and also how long the effectiveness of the responses lasts for; that is, whether responses are persistent or relatively last within a short period of time. VAR models also allow the researcher to examine the proportion of the variation within the system through the variance decomposition technique.

It should be noted here that the data available to carry out the analysis of this research are very limited. Despite the data limitation, the study chooses to use EGARCH (1, 1) for the reasons mentioned earlier. In the section that analyses the impact of dollarization on monetary policy transmission mechanisms, however, the data limitation has been sorted out partly by using standard VAR in levels, as most of the researchers in the literature such as Dabla-Norris and Floerkemeier (2006), Samkharadze (2008), Ramaswamy and Sloek (1998), Clements et al., (2001) and Poddar et al., (2006) have done it in their analysis. To examine the robustness of the results, the Structural Vector Autoregressive model (SVAR) as well as Toda and Yamamoto (1995) procedure (TY) have been included.

3.5. Data Collection

The data required to address the research questions have been discussed in each chapter. In this section, the why, when, what and how the data are collected are going to be discussed. Before going further, it is worth mentioning that although a large proportion of this research comprises quantitative data, minor

qualitative data has also been used in the brief overview of the Eritrean financial sector. The qualitative data are collected from the review of some articles related to the study of Eritrean financial and banking systems. The reason for this is that it is essential to examine the historical development of the financial sector and how its activity has contributed to the dollarization process of the Eritrean economy.

In quantifying the degree of dollarization, foreign exchange reserves, M2 measured by the sum total of M1 and quasi money, domestic currency in circulation, total foreign assets, gold reserves and foreign borrowing measured by adding total multilateral loans, cross-border loans from Bank for International Settlements (BIS) reporting banks and cross-border loans from BIS banks to non-banks are gathered.

These data are gathered from the IMF International Financial Statistics (IFS), Balance of Payments of Eritrea IMF file number 643, Joint External Hub and World Development Indicators of the World Bank. The detailed discussion of these data can be found in the chapters. It is, however, important to address *when* and *how* these data are collected. The data from the balance of payments of Eritrea IMF file number 643 was collected in 2008 at the University of Ottawa using the University of Ottawa database. The remaining data are collected in 2010 at the University of Waikato using the DataStream at Waikato Management School.

In measuring exchange rate volatility, both official and black market exchange rates are collected. The official exchange rates are gathered first at the University of Ottawa in 2008 and then recollected again from IFS at the University of Waikato in 2010. The black market exchange rate is gathered from

different participants of the *franco valuta* in Sweden, U.K., Canada and New Zealand in 2009. This has been done by making contacts with the participants and also going in person to get their unpublished records.

Other data used in the study include the U.S. consumer price index, Federal Funds Rate, import of goods and services, debt service, the CPI of all trading partners, money supply measured by M1, gross domestic product, reserves, domestic credit, credit issued to the private sector and credit issued to the government sector. Some of these data are disaggregated using INTER procedure which is discussed in the next section. The sources of these data are from IMF World Economic Outlook, World Development Indicators of the World Bank and also the IFS of IMF.

It should be noted here that the data collected from the World Development Indicators and IMF Word Economic Outlook were in annual format. However, the data gathered from the IFS and the Balance Sheet Payment of the IMF file number 643 are reported in quarterly format. In order to have consistency, the annual data have been disaggregated using INTER procedure. The details of INTER procedure are discussed next. The data range covers from 1996 to 2008. This is mainly because some of the data, which are used in the analysis, are only available during that period.

3.6. Disaggregating Method

There are different ways of disaggregating annual data. According to the study by Chan (1993) some of these methods are: the NAÏVE procedure, the INTER procedure, the Lisman and Sandee (LS) procedure, the Boot, Feibes and Lisman first difference (BFL-FD) procedure, the BFL-SD (second difference) procedure, the Wei and Stram (WS) procedure. Of these procedures, the INTER

procedure and the WS procedure performed well relative to others in Chan's study of the comparison of these procedures against the actual data. From these procedures, the INTER procedure was selected and used for this study. The steps of the procedure are as follows:

Step one, cumulate the annual time series data Y_t. Let the cumulated annual time series be denoted by C_T where T=1,,,,,N. So we have

$$C_T = \sum_{t=1}^{T} Y_t$$
(3.6)

Step two, construct a cubic polynomial function that fits each consecutive set of four points of the C_T. For example, construct a cubic polynomial function that fits C_1, C_2, C_3 and C_4 and determine the value of the four unknowns from the four simultaneous equations of the following.

$C_1 = a+b \, (t) +c \, (t)^2+d(t)^3$

$C_2 = a+ b \, (t) +c \, (t)^2+d(t)^3$

$C_3 = a+ b \, (t) +c \, (t)^2+d(t)^3$

$C_4 = a+ b \, (t) +c \, (t)^2+d(t)^3$

Step three, determine the values of the cubic polynomial that joins two sets of points. For example, to disaggregate the annual data of the year seven, that is Y_7, determine the cubic polynomial value of p(6), p(6.25), p(6.5), p(6.75) and p(7). To cross examine whether the procedure is in the right track or not it can be seen whether p (6) = C (6) and p (7) =C (7).

Step four, determine the values of the difference between the two consecutive polynomial values. For example, determine the value of the difference between p (6.25) and p (6), p (6.5) and p (6.25), p (6.75) and p (6.5), p (6.75) and p (7). The value of the first difference represents the first quarter.

Similarly, the value of the second, the third and the fourth represent the second, the third and the fourth quarters.

3.7. Data Analysis and Resources Used in the Study

The tabulation and demonstration of certain variables using graphs have been done using Microsoft Excel and also Microsoft Word. The disaggregation of import, debt service and GDP are implemented using INTER procedure in Microsoft Excel. The interpolation of inflation has been made by running Autoregressive order one (AR (1)) in Eviews as well as the disaggregation method of the INTER procedure which was conducted in Microsoft Excel. Moreover, converting the monthly data into quarterly data has been carried out using the techniques of Eviews. All the remaining work of the study such as the estimation of the variables, examining the tests of the series and the analyses have been conducted using Eviews version 7.1. Of course, the writing up of each chapter is conducted using Microsoft word.

Other resources used in the study are fund from the University of Waikato, office and desk space, stationery and other office supplies. Furthermore, access to the internet including Google, Google Scholar, Gmail, Yahoo and Facebook were very helpful when searching for information. These tools were also very effective in communication to deliver information from Eritrea. The University of Waikato Library and access to its facilities such as the database, library catalogue, interlibrary loan and the computers have also made great contributions throughout the study. The DataStream at the University of Waikato, Management School, and the database at the University of Ottawa, Canada were used to collect all the relevant data for the study.

The last but not least resource used in the study is the human resources. More specifically, the study has used supervisory advices and feed backs given during the writing of the thesis. Besides, this research has incorporated the comments provided on the writing of some of the chapters by the student learning team from the Faculty of Education, University of Waikato and the Language and Learning Development Unit team from the Waikato Management School, University of Waikato. Moreover, this study has extensively used the advices and lessons provided in the workshops and seminars organised by the Doctoral Writing Conversation (DWC) Program.

Chapter 4-Measuring Hard Currency Index

4.1. Introduction

Studies such as Girton and Roper (1981), Bahmani-Oskooee and Domac (2003) and Yeyati (2004) have argued that the extent of relying on hard currency or *dollarization* can have significant consequences for the economy with respect to the volatility of the exchange rate, inflation and the effectiveness of monetary policy. Measuring the degree to which any given economy relies on hard currency is crucial before identifying any potential impact that it might have. An important issue arises here as to whether dollarization should be measured in its partial form or in a more holistic way.

It has been noted that the type of the measurement employed in measuring the extent of dollarization will have an impact in the analysis of identifying the effects of dollarization in an economy. Accordingly, the results of the analysis might vary from one study to another study. It is, therefore, crucial to carefully examine and choose the right measurement of dollarization. The standard measure of dollarization, which is commonly used by IMF and others, is the ratio of foreign currency deposits to broad money in the economy (see, for example, Agenor & Khan, 1996; Yinusa, 2008; Clements & Schwartz, 1992; Viseth, 2001; Komarek & Martin, 2001; Akacay et al., 1997; Zoryan, 2005; Melvin & Peiers, 1996; Balino et al., 1999 among others).

This method, however, captures only one form of dollarization, namely *financial dollarization*. Such a measure neglects other forms of dollarization that can exist in the economy. Although this measure aims to capture financial dollarization, it only considers onshore dollar deposits and fails to incorporate

offshore dollar deposits as well as dollar loans issued by domestic banks either to domestic firms and households or to foreign financial institutions and firms. Likewise, the studies by Yeyati (2006), Rennhack and Nozaki (2006) and Nicolo et al., (2005) use the ratio of foreign currency deposits to total bank deposits rather than broad money. The study by Fuentes (2009) employs the ratio of firms' dollar denominated debt to firms' total assets in analysing the causes and effects of dollarization on Chilean firms at micro level. In identifying the determinants of dollarization, the study by Honig (2009) uses the sum of firm liabilities and bank liabilities to measure dollarization.

In contrast to these studies, Hausmann et al., (2001), as well as Hausmann and Panizza (2003) and Reinhart et al., (2003) respectively develop the original sin index (based on the extent of liabilities contracted in foreign currencies˙) and composite index (based on the sum total of the ratios of foreign currency deposits to broad money, total external debt to GDP and domestic government debt denominated in dollars to total domestic government debt). Similarly, by interacting the original sin index with the stock of aggregate foreign debt liabilities, Berkmen and Cavallo (2010) have measured the foreign currency component of the liabilities. Despite the differences in their methods of measuring dollarization, these studies have focused on limited aspects of the process. While the sin index is useful only in capturing the liability dollarization, the composite index puts emphasis on dollar loans issued to the government without including the dollar loans issued to the private sector. Moreover, this method neglects the offshore dollar deposits of the domestic investors. It also fails to include underground dollarization, the dollarization of the black market, which is most common in the economies of third world countries.

Bearing in mind the importance of including as many aspects of dollarization as possible, this study constructs the holistic approach in measuring Eritrean dollarization. In contrast to the studies mentioned above, this research does not confine its measurement to the dollar loans issued to the government. It also captures dollar loans issued to the private sector. In addition to this, the measurement also incorporates the dollarization of the black market. The remaining part of this chapter is organised as follows. The following Section provides the computation of the hard currency index. Section 4.3 discusses data collection and data management. The final section concludes.

4.2. Constructing a Hard Currency Index

To construct the hard currency index, it is vital to ask what form the hard currency takes in the economy. In other words, it is important to identify whether the hard currency only takes the store of value function so as to use the ratio of dollar deposits to broad money as in the case of Clements and Schwartz (1992), Viseth, (2001) and Agenor and Khan (1996) or to total deposits as in the case of Yeyati (2006), Alvarez-Plata and Garcia-Herrero (2008), Hauskrecht and Hai (2004) and Rennhack and Nozaki (2006) and others. It is equally essential to examine whether it takes the unit of account and means of payment function so as to include the amount of hard currency circulating in the economy in the construction of the hard currency index.

Hard currency has been used as a store of value in Eritrea. According to the Legal Notice 101/2005, any one is allowed to open a foreign currency deposit account. However, the account does not bear any interest. As a result, it discourages households and investors to put any hard currency obtained by different means into the bank. Hard currency, however, has not only been used as

a store of value in the Eritrean economy. It has also been used as a medium of exchange in settling international transactions. All goods imported from China, India, Sudan, Kenya, Uganda, Saudi Arabia, Dubai, Iran and also other developing countries have been settled in U.S. dollars. All other imported goods from European countries have been settled in Euros and British pounds. Likewise, all goods exported to these countries have been settled in U.S. dollars, Euros and British pounds respectively. To capture these functions of hard currency in the economy, it is crucial to categorise them in to different forms of dollarization as discussed in the previous chapter.

In the previous chapter, potential traces of financial, liability, real and underground dollarization in the Eritrean economy have been identified. Since the existence of real dollarization is in its infant stage, as reflected by the selling and buying of houses in U.S. dollars starting from 2006, this chapter incorporates the three types of dollarization. In doing so, it is necessary to measure the extent of underground dollarization that exists in the economy first. Let us first consider the foreign exchange reserves in the Eritrean economy used to finance the import of goods from abroad and service the external debt. Let

$$M_t^E = \alpha_t FR_t^T \qquad\qquad (4.1)$$

where M_t^E is import expenditure, FR_t^T is total foreign exchange reserves, and $0 \le \alpha_t \le 1$ is the proportion of total foreign exchange reserves used for financing the expenditure for imported goods. M_t^E is used to express import expenditure if there is no other source of financing import expenditure such as dollars from the black market. The remaining proportion of FR_t^T can be used to

service debt DS_t or carry foreign exchange reserves forward FR_t^R which can be represented as follows:

$$(FR_t^R + DS_t) = (1 - \alpha_t)FR_t^T \tag{4.2}$$

Adding equations (1) and (2) provides

$$M_t^E = FR_t^T - FR_t^R - DS_t \tag{4.3}$$

Equation (3) provides a number of scenarios

$$\text{If } FR_t^R = 0 \text{ and } DS_t > 0 \text{ then } M_t^E = FR_t^T - DS_t \tag{4.4}$$

$$\text{If } FR_t^R \text{ and } DS_t > 0 \text{ then } \quad M_t^E = FR_t^T - FR_t^R - DS_t \tag{4.5}$$

$$\text{If } FR_t^R \text{ and } DS_t = 0 \text{ then } M_t^E = FR_t^T \tag{4.6}$$

Of these three cases, (4.4) and (4.6) reflect the Eritrean economy more realistically than (4.5). With the exception of 1996, Eritrea has been servicing its debt each year since 1995. It can be noted, therefore, that DS is greater than zero except during 1996 which is equal to zero. Information on the foreign exchange reserves of Eritrea indicate that there are no remaining foreign exchange reserves carried forward to the next period. In other words, the information shows that there is shortage of hard currency earnings. Moreover, there is limited hard currency generating economic activities in the economy not to mention the existence of high demand for foreign currency to finance the import expenditure of goods.

It is vital to remember here how foreign exchange reserve is measured as one might wonder where the export earnings might come in. Export earnings are included in the measurement process of foreign exchange reserve. There is, therefore, no need of including export earnings in the equations. One might also

wonder where $FR^T{}_t$ comes from when $FR^R{}_t$ is zero. When $FR^R{}_t$ is zero, $FR^T{}_t$ comes from the export earnings which will then be used to finance import expenditure. The fundamental cause for this scenario is not only the shortage of foreign exchange reserves in the Eritrean economy, but also the higher demand for hard currency required to finance the import expenditure needed to sustain the economy.

The next step is to identify the amount of hard currency in the Eritrean black market which is also used to finance the import of goods. Unlike some countries where imports are formally registered and international payments are done through the banking sector, international payments are not necessarily conducted via the banking sector in the Eritrean economy. Banks hardly sell hard currency to importers due to high demand for hard currency and the foreign exchange reserve crisis. As a result, importers obtain the hard currency through their own means, usually via the black market. Therefore, it should be noted here that the actual imported goods are not only financed by the α_t share of the total foreign exchange reserve as determined above, but also by the hard currency supplied by the black market. The difference between the actual imports of goods M_t^A and the imports of goods financed by total foreign exchange reserves can be written as

$$B_t = M_t^A - M_t^E \qquad (4.7)$$

where B_t denotes the amount of hard currency obtained from the black market to finance import expenditure. Substituting equation (4.3) into (4.7) provides the following three scenarios.

$$B_t = M^A_t - (FR^T_t - DS_t), \text{ if } FR^R_t = 0 \text{ and } DS_t > 0 \tag{4.8}$$

$$B_t = M^A_t - (FR^T_t - FR^R_t - DS_t), \text{ if } FR^R_t \text{ and } DS_t > 0 \tag{4.9}$$

$$B_t = M^A_t - (FR^T_t), \text{ if } FR^R_t \text{ and } DS_t = 0 \tag{4.10}$$

As discussed above, case (4.8) and case (4.9) are the most appropriate cases in determining the amount of hard currency used to finance imported goods through the black market. It can now be easy to measure the overall Eritrean dollarization. Incorporating the three types of dollarization discussed above - financial dollarization represented by claims on foreign commercial banks, liability dollarization proxies by foreign borrowing and hard currency supplied by the black market - the hard currency index is given as follows:

$$HCI_t = \frac{DL_t + B_t + FB_t}{M2_t - DCC_t} \tag{4.11}$$

where HCI_t is the hard currency index, DL_t is dollar loans issued by the Eritrean banks, B_t is the amount of hard currency supplied by the black market, FB_t is foreign borrowing, $M2_t$ is the money supply and DCC_t is domestic currency in circulation. DCC_t is subtracted from $M2_t$ for the purpose of not under estimating the weight of hard currency in the financial system. It should be noted that this study is not only interested in incorporating the holdings of dollars in the black market but also in incorporating the overall forms of dollarization in the Eritrean economy. As such, the index includes the financial dollarization, underground dollarization which is measured by the holdings of the hard currency in the black market and the liability dollarization that exist in the economy. This is a good approach because the measurement has not only traced the amount of hard

currency supplied by the black market to finance the import expenditure but also it has addressed all types of dollarization that prevail in the Eritrean economy.

One might be interested in identifying how this index is related to the informal holdings of dollars for savings or doing transactions domestically. To address this type of interest, it is important to mention the purpose of holding the hard currency. The means of payment for domestic transactions, in the Eritrean economy, are required by regulation to be settled through the local currency. The hard currencies that flow into the hands of the individuals (households) through informal means have to be exchanged for local currency to be able to purchase the domestically traded products. The holding of the hard currencies is due to their strong purchasing power when they are exchanged for the local currency. It can, therefore, be seen that the primary motive for holding the hard currency by consumers is not for saving or doing transactions domestically.

4.3. Data Source and Management

Different secondary sources have been used to collect the data required for measuring the hard currency index. As in the studies of most developing countries, however, data limitation has been the greatest barrier in this study. What makes the accessibility of data difficult is the political sensitivity of the country to the release of information as a result of the United Nation Security Council's sanctions following the political accusations by East African neighbours concerning Eritrea. Nonetheless, the drawback has been partially alleviated by using different techniques and applying a system of data management.

Since the independent economic history of Eritrea is fairly new, quarterly time series data from 1996 to 2008 is used. Two different ways of gathering

quarterly time series data are employed for this analysis. In the first method, monthly and quarterly data are collected directly from different sources. In the second method, the annual data for some of the variables which are not available in either monthly or quarterly format are disaggregated. The two methods are presented below.

4.3.1. Direct Method

To measure hard currency index, quarterly data on foreign exchange reserves are obtained from the International Monetary Fund (IMF) Financial Statistics (FS). Since quarterly data on broad money required for the measurement is not available in a full range, M2 is considered in lieu of broad money. However, quarterly data on M2 is also not available in a full range for the study period. Nevertheless, this is solved by using the sum total of M1 and quasi money as a proxy for M2 needed for the measurement. Quarterly data of M1 and quasi money are collected from the FS of IMF. Domestic currency in circulation has been deducted from M2 in measuring the hard currency index in order not to understate the weight of dollar loans issued by the banks. Quarterly data on domestic currency in circulation is gathered from the FS of IMF.

To find out the dollar loans issued by the banks, quarterly data on total foreign assets, foreign exchange reserves and gold reserves are required as the data for dollar loans are not available in a full range. The sum total of foreign exchange reserves and gold reserves are then subtracted from total foreign assets to obtain the dollar loans required for measuring the hard currency index. Quarterly data on total foreign assets, gold reserves and foreign exchange reserves are obtained from Balance of Payment of Eritrea IMF file number 643 as well as from the FS of IMF.

Foreign borrowing needed for measuring hard currency index is obtained by adding the total multilateral loans, cross-border loans from BIS reporting banks and cross-border loans from BIS banks to non-banks. Quarterly data on these variables are obtained from the Joint External Hub. Some of the data required for determining the volume of hard currency supplied by the black market in the economy are available in annual format. For this reason, disaggregating the annually reported data using a disaggregating mechanism is employed in order to suit the remaining quarterly data. Detailed procedure of this mechanism is discussed in the methodology section of the thesis.

It is important to note here that all the data employed for the study, apart from foreign exchange reserves, gold reserves, import, foreign borrowing and debt services are reported in local currency units. Each data that has been reported in local currency unit is then converted in to the United States currency unit in order to match those which are reported in U.S. currency units. The official exchange rate was used to convert the data reported in local currency units. Average exchange rate of U.S. dollars to national currency unit is used for conversion. The data on official exchange rate is obtained from the FS of IMF and the Balance of Payment of Eritrea IMF file number 643. It should be noted also that the monthly data are transformed into quarterly data using Eviews.

4.3.2. Disaggregating Data

The data on import of goods and services as well as debt service are available in an annual frequency format. These data are collected from World Development Indicators of the World Bank. In order to fit the frequency required for the measurement of the volume of hard currency supplied by the black market, a system of disaggregating the annual data is used. Among the different

techniques of disaggregating, INTER procedure is used to disaggregate the annual data. As has been discussed in the methodology part of this thesis, the INTER procedure and the WS procedure perform well relative to others in the study, by Chan (1993), of the comparison of the different procedures against the actual data.

In using the INTER procedure, first the annual time series data are cumulated and then a cubic polynomial can be constructed to determine the values of the cubic polynomial that joins two sets of points. At last, the values of the difference between the two consecutive polynomial values are determined. By using all the disaggregated and non-disaggregated quarterly data on all the variables required for the measurement of the hard currency index, Figure 4.1 plots the *hard currency index (HCI)* series in the Eritrean economy.

Figure 4.1: The Hard Currency Index for Eritrea
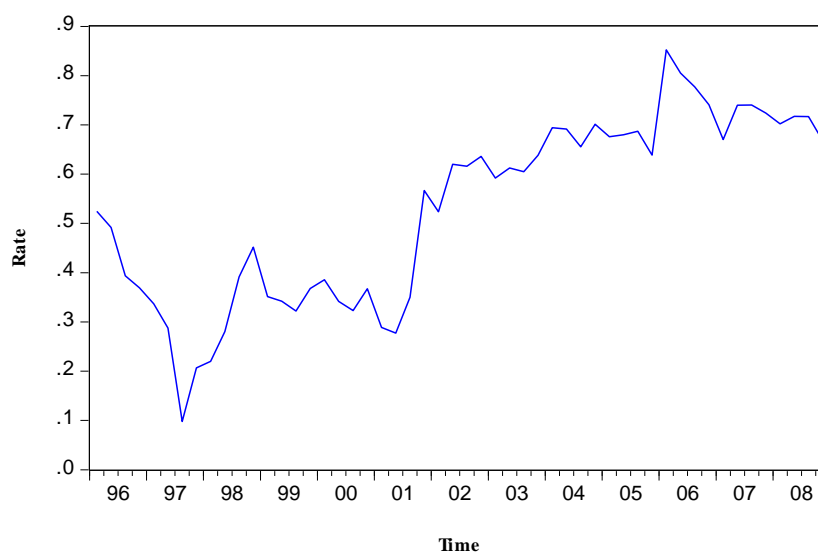
While there has been a general upward trend in the *HCI* over the study period, there was a sharp fall in 1997. This fall might be driven by the lower dollar loans issued by the banks. There are some factors that accompanied this. The fundamental factor that drives the sharp fall is mainly related with the

introduction of a new currency in the Eritrean economy towards the end of 1997. The new currency has less value relative to the former widely used currency, which is the Birr. The fall, thus, might have been caught in the conversion process of the hard currency needed to sustain the economy during that time. Furthermore, an increase in military expenditure driven by the purchase of weapons from abroad in connection with the second war with Ethiopia might have an impact.

The *HCI* has continued to rise especially from 2002 onwards. The persistent rise of the *HCI* comes from the rise in the underground dollarization and the liability dollarization expressed by foreign borrowing. The foundation of these factors is again based on the issuance of new currency and the second war with Ethiopia. Prior to these events, as mentioned in the previous chapters, goods were mainly imported from Ethiopia. As a result, transactions for these imports were settled in Birr, which was a former local currency unit for both countries. After the introduction of new currency and the second war, however, imports needed to be sourced from other countries as Eritrea lost access to the Ethiopian market. Unlike the transactions with the Ethiopian market, the transactions of imports from other countries are now required to be settled in hard currency.

In addition to this, the Eritrean economy lost an equivalent amount of 43.02 million U.S. dollars from export earnings to Ethiopia. Moreover, as has been seen in the previous chapters, the growth of Eritrean GDP declined from an average of 10.8 percent to an average of 0.2 percent between 1998 and 2007. The loss in export earnings coupled with the fall in GDP made the economy more reliant on foreign borrowing and imported goods. The rise in the demand for imported goods and the need to settle transactions in hard currency for imported goods, therefore, increased the reliance on hard currency as reflected in the *HCI*.

4.4. Conclusion

Measuring the degree to which an economy relies on hard currency or dollarization is vital before assessing its effect in the economy. In finding the extent of dollarization, it is also vital to identify and incorporate the different forms of dollarization that might exist in the economy. However, this has been a main shortcoming in the existing literature. The majority of the studies have focused on some limited aspect of dollarization in their studies. The most commonly used measurement of dollarization, which is the ratio of foreign currency deposit to the broad money, for example, tends to neglect other forms of dollarization by focusing on financial dollarization. It also fails to incorporate offshore dollar deposits by including only onshore dollar deposits even though it measures financial dollarization.

In sharp contrast to this, this study adopts a holistic approach to measuring the dollarization based on the incorporation of all major forms of dollarization that exist in the Eritrean economy. To this end, the index has included financial dollarization and liability dollarization. Most importantly, it has captured the extent of dollarization in the black market economy. The index demonstrates that dollarization has increased in the Eritrean economy mainly as a result of an increase in underground and liability dollarization.

The fundamental advantage of the index is that it overcomes the drawbacks related to other forms of measurements in the literature which underestimate the overall level of dollarization in a given economy. However, underestimation of the level of dollarization might reflect its effect on the ultimate outcome of the analysis of the impact of dollarization on macro- and micro-economic variables of the economy. This new approach has significant potential

with regard to the study of other less developed economies especially in identifying the amount of dollarization in the black market.

Chapter 5- Does Dollarization Alleviate or Aggravate Exchange Rate Volatility?

5.1. Introduction

The dollarization of developing countries has been an inspiring field of research for many scholars. Despite a number of studies that address the measurement and consequences of dollarization, much of this existing literature concentrates on the Latin American and Asian economies with very limited focus on African economies. The existing literature suggests that the impact of dollarization can depend on the form of dollarization that exists in a given economy. For example, Akofio-Sowah (2009), Savvides (1996), Schnabl, (2007) and Barrell et al., (2009) among others show that if dollarization is full, then dollarization minimizes the exchange rate volatility.

Similarly, Fielding and Shields (2003) argue that full monetary union leads to lower real exchange rate volatility than is the case under a fixed exchange rate system. However, if dollarization takes a partial form, then the evidence is less clear-cut. The theoretical work by Girton and Roper (1981), Akcay et al., (1997) and Corrado (2007) demonstrate that exchange rate instability increases with the increase of the degree of currency substitution. Empirical studies by Calvo and Carlos (1992, 1996), Yinusa (2008) and Akcay et al., (1997) suggest that an increase in dollarization increases the exchange rate volatility. In contrast to these studies, Devereux and Lane (2003) find that financial dollarization in the form of acquiring dollar loans alleviates exchange rate volatility.

This chapter contributes to the limited research on the African economies by specifically investigating the consequences of dollarization on Eritrean exchange rate volatility. In contrast to the existing literature, both the official and

black market exchange rate in nominal and real form have been used in the analysis. Quarterly time series data for Eritrea are employed for the study period 1996Q1-2008Q4. Estimation is based on extending the Exponential Generalised Autoregressive Conditionally Heteroscedasticity (EGARCH) model originally proposed by Nelson (1991). It has been found that dollarization has a positive impact on real exchange rate volatility of the official market and also on both nominal as well as real exchange rate volatility of the black market.

This chapter is organized as follows. In the following section, a brief review of the relevant literature is presented. Section 5.3 discusses the data and methodology. Section 5.4 offers a discussion of the econometric findings. The final section presents a summary and conclusion.

5.2. Literature Review

It was mentioned in Chapter 2 that many developing countries have either fully or partially dollarized their economies. The decisions by these countries to either fully or partially dollarize their economies have been due to either political reasons or economic considerations such as high inflation, currency instability and strong trade ties with a particular country that generates the demand for another currency. Whether dollarization takes a full or partial form, it has been argued that a significant effect is exerted on exchange rate volatility. This has been a major concern for decision makers because exchange rate volatility has many undesirable economic and financial effects which the policy makers of the dollarized economy might need to confront to. By using a gravity model, correlation analysis and cross country panel data, Kazunobu and Fukunari (2009), Kyung-Chun (2008), and Gunther (2009), for example, suggest that exchange rate

volatility discourages trade flows, increases equity market volatility, decreases growth and discourages investment.

As a result of the negative effects of exchange rate volatility mentioned above, a number of scholars have examined as to what causes exchange rate volatility. Some of these scholars such as Hviding et al., (2004), Benita and Lauterbach (2007), Canales-Kriljenko and Habermeier (2004) have identified interest rate, central bank intervention, regulation of the foreign exchange market and decentralization of the dealers' market as key factors affecting exchange rate volatility. These studies, however, have overlooked the role that dollarization plays in exchange rate volatility, though there are some other studies that have considered the impact of dollarization in the exchange rate determination.

As has been mentioned earlier, some studies have found that full dollarization reduces the exchange rate volatility of the dollarized economy. Among those that consider the impact of full dollarization, the studies by Akofio-Sowah (2009), Bogetic (2000) as well as Lange and Sauer (2005), for example, show a decline in the exchange rate volatility of Latin American countries. The studies by Schnabl (2007), Barrell et al., (2009), Bartram and Karolyi (2006), and Clark et al., (2004) also show a decline in exchange rate volatility in the Euro zone area. Similarly, Savvides (1996) shows that exchange rate volatility is lower in the Franc zone than non-Franc zone.

In contrast to this, a number of studies on the impact of partial dollarization find an increase in exchange rate volatility. Girton and Roper (1981) derived a currency substitution model using money demand functions to show the impact of currency substitution on exchange rate instability. Theoretically, they show that the greater the degree of currency substitution, the larger the movement

of the exchange rate. The theoretical study by Corrado (2007) also suggests that real dollarization in the presence of financial dollarization causes higher exchange rate movements. The approach for this theoretical study is based on a general equilibrium framework with nominal rigidities and imperfect competition in the non-traded goods sector. Similarly, Akcay et al., (1997) have developed a theoretical model to show the increase in the instability of exchange rate as a result of currency substitution. They have concluded that greater change in the exchange rate that equilibrates the change in the rate of exchange is required as the degree of currency substitution increases.

Besides their theoretical derivation of the positive impact of dollarization on the exchange rate volatility, using EGARCH modelling, Akcay et al., (1997) find that volatility increases with an increase in the degree of currency substitution. Likewise, Bahmani-Oskooee and Domac (2003) and Yinusa (2008) provide similar findings for the Turkish and Nigerian exchange rates respectively. In particular, Yinusa (2008) finds causality running from dollarization to exchange rate volatility in the Nigerian economy by employing a Vector Autoregressive model and running Granger causality tests. The studies by Calvo and Carlos (1992, 1996) also show positive correlation between exchange rate volatility and currency substitution. Moreover, the GARCH analysis in the study by Lay et al., (2012) indicates that dollarization caused the depreciation of the Cambodian currency and hence strengthened the exchange rate volatility in its economy.

However, the studies by Honig (2009), Berkmen and Cavallo (2010) and Berg and Bornsztein (2000) reveal a different outcome. Their message is that even if dollarization causes exchange rate volatility, it encourages policy makers to

engage in different techniques for exchange rate stabilization. According to Calvo and Reinhart (2002) terminology, the engagement of the policy makers to stabilize the exchange rate is due to the presence of the so called "fear of floating". The impact of partial dollarization on volatility is, therefore, mitigated as the authorities engage in automatic exchange rate stabilization.

If countries aim to stabilize their nominal exchange rate[16] or adopt a fixed exchange rate regime, as in the studies above, will it be possible to see less exchange rate volatility in their economies even in the presence of dollarization? Do the efforts to stabilize the exchange rate work while there is partial dollarization? The answer to these questions may rest on whether the economy is free of black market activity in the foreign exchange market and whether the domestic money supply is flexible enough to cope with any disturbances. Therefore, the findings of Berkmen and Cavallo (2010), Berg and Bornsztein (2000) and Honig (2009) may only be valid in countries where there is very little or no black market activities or no parallel markets. In countries where there is an active black market for foreign exchange, one might expect to observe exchange rate volatility even if the authorities have stabilized the official exchange rate.

The early work by Girton and Roper (1981) shows that exchange market intervention may not help stabilize exchange rate volatility under partial dollarization even if there is no black market system in the economy. Similarly, Corrado (2007) argues that real dollarization along with financial dollarization makes the achievement of less costly stabilization programs very difficult. The theoretical work by Cabral (2010) also shows that the cost of stabilization is

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[16] The nominal exchange rate is unadjusted for relative prices while real exchange rate is adjusted.

higher under dollarization than under a small economy with fear of floating. In a different approach, the results of the regression analysis in the study by Devereux and Lane (2003) suggest that external financial linkages with the creditor countries in the form of bank loans lowers bilateral exchange rate volatility in developing countries.

Despite the dissimilarity in the findings of these studies, it might be quite logical to assume that partial dollarization would aggravate exchange rate volatility, while full dollarization might alleviate exchange rate volatility. This assumption is based on the fact that the existence of partial dollarization indicates the existence of currency and/or asset substitution in the economy. If agents are swapping foreign and domestic currencies, the value of foreign exchange is likely to respond to fluctuations in currency demand. That is, there are ups and downs in the exchange rate depending on the demand for the currency. Higher demand pushes the currency's value up while lower demand pulls the value of the currency down. It is, therefore, unlikely to see a steady state of the exchange rate for lengthy periods of time if it is determined by the interaction of demand and supply and in particular if demand plays great role in the determination. The real outcome of this assumption, however, depends on an empirical analysis which may vary from one set of economic structures to another set of economic structures.

If an economy is fully dollarized, however, the foreign currency is adopted as legal tender. The volatility of the foreign currency itself becomes the volatility of the domestic currency. Many developing countries, however, fix their currencies against a hard currency which makes the volatility of the hard currency minimal. This could be one of the reasons for the stability of the exchange rate

volatility of the fully dollarized economies in Latin American countries. Most countries have pegged their currencies against the U.S. dollar and the use of the U.S. dollar by those countries that are fully dollarized provides the benefits related to its stability.

5.3. Data and Methodology

It has been mentioned in the brief historical overview of Eritrea that Eritrea was under the control of Ethiopia for long period of time and got its official independence in 1993. As an independent nation, therefore, Eritrea has a relatively short economic history. Although its official independence was in 1993, the organisation of the paper work and intuitional documentation process was not fully developed at that time. The records of most of the data required for the study were late. Moreover, some data were not able to be found after 2008. This restricts the study period from 1996Q1- 2008Q4.

In measuring the exchange rate, both official and black market data are used. Eritrea not only has an official market exchange rate system, but also had a parallel market. This was a legal market prior to 1997, but thereafter became a black market for foreign exchange due to the restrictions imposed by the Bank of Eritrea. The exchange rate of the black market is included in the analysis since the official exchange rate has been fixed starting from 2003 (apart from a hike in 2005). The rigidity of the official exchange rate can be seen from the returns on both forms of exchange rates against the U.S. currency, as plotted in Figure 5.1.

It can be seen from the figure that the information obtained from the official market exhibits stability of the fluctuation from 2003. This stability is as a result of pegged exchange rate in the economy. Although prior to 2003 the figure shows that there was a fluctuation in the official exchange rate, the steadiness of

the rate in the years after might reflect its impact in the analysis. It will, therefore, be intricate to trace the impact of dollarization on the exchange rate of the Eritrean economy if only nominal official exchange rate data is used. For this reason, it is vital to include data on the black market exchange rate to see the effect of dollarization on the overall exchange rate system of Eritrea.

Figure 5.1: Official versus Black Market Returns
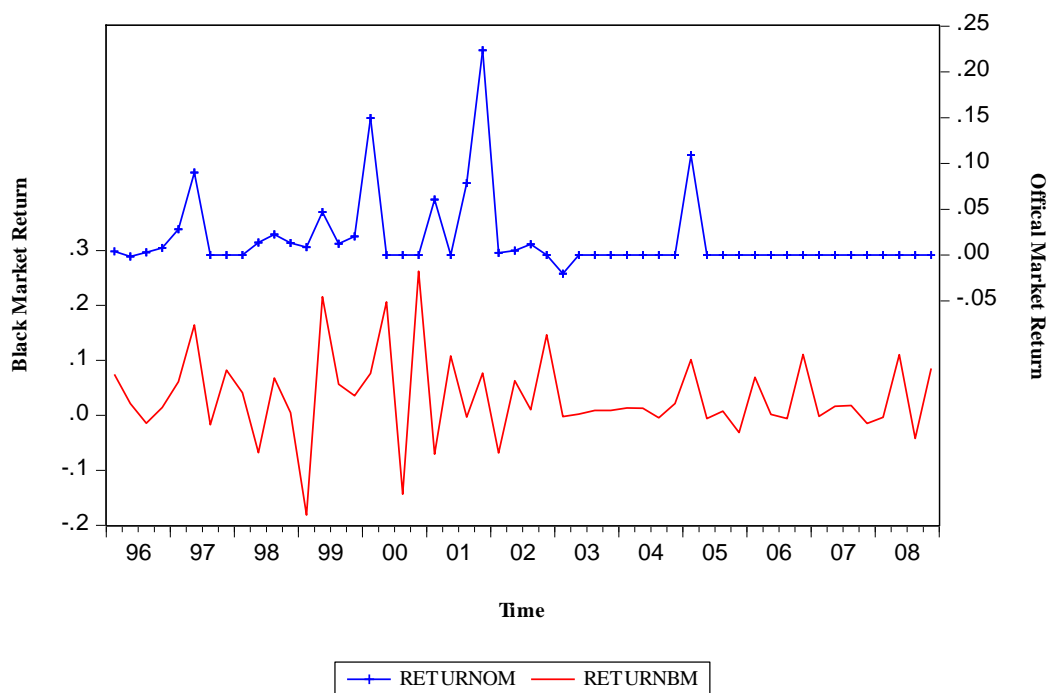
The data for the official nominal exchange rate (RETURNOM) are obtained from the Balance of Payments of Eritrea IMF file number 643. The data for the nominal black market exchange rate (RETURNBM), however, is obtained from the unpublished records of the participants in the Eritrean exchange market.

The magnitude of the volatility of an exchange rate depends on whether the exchange rate is taken in its real or nominal form. Some of the literature that conduct exclusive examination on the exchange rate volatility with the exemption of dollarization has used the real exchange rate in measuring exchange rate

volatility.[17] Clark et al., (2004) pointed out that the choice of using either the nominal or real exchange rate is not likely to affect significantly measured volatility or econometric results. However, by employing both real and nominal exchange rates in measuring exchange rate volatility alone, they have found that exchange rate is more volatile under real than nominal exchange rate. Moreover, Rogoff (1996) pointed out that real exchange rate is tremendously volatile in the short run. For this study, as mentioned earlier, both nominal exchange rate and real exchange rate are used to see if there is a difference.

For the purpose of computing real official and black market exchange rates, Eritrean and U.S. consumer price index data are obtained from the Financial Statistics of the IMF, while part of the Eritrean CPI data are also obtained from the World Economic Outlook on the IMF website. Since quarterly Eritrean CPI data from 2003 onwards are not available, values are interpolated using autoregressive and disaggregating methods. INTER procedure that has been discussed in the previous chapter is used in disaggregating the data. The hard currency index that has been computed in the previous chapter has been used in the analysis. Detailed discussion on the data collection procedure of measuring the hard currency index to represent the dollarization variable can be found in the previous chapter.

The most commonly used measurement of exchange rate volatilities are the Autoregressive Conditionally Heteroscedastic method (ARCH family) and a standard deviation method.[18] The ARCH family method provides conditional

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[17] See Amadou (2007), Clark et al., (2004), Bauwens et al., (2005), Yinusa (2008) and Akcay et al., (1997).
[18] See Akcay et al., (1997), Brodsky (1984), Dell Ariccia (1999) and Kenen and Rodrick (1986).

volatility while the standard deviation method measures unconditional volatility.[19]

The early work by Rana (1981) on exchange rate volatility in eight Asian countries shows that measuring volatility using the unconditional standard deviation is both inconsistent and misleading if the underlying distribution of exchange rate returns is non-normal. In this study, ARCH family method has been selected over standard deviation method as the distributions of the exchange rate of both official and black markets are found to be leptokurtic, a distribution with positive excess kurtosis.

Three different models of ARCH family have been employed to see the behaviour of exchange rate volatility. These models are Generalized Autoregressive Conditionally Heteroscedastic (GARCH (1, 1)), GARCH-in-mean (1, 1) and Exponential Autoregressive Conditionally Heteroscedastic in mean (EGARCH-M (1, 1)). In the first case, GARCH model is chosen over ARCH model as it is widely used in measuring exchange rate volatility in many studies. Moreover GARCH (1, 1) captures volatility much better than ARCH models as the former is less likely to breach non negativity constraints according to Brooks (2002) explanation. GARCH (1, 1) can be specified as follows:

$$\ln\left(\frac{e_t}{e_{t-1}}\right) = \phi + u_t$$

$$\sigma_t^2 = \omega + \alpha u_{t-1}^2 + \beta \sigma_{t-1}^2 \tag{5.1}$$

where e_t and e_{t-1} are the nominal exchange rate at time t and time t-1 respectively. u_t is the random error term and it is $\sim N\,(0, \sigma_t^2)$. u_{t-1}^2 is the squared residuals at

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[19] See Akcay et al., (1997), Brodsky (1984), Dell Ariccia (1999) and Kenen and Rodrick (1986).

time t-1. ϕ and ω are constant coefficients. σ_t^2 is the conditional variance of the disturbances at time t. σ_{t-1}^2 is the conditional variance term at time t-1. α and β are ARCH and GARCH parameters respectively. In the second case, GARCH-M (1, 1) has been employed to see the behaviour of exchange rate volatility since GARCH (1, 1) captures only the symmetric impact of positive and negative shocks of the error term on the volatility of exchange rate. GARCH-M (1, 1) will enable to capture the asymmetric effect of positive and negative shocks of the error term on the exchange rate volatility. GARCH-M (1, 1) can be specified as follows:

$$\ln\left(\frac{e_t}{e_{t-1}}\right) = \phi + \delta\sigma_t^2 + u_t$$

$$\sigma_t^2 = \omega + \alpha u_{t-1}^2 + \beta\sigma_{t-1}^2 \tag{5.2}$$

where the definition of the variables and parameters are the same as GARCH (1, 1) except now the variance with its parameter δ is included in the mean equation of the exchange rate. Having considered the data on the black market rate of exchange to be included in the analysis, the result of GARCH (1, 1) and GARCH-M (1, 1) is demonstrated in Figure 5.2. Both models show a similar pattern apart from a few rises and falls of the exchange rate volatility measured using GARCH (1, 1) from GARCH-M (1, 1).

The exchange rate volatility measured using GARCH (1, 1) has slightly higher value than the exchange rate volatility measured using GARCH-M (1, 1) in some periods of the study, as can be seen by the solid line that represents the GARCH (1, 1). Towards the end of the study period, however, the exchange rate volatility measured using GARCH (1, 1) has slightly lower value than the exchange rate volatility measured using GARCH-M (1, 1).

Figure 5.2: GARCH (1, 1) versus GARCH-M (1, 1)
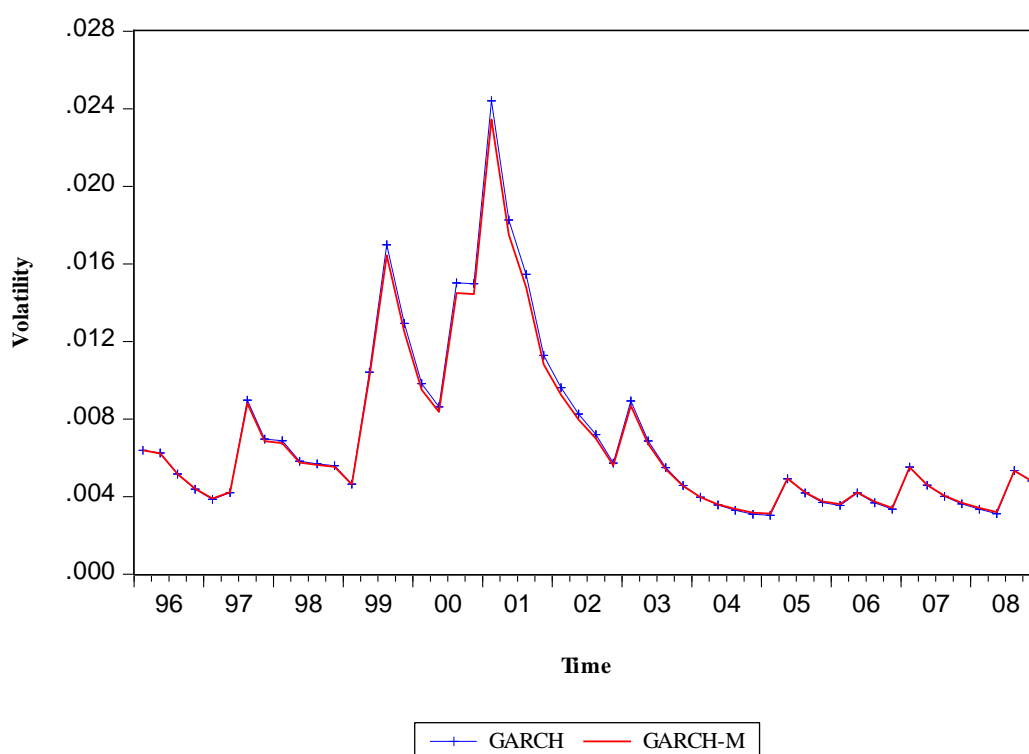
From the conditional variance of Figure 5.2, it can be seen that the volatility of the exchange rate in the black market is high during 1997 to 2001 time period but it becomes fairly less after those periods. The dip and the hike during those periods could be due to the economic and financial instability that resulted from the introduction of the new currency which was followed by the second war with Ethiopia as has also been mentioned in the previous chapters.

Another reason could be due to the large flow of hard currency and lagged effect of high demand for the hard currency. Although more hard currency was getting into the economy during those periods as a result of more remittances from Eritreans residing aboard to help the country as well as their families in Eritrea, more hard currency was required to keep the socio-economic and political system running. While the remittance of more hard currency might have made its

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value less expensive on one hand, the requirement to run the socio-economic and political system of the economy might have strengthened its value on the other hand.

In addition to this, the official exchange rate was flexible during those periods, which is likely to be a contributing factor for the fluctuations in the black market that competes with the official market. The official exchange rate, however, became almost rigid almost from 2003. The rigidity of the rate shows that the official exchange rate became less competitive against the black market rate which led to fairly less volatility of the exchange rate in the black market. It should be noted, however, that the black market rate is also influenced by the international market. Whatever happens in the international market, therefore, reflects in the exchange rate of the black market.

To see what the official nominal exchange rate volatility looks like and how it differs from the nominal exchange rate volatility of the black market, the same ARCH family models are applied. Figure 5.3 presents GARCH (1, 1) and GARCH-M (1, 1) of the official nominal exchange rate volatility. As can be seen from the figure, relative to the exchange rate volatility of the black market, the exchange rate volatility in the official market is fairly stable apart from a few ups and downs. The graph demonstrates that these ups and downs are high during 1999 to 2003 period. Both GARCH (1, 1) and GARCH-M (1, 1) have similar results except from few departs. The official exchange rate volatility measured using GARCH (1, 1), however, is on average higher than the official exchange rate volatility measured using GARCH-M (1, 1).

Figure 5.3: Official Exchange Rate Volatility
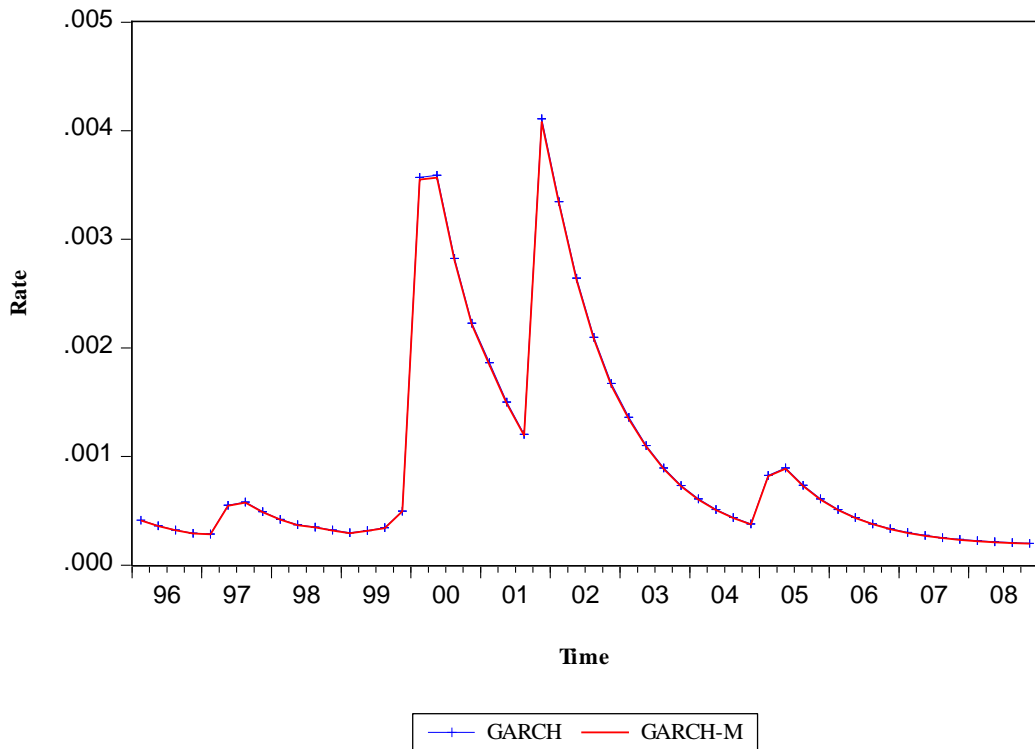
In the third case, volatility has been measured using an EGARCH-in-mean (EGARCH-M (1, 1)) model. This model has key benefits over the standard GARCH (1, 1) model in that log σ_t^2 is used in the specification of the variance equation instead of σ_t^2 which ensures that σ_t^2 is positive. At the same time, the EGARCH-M (1, 1) model can also capture asymmetric effects of positive and negative shocks on exchange rate volatility.

To capture the effect of dollarization on the exchange rate volatility, similar approach advocated by Akcay et al., (1997) has been adopted by augmenting an EGARCH-M (1, 1) model through the inclusion of a dollarization variable in the conditional variance equation. According to Akcay et.al., (1997), the model is specified as follows:

$$x_t = \alpha_0 + \alpha_1 x_{t-1} + \alpha_2 x_{t-2} + \alpha_3 x_{t-3} + \dots + \alpha_p x_{1-p} + \delta \ln h_t + u_t$$

$$u_t = \sqrt{h_t} \times v_t$$

$$\ln h_t = \gamma + \psi z_t + \sum_{i=1}^{r} \beta_i \ln h_{t-i} + \sum_{j=1}^{m} \theta_j \left\{ |v_{t-j}| - E|v_{t-j}| + \aleph\, v_{i-j} \right\}$$

(5.3)

where x_t is exchange rate deprecation and z_t is a proxy of dollarization. u_t is the random error term and v_t is independent, identical distribution (i.i.d.) with zero mean and unit variance. $\alpha_0 .....\alpha_p, \delta, \gamma, \psi, \beta_i, \theta_j, E, \aleph$ are the parameters. $\ln h_t$ is the logarithm of conditional variance at time t. $\ln h_{t-1}$ is the logarithm of conditional variance at time t-1. $|v_{t-j}|$ stands for the absolute value of the residuals of the previous period. A modification on the above model has been made to suit this study. Instead of using exchange rate depreciation as in the model above, the return on exchange rate has been used.

Slight modification on this model was made by changing the independent variable of the mean equation and also changing the variance equation. Specifically, the return on the exchange rate of the previous years was excluded from the mean equation and log of the conditional variance alone has been included. In the variance equation the presentation of the error term has also been changed. The modifications of the equations are shown below.

$$\varepsilon_t = \alpha + \phi \ln \sigma_t^2 + u_t$$

$$\ln \sigma_t^2 = \omega + \delta h_t + \varphi \frac{|u_{t-1}|}{\sqrt{\sigma_{t-1}^2}} + \gamma \frac{u_{t-1}}{\sqrt{\sigma_{t-1}^2}} + \Psi \ln \sigma_{t-1}^2$$

(5.4)

where ε_t is the return on exchange rate (*e*) calculated as $\ln \dfrac{e_t}{e_{t-1}}$ or $\ln e_t - \ln e_{t-1}$. $\ln \sigma_t^2$ is the natural logarithm of the conditional variance,

u_t is a random error term, h_t is a variable for the hard currency index used as a measurement of dollarization. The structure of the error term is assumed to have a generalized error distribution; $\alpha, \phi, \omega, \delta, \varphi, \gamma, \Psi$ are the parameters to be estimated where α captures the conditional mean. γ captures the asymmetric effects of the positive and negative shocks on exchange rate volatility. If γ is statistically significant and negative, it indicates that a positive shock will have different effect as the negative shock of the same level in the exchange rate volatility. If it is statistically insignificant, however, a positive shock will have the same effect as a negative shock in the exchange rate volatility.

The parameter φ determines the size effect of the shock on volatility. The impact of the lagged conditional variance is captured by Ψ. δ determines the effect of dollarization on exchange rate volatility. If the parameter δ is positive and statistically significant, the finding shows that an increase in dollarization increases the exchange rate volatility in the economy. If it is negative and statistically significant, however, an increase in dollarization decreases the exchange rate volatility in the economy. On the other hand, if it is negative or positive yet statistically insignificant, then it indicates that dollarization has no effect on the exchange rate volatility in the economy. The effect of the conditional variance on exchange rate returns is determined by ϕ.

5.4. Results

Table 5.1 reports that the mean returns and standard deviation of the real returns on official exchange rate (rrom) is small relative to the returns on black market rates (rbm) and real returns on black market rates (rrbm). The skewness and kurtosis along with the normality tests based on Jarque-Bera statistics point

towards non-normality for all series. ADF testing suggests that non-stationarity can be rejected at 10 percent level of significance or better throughout.

Table 5.1: Statistical and Stationarity Results of the Returns

Series	Mean	Std. Dev.	Skewness	Kurtosis	Normality	ADF Statistic
rbm	0.0328	0.0799	0.3751	4.366	5.2637	-3.9996
rrom	0.0045	0.07331	3.4906	18.090	599.01	-6.8370
rrbm	0.0202	0.1012	1.5526	8.875	95.690	-2.6231

Note: RBM stands for returns on the black market exchange rate. RROM is real returns on the official exchange rate. RRBM is the real returns on the black market exchange rate.

Table 5.2 reports the findings from Augmented Dickey-Fuller (ADF), Phillips-Perron (PP) unit root tests and Kwiatkowski, Phillips, Schmidt and Shin (KPSS) stationarity tests. It can be seen from the results of ADF tests that there is a unit root in the hard currency index series. At one, five and ten percent levels of significance, the t-ratio of the equation with intercept lies on the acceptance region under both lag selection criteria.

When intercept and trend are included, however, the series shows that the t-ratio falls in the acceptance region only at one and five percent levels of significance. This result is the same under both lag selection criteria. As can be seen from the table, the p-values are high when only intercept is taken but not when both intercept and trend are included. Nevertheless, the p-value under both specifications indicates that there is a unit root, which is the presence of non stationarity in the series.

The results of the unit root test using PP also show the presence of unit root. The t-ratio under the specification of the equation with intercept falls in the acceptance region of the critical value at one, five and ten percent levels of

significance. It can be seen that the p-value of the test is also high which also shows the acceptance of the null hypothesis that there is a unit root.

Like the results of the ADF test, the results of the PP test shows similar outcome when both intercept and trend are included in the specification. That is, the t-ratio falls in the acceptance region of the critical value only at one and five percent of level of significance. Under the KPSS test, the null hypothesis that there is stationarity in the hard currency index series is rejected when only intercept is included in the specification of the equation. Overall, these tests indicate that there is non-stationarity in the hard currency index series without trend. The series, however, is trend stationary at 10 percent level of significance. After testing the first difference of the series, however, all the values of t-ratios and p-values under both specification and all tests indicate that the first differenced of the hard currency index series is stationary.

Table 5.2: Unit root and Stationary Tests on the Hard Currency Index

Tests	Levels		First Differences	
	Without trend	With trend	Without trend	With trend
ADF (AIC)	-1.206 (0.665)	-3.300* (0.078)	-7.487*** (0.000)	-7.427*** (0.000)
PP	-1.206 (0.665)	-3.300* (0.078)	-7.488*** (0.000)	-7.428*** (0.000)
KPSS	0.803***	0.114	0.127	0.110

Note: The values in parenthesis are the p-values. The results from ADF testing are the same irrespective of SIC or AIC lag length criteria.
* Significant at 10 percent. *** Significant at all levels.

Before the inclusion of the hard currency index into the EGARCH-M (1, 1) equation, testing for serial correlation in the first difference of the series is carried out by applying correlogram. The results are reported in Table 5.3. It is

clear from the results that the Q statistics are insignificant at all lags which indicate that there is no serial correlation in the series.

Table 5.3: Autocorrelation, Partial Autocorrelation and the Q statistic

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	-0.079	-0.079	0.3401	0.560
		2	0.035	0.028	0.4061	0.816
		3	-0.063	-0.059	0.6329	0.889
		4	-0.026	-0.037	0.6730	0.955
		5	-0.112	-0.114	1.4061	0.924
		6	-0.013	-0.034	1.4159	0.965
		7	-0.041	-0.045	1.5201	0.982
		8	0.105	0.086	2.2137	0.974
		9	-0.025	-0.019	2.2546	0.987
		10	-0.009	-0.037	2.2598	0.994
		11	-0.161	-0.168	4.0188	0.969
		12	0.099	0.072	4.6914	0.967
		13	0.008	0.045	4.6958	0.981
		14	0.092	0.079	5.3112	0.981
		15	0.166	0.186	7.3816	0.946
		16	0.032	0.023	7.4629	0.963
		17	-0.050	-0.037	7.6647	0.973
		18	0.044	0.068	7.8261	0.981
		19	-0.174	-0.102	10.395	0.943
		20	-0.141	-0.162	12.130	0.912
		21	-0.152	-0.184	14.202	0.861
		22	0.089	0.021	14.942	0.865
		23	-0.062	-0.074	15.312	0.883
		24	0.035	-0.028	15.433	0.907

The first difference of the hard currency series is used in the variance equation instead of the hard currency series in levels in the analysis. The results of the estimated EGARCH-M (1, 1) model are reported in Table 5.4 below. As discussed previously, the hard currency index is incorporated into the conditional variance equation in order to explain its impact on the official and black market real and nominal exchange rates. The results show that there is volatility persistence in both the nominal and real black market exchange rates. The variance equation estimates point to the possibility that the real official exchange rate is non-stationary in variance. This may be a result of the official nominal exchange rate being prone to intervention and distortion during the study period.

The results on the estimates for the mean equations indicate that the conditional variance has a positive and significant effect on the exchange rate returns variable regardless of what form of exchange rate is used with an estimate for ϕ of 0.074 for the black market nominal exchange rate. The corresponding estimates using real exchange rate data are 5.365 and 0.318. These results indicate that the more volatile the exchange rate, the weaker the value of the currency. This finding is consistent with the finding in the study by Akcay et al., (1997).

Table 5.4: EGARCH –M (1, 1) Estimation

Parameters	Nominal Exchange Rate	Real Exchange Rate	
	Black Market	Official Market	Black Market
α	0.412 (10.304)	-0.001 (-104.26)	1.498 (2.773)
ϕ	0.074 (7.371)	5.365 (12.410)	0.318 (3.870)
ω	-7.058 (-24.500)	-4.075 (-190.28)	-6.455 (-10.28)
δ	2.141 (6.021)	5.484 (5.541)	0.628 (3.134)
φ	0.478 (5.768)	-3.206 (-91.964)	0.183 (2.054)
γ	-0.440 (-5.944)	-1.047 (-5.067)	-0.216 (-2.047)
Ψ	-0.282 (-8.664)	-0.038 (-14.305)	-0.355 (-157.2)

Note: the values in the parenthesis are the t-ratios.

In the case of the variance equation, the estimates for δ are both positive and statistically significant in all cases. This result suggests that an increased reliance on hard currency leads to increased volatility in the black market foreign exchange market. The same conclusion can also be drawn with respect to the real official exchange rate. This finding is in line with the empirical findings of the majority of the literature on the impact of partial dollarization on exchange rate volatility that have been reviewed so far. A question might arise here as to why

and how increased reliance on hard currency leads to larger volatility in the black market rates. The answer to why an increase in relying on hard currency increases exchange rate volatility is simply because the economy is partially dollarized.

The mechanisms on how increased reliance on hard currency increases volatility is as follows: as long as the economy is partially dollarized, both factors that affect the domestic and foreign currency will affect the exchange rate. From the foreign currency point of view, the supply of remittances from Diasporas, whose incomes are influenced by the economic conditions of the country where they live, affects the supply of foreign currency. Furthermore, competitions among the dealers can affect the supply of foreign currency in the black market. On the demand side, the volume of foreign exchange reserves, the growth of domestic economy, the progress of the export sector and the participation of the government in the import sector. Better domestic economic performance in the form of growing tomatoes, onions, chilly, sorghum, bananas and others which used to be imported from abroad will make less demand for foreign currency as they are now domestically produced.

If the government is engaged in importing from overseas and makes the supply of products available in the domestic market, then private importers might find it difficult to be competitive in the domestic market. If, for example, the government imports sugar and dominates the sugar market, then importers will have a smaller share of the market and will of course demand less hard currency needed to import sugar. If the government is getting the foreign currency needed to import sugar from the black market still the demand for hard currency will be high but if the government is getting the hard currency from its export earning then the demand for hard currency will be less in the black market for foreign

exchange. Either way, it is likely to see fluctuation of the black market exchange rate driven by the reliance of the economy on hard currency that triggers a number of factors discussed so far.

Other characteristics of the variance equations to note concern the estimates φ and γ which respectively capture the size and sign effect of the shocks on conditional variance. These estimates are significant throughout. The negative sign on γ captures an asymmetric effect whereby negative news has a larger impact on the exchange rate volatility than an equal and opposite positive shock. Negative news such as the disagreement on border demarcation that creates political tension between Ethiopia and Eritrea, political instability with Yemen, Djibouti and Sudan and the domestic minor political movements which cause the now and then unrest is likely to have larger impact on the volatility mainly due to its greater psychological impact on the participants of the foreign exchange market.

The results here suggest a need for policy intervention. There is evidence that the domestic currency gets weaker with an increase in exchange rate volatility. This can be expected to erode confidence in the domestic currency and create more demand for alternative stronger currency. As a result, this enhances the dollarization process and promotes more dollarization in the economy. This increased partial dollarization in turn sustains the aggravation of exchange rate volatility. In order to control this spiral involving increased volatility, the monetary authorities need to implement policy measures that restore the credibility of the domestic currency. This can require the building of sound

economic and financial systems that promote growth and foster the confidence of investors as well as consumers.

Moreover, enhancing good relationships with the neighbouring countries, as well as negotiating and discussing on the value of the currency in terms of the neighbouring countries' currencies would benefit the economy. While diplomatic relationships would strengthen and ease the flow of trade from the neighbouring countries, negotiating on setting favourable price of the trading currencies would minimize the fluctuations. The residual diagnostics tests, an ARCH effect tests, on the results of nominal black market exchange rate return, real official and black market exchange rate returns are examined. Table 5.5 reports the results.

Table 5.5: ARCH Effect Tests after the Estimation of EGARCH-M (1,1)

The Returns	F-statistic	Obs*R-squared
Nominal Black Market	0.060	0.626
	(0.807)	(0.803)
Real Official Market	0.007	0.008
	(0.931)	(0.930)
Real Black Market	0.060	0.063
	(0.807)	(0.803)

Note: the results in parenthesis are the p-value.

The results in Table 5.5 indicate that there are no ARCH effects left in the residuals using both data from official and black markets. The F-statistic and Obs*R-squared of all the ARCH family under both markets are insignificant. Since the F-statistic and TR2 show insignificance of the parameter that captures the autocorrelation of the error term, the null hypothesis that there is ARCH effect can now be rejected.

5.5. Conclusion

This chapter explores the impact of relying on hard currency, or dollarizing an economy, on exchange rate volatility. Specifically, this study investigates whether partial dollarization alleviates or aggravates exchange rate volatility by conducting an investigation based on GARCH modelling. This study varies from the existing literature on dollarization and exchange rate volatility by adopting a new method of measuring dollarization developed in the previous chapter. In measuring the exchange rate volatility, different ARCH family models over the commonly used method of standard deviation have been used due to unique distributions of the exchange rates of both official and black markets. In particular, EGARCH-M $(1, 1)$ has been employed by including the dollarization variable in the variance equation.

The results of the existing literature have shown that dollarization may alleviate or aggravate exchange rate volatility depending on its form in the economy. In line with those studies that demonstrate that partial dollarization aggravates exchange rate volatility, the results of this chapter show that partial dollarization in Eritrea has both a positive and significant impact on the real official and black market exchange rate volatility.

A number of avenues for future research arise from this study. First, the alternative method employed in measuring dollarization offers potential for future investigations of dollarization in other countries with particular focus on the black market. Second, if the monetary authorities are keen to control exchange rate volatility then addressing the causes and drivers of dollarization is needed. In this respect, appropriate policy design may involve the creation of strong and credible

institutions that can underpin confidence in the domestic currency. Besides, improving political and economic relationship with different trading countries, in particular with the neighbouring countries, is crucial. It might also pay to address the limitation of the legal foreign exchange bureaus which are engaged in providing foreign exchange services. Issuing licences to financially capable foreign exchange agents might minimize the need to feed import expenditure via the black market activity.

Chapter 6-Does Dollarization Reduce or Produce Inflation?

6.1. Introduction

Dollarization has been the most common economic style of many developing and emerging economies. The remarkable phenomenon of this exchange rate regime in these economies is not only its increment over certain periods of time, but also its irreversibility. This becomes a concern for policy makers and has inspired many economists to investigate as to what causes dollarization, why it is irreversible and how it affects the economy.

What causes dollarization has been broadly discussed in Chapter 2. In that chapter, it has been seen that some of the causative factors are: the inability to borrow in one's own currency, the existence of high inflation, exchange rate volatility, monetary policy instability and openness. On the effects of dollarization, the studies are grouped into macro and micro levels. At macro level, some of the studies have examined the effects of dollarization on inflation, interest rate, growth of output volatility, exchange rate volatility, and the effectiveness of monetary policy. It has been seen from Chapter 5 that dollarization may alleviate or aggravate exchange rate volatility. Although the various effects of dollarization on monetary and real variables vary depending on the form of dollarization in the economy, the conventional view is that it makes monetary policy and exchange rate policy less effective.

At micro level, different scholars have studied the impact of dollarization on financial and non-financial firms. The literature on non-financial firms has found two contrasting results of dollarization. In his preliminary study on the emerging market crisis, Krugman (1999) discusses the negative balance sheet

effect of exchange rate depreciation on firms with dollar debt. Galindo et al., (2003), Aguiar (2005), Fuentes (2009) and Echeverry et al., (2003) have also found similar results in their case studies of Latin American, Mexican, Chilean and Columbian firms respectively. Unlike these studies, Bleakley and Cowan (2002) and Luengnaruemitchai (2003) found positive impact of devaluation on investment level of firms with high foreign debt in Latin America and East Asian firms.

The literature on the impact of dollarization on financial firms commonly points out the vulnerability of the banking industry to external shock and also to the financial fragility. The studies by Burnside et al., (2001) that find currency mismatch led crisis and by Aghion et al., (2000, 2001) that find devaluation driven currency crisis of firms with dollar debts are among others. Using firm level data and examining the financial performance of the financial sector in Indonesia, Korea, Malaysia, Taiwan and Thailand, Chue and Cook (2004) find evidence of high probability of poor financial performance and bank closure. De Nicolo et al., (2003) and Domaç and Martinez Peria (2003) have also found higher risk of financial fragility and banking crisis in dollarized economies. Similarly, the regression analysis by Court et al., (2010) shows the negative impact of dollarization on financial deepening

Analyzing the overall impact of dollarization on macro- and micro-variables of the economy, be it in its full or partial form, is beyond the scope of this chapter. However, this chapter addresses the effect of dollarization with respect to inflation. In particular, this study deals with the impact of partial dollarization on inflation of the Eritrean economy. Inflation in Eritrea has been a major policy concern due to its consistent growth. The annual average inflation

rate jumped from 4.46 percent of the 1980s to 8.83 percent in the 1990s. Inflation carried on growing in the 2000s reaching its peak of 25.11 percent in 2004. Has dollarization somehow been a contributor to the growth of inflation in the Eritrean economy? To address this question, first modeling inflation under partial dollarization of the Eritrean economy is conducted by using money demand and money supply models. Second, Vector Error Correction modelling together with the Dynamic Ordinary Least Squares (DOLS) is applied to the inflation model developed under partial dollarization of the Eritrean economy. It is important to note here that although a few studies have explored the dynamics of inflation in Eritrea, they have not investigated the impact of dollarization on inflation. It is, therefore, expected that this study will cover the gap by conducting a thorough investigation on inflation and dollarization.

The empirical results of this study indicate that inflation in the Eritrean economy increases with the increase of dollarization both in the long and short run. This positive effect of dollarization on inflation is consistent regardless of the inclusion of either official or black market exchange rates in the model. The results of the error correction term show that about 7.2 percent and 7.6 percent of the disequilibrium is corrected in the first period when official and black market exchange rates are used respectively to represent the exchange rate variable in the model. Both error correction terms are negative and statistically significant. This implies that there is an adjustment back to the long-run relationship in successive periods to remove the discrepancy in the short run. The negative error correction term shows that the adjustment process is stable and convergent towards the long-run equilibrium.

The remaining part of this chapter is organized as follows: the next section discusses the studies of inflation according to different views of various scholars. This is then followed by the discussion of inflation in Eritrea. In Section 6.4, the construction of inflation model under partial dollarization is made. Section 6.5 discusses data sources and management followed by the unit root test of the variables of the model, determination of the integration order and the cointegration test in Section 6.6. Section 6.7 presents the estimated results of the cointegrated equations. The last section discusses the conclusion of the study.

6.2. The Studies of Inflation

Throughout the history of human kind, inflation prevails in different economies of the world at different periods of their existence. Although inflation is a global phenomenon, its magnitude varies from one country to another country. It also varies from one group of economies to another group of economies as demonstrated in Figure 6.1 below.

Figure 6.1: Inflation across the Globe
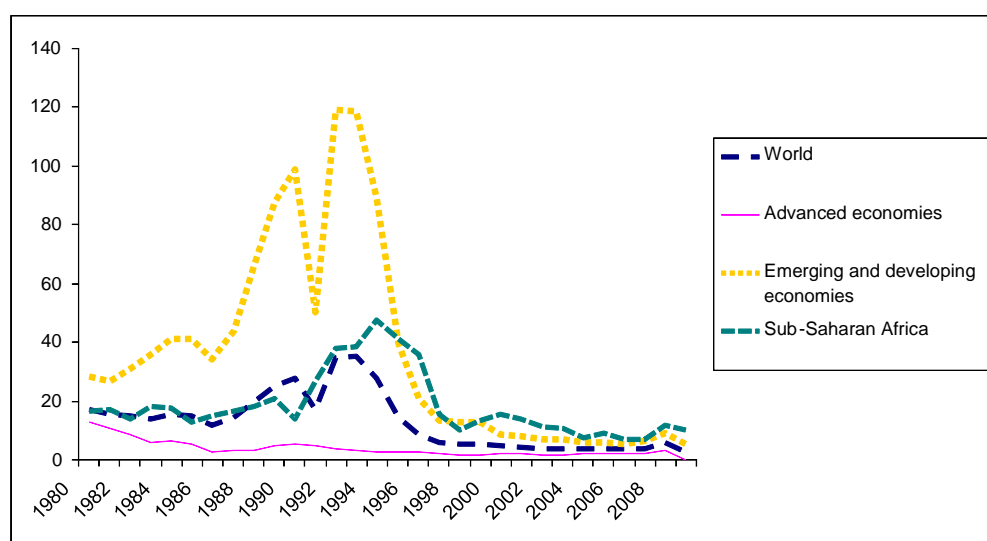
Source: International Monetary Fund, World Economic Outlook Database, October 2010.

As can be seen from the figure above, throughout the 1980s, 1990s and almost 2000s inflation across advanced economies is lower than inflation across emerging and developing economies. Inflation in the Sub-Saharan African countries in the 1980s through to the mid-1990s was lower relative to the inflation of the emerging and developing countries. However, it became greater than the inflation in the emerging and developing economies particularly from the early 2000s. It then continued to be above the inflation rate of all other economies throughout the 2000s. While both advanced as well as the emerging and developing countries are maintaining single digit inflation especially from the early 2000s, Sub-Saharan African countries are still struggling with double digit inflation rates.

Whether it is a single or a double digit, it should be noted that inflation uniformly affects these economies, though the extent may vary. Due to its manifold effects both at micro and macro levels, inflation has always been a great economic concern in decision making. For this reason, different economists have devoted considerable amount of efforts to identify what causes inflation in the first place and how its effects in any given economy can be minimized. In doing so, different theories of inflation have emerged from different schools of economic thoughts. The next section, therefore, discusses various views of these thoughts.

6.2.1. The Classical and Neo-Classical View

The dominant view of inflation that governed the economic framework of the 18th and 19th century was the theory of inflation developed by the classical economists. This theory was based on the quantity theory of money (QTM) which firstly was advocated by Irving Fisher in 1911 (Cittadino et. al., 2007). According

to the quantity theory of money, the level of price is directly proportional to the supply of money and velocity of money but indirectly proportional to the real output. Similar to the classical theory of inflation but slightly different view was developed by neoclassical economists of the Cambridge school towards the end of 19th century and the beginning of 20th century (Dwivedi, 2005). According to Dwivedi, the original doctrine of inflation by the Cambridge school of neoclassical economists was that inflation is caused by an increase in demand for money rather than by an increase in money supply.

The QTM failed to explain the experience of some economies during WWI and WWII. Some economists found an empirical failure of the theory and began to investigate alternative explanations of what causes inflation. Smith (1985a, 1985b), for instance, has found a negative correlation between the level of price and the stock of money in the economies of the British colonies of North America. As a result, financial asset theory of money was proposed by Sargent and Wallace (1981). Their argument is that an increase in money supply will not cause inflation if it is backed by equivalent increase of assets of the central bank and if there is no monetization of the government debts. According to Bernholz (1988), however, the financial asset theory of money failed to explain the experience of some countries.

6.2.2. The Keynesian View

The Keynesian theory of inflation is attributed to the famous economist of the 20th century, John Maynard Keynes. Keynes pointed out that a change in the money supply does certainly change the other variables in the economy. He particularly argued that an increase in money supply may decrease the velocity of money and would also increase the number of transactions (Bized, n.d.).

According to Keynes, therefore, changes in the money supply would affect the level of price more than proportional as the quantity theory of money would argue.

Keynes introduced an alternative theory to explain what causes inflation. According to his theory, an increase in aggregate demand pushes prices of goods and services which increase the profits of firms given wages are constant in the short run. An increase in the firms' profit induces more demand for investment which requires more demand for labor. This then pushes wages which again pushes prices of goods up (see Britannica, n.d. for more detailed information).

Following Keynes, the Keynesian theory of inflation advocates that the inflationary pressure increases as the economy tends towards full employment driven by the excess demand. The inflationary pressure, however, decreases as the rate of unemployment increases. This inverse relationship between inflation and unemployment which is also called the Phillips curve was popularized by A. W. Phillips (Colander and Gamber, 2006). The Philips curve, however, failed to explain inflation in the 1970s as there was parallel movement of inflation and unemployment in the same direction which is also known as stagflation.

6.2.3. The Monetarist View

The failure of the Phillips curve invoked further investigation. As a result, Friedman (1968) and Phelps (1968) developed the concept of the natural rate of unemployment to explain the difference between the short run and long run Phillips curve. According to their explanation, there is a short-run tradeoff between inflation and unemployment but the tradeoff disappears in the long run. Similar to the concept of the natural rate of unemployment, the concept of Non Accelerating Inflation Rate of Unemployment (NAIRU) was developed by

Friedman and adopted by Modigliani and Papademos (1975). The economic philosophy of the NAIRU is that to reduce inflation, the unemployment rate has to be above the NAIRU. If there is a desired level of inflation, however, the unemployment rate should not fall short of the NAIRU.

The popular view among the monetarists is that inflation comes from the rise in money supply. According to famous monetarist economist Milton Friedman (1970), "Inflation is always and everywhere a monetary phenomenon,,, and can be produced only by a more rapid increase in the quantity of money than in output." By and large the monetarist view is similar to the quantity theory of money of the classical economists. Unlike the classical economists, however, the monetarist economists do not believe in the proportional rise of inflation to the rise of money supply as pointed out by Dwivedi (2005). They also do not support the idea that money supply does not have any impact on the real output in the short run. According to their argument, a change in the money supply does not affect the real output in the long run. It does, however, change the level of prices both in the short run and long run.

6.2.4. The Structuralist View

As a result of the different institutional factors that exist in developing countries, a different approach was developed by some Latin American economists (see Kirkpatrick & Nixon, 1976). This approach explains that inflation is an inevitable and is the byproduct of the development program of the developing countries. The fundamental cause of inflation according to this view is the structural imbalance of developing countries. Some of the structural imbalances are the scarcity of food supply, the mismatch of resources,

underdeveloped infrastructure, restricted access to foreign exchange and social as well as political constraints.

In contrast to the theories of inflation discussed earlier, the sturcturalist theory advocates the supply side as the main source of inflation in developing countries. According to the theory, as point out by Yeldan (1993), demand only fuels inflation that results from the supply side of the economy. Although the structuralist economists acknowledge the expansion of demand with the expansion of inflation, they argue that demand does not originate inflation in developing countries. From the supply side, their theory emphasis on the shortages of foreign exchange, structural rigidities and unemployed resources as the major determinant factors of inflation in developing counties.

Apart from the above theoretical studies of inflation, the empirical study by Narayan et al., (2011) indicates that remittances contribute to the inflation growth in developing countries. By using the Arellano and Bond panel dynamic estimator, they have found positive impact of openness, debt, current account deficits, the agricultural sector, the U.S. short-term interest on inflation. On the other hand, they have found negative impact of improvement in democracy on inflation. The Vector Autoregressive estimation by Loungani and Swagel (2001) also shows that money growth and exchange rate change play a great role in the inflation process of those developing countries with floating exchange rate regimes more so than those developing countries with fixed exchange rate regime. In addition to these studies, the empirical study by Kirkpatrick and Onis (1985) demonstrates the statistically significant relationship between inflation and the structural characteristics of the International Monetary Fund's structural adjustment program in developing countries.

6.2.5. Contemporary View of Inflation

The contemporary view of inflation is that the origins of inflation are not only the supply side or the demand side but a combination of both. Accordingly, prices of goods and services are determined by the market demand and market supply at micro level and by aggregate demand and aggregate supply at macro level, as indicated by Dwivedi (2005). For this reason, whatever happens to the market demand and supply or aggregate demand and aggregate supply reflects in the price level. The contemporary view of inflation is, in short, the hybrid of the previous theories of inflation in that inflation is caused by the factors that affect the demand side and the supply side.

6.2.6. Inflation and Dollarization

Up to this point, different views of how inflation is influenced by different factors have been covered. These views, however, have not addressed the impact of dollarization in their studies. Whether inflation is a matter of monetary phenomenon, real or structural factors, as discussed so far, it is vital to analyze the effect of dollarization on inflation of an economy. If, in particular, inflation is a monetary phenomenon, neglecting dollarization would mislead policy makers in their decision making for controlling inflation. For this reason, some scholars have included dollarization in their studies of inflation.

The first group of these studies has addressed the impact of full dollarization on inflation. Among this group, by using a matching estimator technique, Edward and Magendzo (2001) find that inflation is lower in dollarized economies than non-dollarized economies. In line with this finding, by deriving a general formula for optimal inflation rate, the study by Kurasawa et al., (2007) also finds that the benefit of dollarization in terms of lowering inflation is higher

than the costs of dollarization in terms of seigniorage loss in El-Salvador, Ecuador and Argentina.

Furthermore, the studies by Soto (2008) and Quispe-Agnoli and Whisler (2006) also point out the decline in inflation rate as a result of full dollarization in Ecuador and El Salvador. Similarly, by comparing the country-specific orders of fractional integration estimated over the pre-European Monetary Union (EMU) period to the integration of Euro-area inflation during the EMU period, the results of Meller and Nautz (2009) indicate the reduction of inflation persistence in the Euro area after those countries joining the European Monetary Union. Kim et al., (2004) also point out a similar outcome. Full dollarization does not only help economies reduce inflation but it has also reduced the magnitude of inflation volatility persistence, as indicated in the study of El-Salvador by Payne (2009).

In addition to the above findings, the study by Akofio Sowah (2009) indicates that the average inflation rate is lower in officially dollarized countries than unofficially dollarized countries. Furthermore, by applying a regression analysis and including a dummy variable to represent a group of currency union countries, the study by Akofio Sowah (2009) reveals that the average inflation rate is less in currency unions of Sub-Saharan African countries than those African countries without currency unions. Likewise, by employing a modified control group approach and probit model, the study by Elbadawi and Majd (1996) shows lower inflation rate in the Franc Zone area compared to the non-Franc Zone Sub-Saharan countries.

The second group of the studies examines the impact of partial dollarization on inflation and finds two opposite outcomes. While some of these studies find that partial dollarization increases inflation, some others find the

opposite. Using the regression of a model based on log linearization of a standard money demand equation, Yeyati (2006) for instance show higher inflation rates in financially dollarized economies. In the same way, by using the generalized impulse response analysis, Bahmani-Oskooee and Domac (2003) empirically find similar results in the Turkish economy. In their studies, although partial dollarization reduces the monetary base in its initial stage, it eventually causes the rise of monetary base which pushes inflation tax and administered prices. Likewise, by applying an autoregressive distributed lag, Karacal (2005) finds that dollarization increases inflation both in the short and long run in the Turkish economy. The Granger causality test results, in the case study of the interaction between dollarization and inflation in Lebanon, by Ghalayini (2011) also shows that inflation is explained by dollarization.

In contrast to the above findings, the study by Berg et al., (2003) indicates that dollarization, whether it is in its full or partial, form reduces inflation in South and Central American countries. Similarly, based on the derivation of transaction cost driven from money demand function and by empirically analyzing their model, Gruben and Mcleod (2004) find lower inflation in Latin America and other twenty countries. Reinhart et al., (2003) also explain the existence of low inflation alongside dollarization in a dollarized economy in their argument of the effectiveness of monetary policy.

The third group of the studies explores the impact of dollarization on inflation as a result of exchange rate pass through. The common view according to this group of studies is that the exchange rate pass through is higher, the higher the degree of dollarization. In their studies of addicted to dollars Reinhart et al., (2003) find that highly dollarized countries have higher inflation and higher

exchange rate pass through than low- to moderately- dollarized countries. The impulse response function of inflation to exchange rate changes in the study by Alvarez-Plata and Garcia-Herrero (2008) shows an increase in the exchange rate pass through with the increase of the degree of dollarization. Similarly, by using a base line VAR, Leiderman et al., (2006) have found that the exchange rate pass through is higher in Peru, a highly dollarized economy, than in Chile which has a low degree of dollarization. The studies by Goujon (2006) as well as Oomes and Ohnsorge (2005) also indicate the same findings in the case of Vietnam and Russian economies by using an error correction model.

Different to the common view of the exchange rate pass through in the dollarized economy discussed above, few studies have shown different results. By using VAR and co-integration techniques, Billmeier and Bonato (2002) have found low exchange rate pass through effect in Croatia, a highly dollarized economy. Carranza et al., (2009) argue that exchange rate pass through could be positive or negative depending on the extent of the exchange rate depreciation and the business cycle. Their results of the ordinary least square regression of inflation on certain variables show positive pass through effect for all the countries in their studies. When the pass through variable is interacted with the recession indicator variable, however, they find a negative pass through effect. The negative pass through effect increases with the increase in the degree of dollarization. They also find a negative pass through effect when they include the coefficient that captures the magnitude of depreciation.

The finding of the above studies commonly point out that dollarization does affect inflation in a given economy. It is quite controversial to see in those findings that while full dollarization reduces inflation, the pass through effect is

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higher the higher the degree of dollarization. If the pass through effect gets higher when the degree of dollarization gets closer to full dollarization, what kind of economic explanation can be drawn? Why does full dollarization help reduce inflation while partial dollarization does not for some economies? Do the findings on partial dollarization not contradict each other, because some of them report that while partial dollarization increases inflation in general, the exchange rate pass through is lower with less partially dollarized economies? Should those countries with high degrees of dollarization reconsider to either fully dollarize or reduce their dollarization? This study addresses the potential reasons for some of these questions, although the answers to these questions rely more on empirical investigation.

When economies are highly dollarized the exchange rate pass through effect is higher as a result of the balance sheet effect of exchange rate depreciation. This is most evident especially when firms issue debts in foreign currency. The mechanism is that exchange rate depreciation initially affects the balance sheet of the firms that issue debts in foreign currency. This is mainly due to the mismatch between firms' revenue, which is denominated in local currency and the firms' debt which is denominated in foreign currency.

It is important to note here that banks expect firms to service their debts in foreign currency. Therefore, if the exchange rate depreciates, the firms' debt in terms of local currency rises as they have to exchange large amount of local currency for small amounts of foreign currency to pay their debts. The rise of the debt payments in terms of local currency forces firms to raise prices to cover up their costs. The larger the amount of debt denominated in foreign currency, the bigger the effect of the exchange rate depreciation on the firms' balance sheet. The

bigger the effect of exchange rate depreciation on the firms' balance sheet, the greater its impact on the prices. It is, therefore, expected that the higher the degree of dollarization, the larger is the exchange rate pass through effect. A brief framework of the balance sheet effect procedure is shown in Appendix 6.1.

The balance sheet effect is related with the effect of relying more on imported goods. If the economy is sustained by importing goods from abroad, it requires foreign currency to finance its import expenditure. Provided that the exchange rate regime of the economy is not fixed, depreciation of its currency means more domestic currency is required to exchange for foreign currency. This then raises the cost of imports which ultimately reflects its effect in the form of rising prices of imported goods in the economy. The higher the degree of the reliance of the economy on imported goods and the higher the degree of depreciation, the higher will be the degree of dollarization as well as the higher the price of goods in that economy.

When the economies are fully dollarized, however, they are legally abandoning their local currency and adopting foreign currency to have all the functions of money. There is, therefore, no mismatch effect in the balance sheet of firms. Banks can lend foreign currency and expect to be paid in foreign currency as in the case in a highly dollarized economy. Unlike the firms in highly dollarized economies, however, firms in fully dollarized economies can earn foreign currency which enables them to pay their debts in foreign currency. In this way, fully dollarized economies can avoid the exchange rate pass through effect relative to highly dollarized economies.

Another potential economic factor that explains the discrepancies in the findings of the literature is the purchasing power effect. Normally inflation makes

the purchasing power of the domestic currency weak. As a result, individuals tend to swap strong currency for the weak domestic currency. If the swapping ultimately leads to real dollarization, then there are two outcomes. First, firms will not face currency mismatch even if the economy is partially dollarized, because firms can earn dollars and pay their debts in dollars. Second, the purchasing power of the currency is strong. As a result of these two outcomes, inflation might drop down in the economy. The flow of the purchasing power effect is demonstrated in Appendix 6.2.

6.3. Inflation in Eritrea

Inflation in Eritrea has been the main economic concern for policy makers throughout almost the existence of the country as an independent nation. Its rapid growth in late 2000s not to mention its worse condition in the early 2000s put the economy on a high inflationary watch list by the International Practices Task Forces as reported in Ilter (2012). Although different drastic measures have been taken to ease its magnitude in the economy, still more work is needed to be done in the future. It is, therefore, vital to address its nature in different periods of the economy in order to identify the policy decisions needed to be taken to ease its growth in the economy. It is also crucial to examine the potential factors that trigger inflation in each period if effective strategies for controlling its magnitude are going to be implemented.

6.3.1. Inflation Prior to 1991

Before its independence, the Eritrean economy was highly regulated by consecutive regimes of the Ethiopian government. The economy at large and the rate of its growth in particular were determined by the decisions of the regimes. For this reason, major macro-economic variables such as the inflation rate, the

unemployment rate and the exchange rate in Eritrea were the reflections of whatever policies were adopted by the Ethiopian regimes. One of the main prevalent policies that were widely used by the regimes, particularly the Derg regime, was the pursuit of a command economy.

In spite of the existence of a planned economic system, the Derg regime managed to have reasonably moderate economic stability during its administration. The average annual inflation rate during the 1980s, that is prior to the dismantling of the Derg regime, was approximated to 4.6 which was much lower than the rate in the 1990s which averaged to 8.83. One of the main mechanisms through which the Derg regime had been able to maintain inflation as low as that was the administration of foreign aid. The regime used food aid received from developed countries to fill the gap that resulted from the shortage of domestic supply in times of draught. To keep inflation as low as possible the regime set low prices for basic consumption goods such as wheat, sugar and oil received as aid and sold them to the public instead of giving them away freely.

In addition to this, the regime embraced a fixed exchange rate system by pegging the Birr, former Ethiopian currency, to the U.S. dollars. During the entire period of its administration, which was from 1974 to 1991, the exchange rate was set to 2.07. This rate was stronger relative to the average exchange rate during 1992 to1997 which approximately was 5.41. In as much as the economy relies on imported goods regularly, the strong value of the Birr was favorable to imports which made prices of imported goods cheaper and the inflation rate lower. Besides the strong value of the Birr, on average, the foreign exchange reserve during the Derg regime was 125.3 million, whereas during the period 1991 to 2008 it amounted to approximately 36.30 million. The availability of adequate

foreign exchange reserve eased the problem of foreign currency shortages which otherwise would have boosted the cost of foreign currency attainment and thereby the prices of imported goods.

6.3.2. Inflation Post 1991

After the official independence of Eritrea in 1993, a different era emerged in the economy where market played a greater role instead of a command economy. In 1994, the Eritrean government eliminated price control on all goods apart from a few basic goods and bread, which was set at 20 cents a loaf. Despite the adoption of market-led economy, where supply and demand determine the level of price, the inflation rate began to rise. Although the increase in inflation was reasonable relative to the inflation rate after the issuance of the new currency in the economy in 1997, it was high relative to the Derg regime. One of the determinant factors for this outcome was the rise in aggregate demand which resulted from the repatriation of more Eritreans to either settle down or visit the country. The rise in the aggregate demand in light of limited aggregate supply might have pushed the inflation rate right after independence of the country, as can be seen in Figure 6.2.

Another factor was the devaluation of the Birr, the former common currency of Eritrea and Ethiopia, from 2.07 to 5.46 in 1994. This was the result of the adoption of market-led exchange rate system by the new government of Ethiopia in May 1993 (see Hansson, 1995). The rate of inflation, however, began to fall from 1995 and continued to fall towards 1997. While the liberalization of price controls could partially explain this, good economic performance based on the permission of free competition during that period also played its part.

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Figure 6.2: Inflation Rate in Eritrea from 1993 to 2008
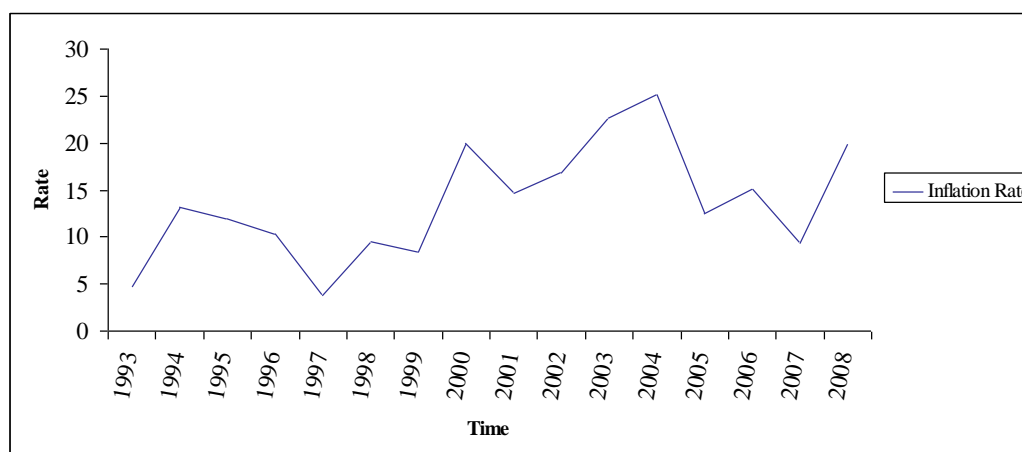
Source: International Monetary Fund, World Economic Outlook Database, April 2010.

Moreover, the agreement on free movement of goods and services between Eritrea and Ethiopia during those periods played a great role in keeping inflation low. Free movement of goods and services in both countries minimized the cost of trade barriers resulted from tariffs and thereby the prices of those goods available in the domestic market of both economies. The fall in the inflation rate, nonetheless, did not last long. As can be seen from Figure 6.2, the inflation rate began to rise after 1997 and reached its peak in 2004, which was 25.11 percent per annum. The fundamental cause of this was the policy decision made on the monetary affairs of Eritrea. The Bank of Eritrea introduced an independent currency towards the end of 1997 so as to have complete control over the Eritrean monetary system and there by the Eritrean economy. The introduction of independent currency, however, was not favored by the National Bank of Ethiopia which eventually led to disagreement on the exchange rate between the new currency and the Birr. Although the Bank of Eritrea preferred the exchange rate to be one-to-one and trade between both countries to be settled in respective local currencies, this was not in the best interests of Ethiopia. Instead, the National

Bank of Ethiopia favored using U.S. dollars in the settlement process (Haile, 2008; Africa Research Group, 1999, as cited in Zondi & Rejouis, n.d.).

Eventually, the disagreement over economic issues together with some other political issues triggered war and disrupted trade between both countries. As a result of the loss of access to the Ethiopian market, basic consumption goods such as pepper, teff, sugar, coffee, herbs and spices had to come from other countries such as China, India, Sudan, Kenya and Uganda. Unlike the previous trade agreement with Ethiopia, these goods were now subject to tariffs. Moreover, the transactions had to be settled in U.S. dollars instead of the respective countries' local currency. The requirement to settle import transactions in U.S. dollars coupled with the tariff charges, therefore, sped up the growth of inflation.

Besides currency independence, the persistent devaluation of the new currency contributed to the rise in inflation after 1997. As can be seen from the normalized quarterly data of CPI and the exchange rate in Figure 6.3, the new currency continued to be cheap in both markets fairly after its introduction. Although the Bank of Eritrea fixed the value of the currency from 2003 onwards, devaluation that comes from the black market has sustained the rise in the inflation rate in the Eritrean economy. Due to the fact that the devaluation of the currency against the U.S. dollar, particularly in the black market, goes alongside the inflation rate of the economy, it can be said that inflation has been driven by the value of the new currency.

The constant rise in inflation after 1997 can also be explained by the unexpected expansion of both monetary and fiscal policy in the economy. The government expenditure rose from an average of 32.7percent of the total GDP

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prior to 1997 to 54.3 percent of total GDP in the period 1998 to 2004. After 1997, the defense expenditure alone jumped from 8.2 to approximately 30.2 percent of the total GDP. The expansion in fiscal policy is accompanied by the expansion of the monetary policy to finance the fiscal expenditure needed in the economy.

Figure 6.3: Inflation Rate, Official Exchange Rate and Black Market Exchange Rate
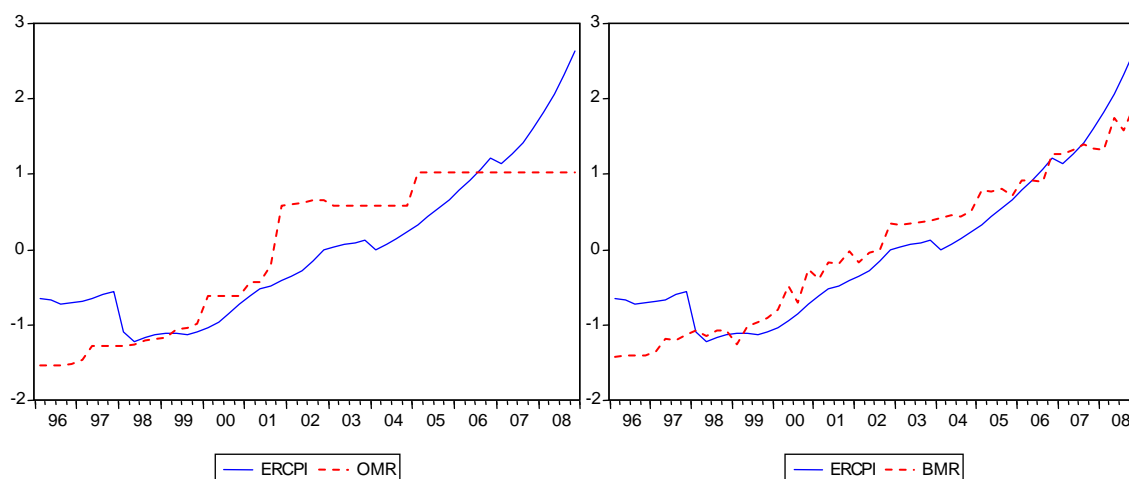
Source: Data obtained from IMF and normalized using Eviews software.
     ERCPI stands for consumer price index in Eritrea
     OMR stands for exchange rate from official market
     BMR stands for exchange rate in the Black market

In order to minimize the growth of inflation and its multiple economic effects, the government introduced new systems of price control on basic consumption goods. To control prices, the production of crops such as barley and tomatoes was started in the early 2000s. Originally, the government was selling these food items to local merchants at a fixed price, though this was not effective in lowering prices. Later on, the government opened headquarters to sell necessity goods directly to the public at fixed prices, leaving the private sector free for competition. The government department offices were also made available for purchase of similar items at fixed prices.

The policy intervention somehow relieved the growth in inflation from 2004 onwards, as can be seen from Figure 6.2. Relative to the inflation rate

during the periods prior to the introduction of the new currency, however, it remains high. On average, the inflation rate following the independence of the country up until the issuance of the new currency was 8.78 percent. Following the introduction of the new price controls, however, the average inflation rate during four consecutive years was 14.20.

So far, it has been discussed that the introduction of the new currency, the war, the devaluation of the currency and the expansion of both monetary and fiscal policies have contributed to the growth of inflation in the Eritrean economy. One might raise a question as to how dollarization might fit in to explain the process of inflation in the economy. Whether it has somehow contributed to the growth or decline of inflation in its dynamics is the key investigation in this chapter. The next section, therefore, discusses the ways that dollarization influences the inflation process in the Eritrean economy.

6.3.3. Inflation and Dollarization of the Eritrean Economy

Before going deeper into the discussion on how dollarization might affect inflation in the Eritrean economy, it is essential to make it clear that the existing literature finds little evidence that dollarization causes inflation. The studies on Granger causality test on inflation and dollarization by Alvarez-Plata and Herrero (2008) as well as Zamaroczy and Sa (2003) showed that dollarization is less likely to Granger cause inflation in the economies of Bolivia, Cambodia, Lao People's Democratic Republic and Vietnam respectively. The study on the link between dollarization and inflation by Bahmani-Oskooee and Domac (2003) also show that dollarization does not cause inflation in the Turkish economy. To determine whether or not this is the same in the Eritrean economy is a matter of empirical investigation. While putting this aside for the time being, it is important to focus

on what roles dollarization might play in the process of inflation in the Eritrean economy.

To see how dollarization might influence the inflation dynamics of the Eritrean economy, a breakdown on the CPI by food and nonfood inflation is made, as shown in Figure 6.4 below. As is clear from the figure, the price level of food (PLF) prior to 1998 was lower than the price level of nonfood. Food prices, however, began to rise above the price level of nonfood after 1998 and continued to be higher throughout the remaining period of the study. The lower price level of food prior to 1998 to some extent showed the advantage that the economy had due to the currency union and trade agreement with Ethiopia at that time.

Figure 6.4: The Price level of Food and Non Food Items
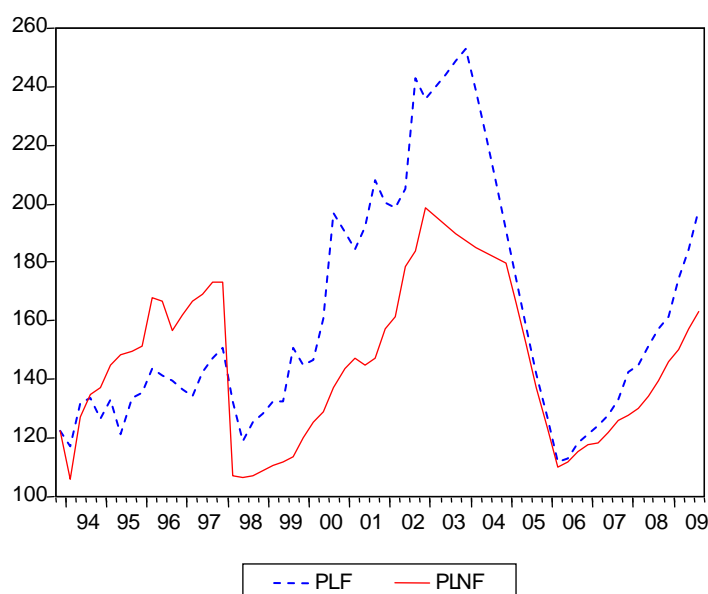
Source: IMF Staff country Report No. 98/91, 00/55 and 03/166: Eritrea selected issue, National Statistics and Evaluation Office. PLF stands for is price level of Food items and PLNF stands for price level of Non-Food items.

The rise in the price level of food after 1998 on the other hand partly shows the side effect of the conflict and shortage of labor supply in the agricultural sector as a result of the war, which eventually resulted in the

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reduction of the agricultural products. The post 1998 increment of the price level of food is not only explained by the reduction in the domestic supply of food products but also by the rise in food imports. Information obtained from the National Investment Brief of Eritrea shows that food imports increased from an average value of 50 million U.S. dollars during the period 1993 to 1996 to an average value of 92 million U.S. dollars between 2000 and 2004. Data obtained from Trading Economics also shows that the total proportion of food imports to total imports in 2003 alone accounted for 45.6 percent which is nearly half of the total imports. According to the Amber Waves' report, 87 percent of grains, 51 percent of vegetable oils, and 100 percent of sugar in the Eritrean economy are imported from overseas. Here is where the dollarization of the economy comes in to explain to a certain extent its influence on inflation. The more the economy relies on food imports, the more dollars are demanded to finance imports as the majority of imports are mostly from developing countries which require dollars for import transaction settlements. The higher the demand for dollars, the greater its value is relative to the local currency. The greater the value of the dollar means, the more costly it is for importers. Ultimately, the rise in the cost of import reflect its effect in the form of high prices of food imports, as importers are aiming at setting off the costs and then make profits.

6.4. Modeling Inflation under Partial Dollarization of the Eritrean Economy

An empirical panel investigation on the demand for money in developing countries by Valadkhan and Alauddin (2003), using seemingly unrelated regression (SUR) estimation technique, indicates that disequilibrium in the money market can exacerbate inflation. To this end, money demand and money supply equations have been used in modeling inflation under partial dollarization of

Eritrea. To make matters simple, the optimization procedure of deriving the money demand has not been developed here. It has been focused directly on the equation of the linear relationship of the money demand and its determinants, which is more relevant in the modeling. The studies of the demand for money in five ASEAN countries and developing countries by Abdullah et al., (2010) and Arrau et al., (1991) respectively suggest that the money demand is affected by the scale variables such as income and opportunity cost variables. In modeling inflation under partial dollarization of the Eritrean economy, we have the following expression of money demands.

$$D^f = f\left(e,\, y,\, p^f,\, p^l\right)$$

$$D^l = d\left(e,\, y,\, p^f,\, p^l,\, i^l\right)$$

where D^f stands for the foreign money holding, D^l stands for local currency holding e, y, p^f, p^l and i^l denotes exchange rate, gross domestic product, inflation rate of foreign countries, local inflation rate and local interest rate respectively. The partial derivatives of each money demands with respect to their determinants are represented as follows. From the first money demand function we have

$$\frac{\partial f}{\partial e} \text{ and } \frac{\partial f}{\partial p^f} > 0$$

$$\frac{\partial f}{\partial y} \text{ and } \frac{\partial f}{\partial p^l} < 0$$

From the second money demand function we have

$$\frac{\partial d}{\partial e} \text{ ; } \frac{\partial d}{\partial i^l} \text{ and } \frac{\partial d}{\partial p^f} < 0$$

$$\frac{\partial d}{\partial y} \text{ and } \frac{\partial d}{\partial p^l} > 0$$

Firms and households diversify their currency holdings by holding foreign and domestic currency in their portfolios. The decline in the rate of foreign exchange, thus, affects both the domestic and foreign desired currency balances of the firm and household's portfolios. Foreign desired currency balances increase as the exchange rate depreciates. Conversely, domestic desired currency balances decrease with the decrease of the exchange rate. Part of the reasons for this is that firms and households tend to lose confidence as the value of the domestic currency depreciates. The decline in confidence makes firms and households to partly substitute foreign currency for domestic currency as their confidence in foreign currency is higher than their confidence in domestic currency.

The rise in income denoted by gross domestic product raises domestic currency holdings while reducing foreign currency holdings. This assumption is based on basic money demand theory. As the level of income rises, so does expenditure which causes the rise in domestic currency holdings. Keeping other things constant, it is assumed that the rise in domestic currency holdings decreases the foreign currency holdings. In the study of the determinants of the demand for money in developed and developing countries, Bitrus (2011) finds that income related factors are the most influential factors in developing countries. In particular, the study showed that the level of income is the most significant determinant of money demand in developing countries. Likewise, the results of feasible generalized least squares (FGLS) model by Ozturk and Acaravci (2008) suggest that the money demand in transition economies is positively affected by gross domestic product.

Domestic inflation is expected to push the level of domestic desired currency balances but shrink the foreign desired currency balance. The opposite is

true for foreign inflation. According to the theory of money demand, the quantity of domestic money desired by firms and households increases as the level of domestic prices rises. If the domestic desired money increases, it is likely to see the decline in foreign desired money balance.

The rate of domestic interest negatively affects the domestic money holdings. The reason for this is that the opportunity cost or the forgone value of holding domestic money rises as the domestic interest rate increases which encourages savings and reduces the domestic currency holding. Foreign interest rate is not expected to affect the Eritrean money demand due to two reasons. First, the fact that the interest earnings from foreign currency deposits in Eritrea is zero. Second, the primary motive for foreign currency holding of the private firms and households in Eritrea is not to use foreign currency as the store of value either in the Eritrean banks or overseas. Rather, to settle transactions needed for imports by firms and to exchange for more domestic currency needed to finance consumption expenditure by the households. Having discussed the impacts of different determinants of both money demands, we can now express the equations as follows:

$$D_t^{\ f} = \alpha_1 e_t + \alpha_2 \left(p_t^{\ f} - p_t^{\ l} \right) - \alpha_3 y_t + \varepsilon_t \qquad (6.1)$$

$$D_t^{\ l} = \phi_1 y_t + \phi_2 \left(p_t^{\ l} - p_t^{\ f} \right) - \phi_3 i_t^{\ l} - \phi_4 e_t + v_t \qquad (6.2)$$

The overall money demand in the Eritrean economy thus is given by

$$MD_t^{\ T} = \alpha_2 \left(p_t^{\ f} - p_t^{\ l} \right) + \phi_2 \left(p_t^{\ l} - p_t^{\ f} \right) - \phi_3 i_t^{\ l} + v_t \qquad (6.3)$$

Where assumption is made on $\alpha_1 = \phi_4$ and $\alpha_3 = \phi_1$. $\upsilon_t = \varepsilon_t + \nu_t$ is the random error term. MD_t^T stands for total money demand in the economy. On the money supply side, we have both foreign and domestic currency supply in the economy represented as follows:

$$MS_t^T = MS_t^F + MS_t^L \qquad (6.4)$$

Where MS_t^T is the total money supply, MS_t^F stands for foreign currency supply and MS_t^L is domestic money supply. In line with the new consensus of the Post Keynesian and Neoclassical theories, domestic money supply is assumed to be endogenous. It is assumed to be driven by some macro-economic variables instead of assuming that it is fixed by the Bank of Eritrea. The potential variables that can affect the domestic money supply are the rate of domestic interest, exchange rate and relative price differences. The domestic money supply can, thus, be represented as

$$MS_t^L = \beta_1 e_t + \beta_2 \left(p_t^f - p_t^l \right) - \beta_3 i_t^l + \eta_t \qquad (6.5)$$

η is a random error term. Foreign currency supply is assumed to be fixed in this model as it is determined by the economies of the foreign country. Thus, the total money supply in the Eritrean economy can be expressed as follows:

$$MS_t^T = \alpha MS_t^F + \beta_1 e_t + \beta_2 \left(p_t^f - p_t^l \right) - \beta_3 i_t^l + \eta_t \qquad (6.6)$$

The equation includes the exchange rate as devaluation causes domestic currency holders to supply more domestic currency to exchange for few foreign currencies. Supplying more domestic currency in the foreign exchange market does not in itself reflect an increase in money supply unless there is an increase in M0 or M1. As the data on official exchange rate and M1 indicate, the sharp decline in the value of Eritrean currency in the second quarter of 1999, first

quarters of 2000, 2001 and the third quarter of 2001 is followed by the rapid increase in the quantity of M1. This partly shows that more money had to be printed in order to accommodate the exchange need.

Domestic inflation rate is assumed to affect the money supply negatively as an increase in domestic inflation leads to contractionary monetary policy. However, foreign inflation is expected to indirectly influence the money supply through the exchange rate. If there is an increase in foreign inflation, more foreign currency is needed to purchase the same amount of goods used to import from the foreign country. Provided that the domestic currency has been low in the Eritrean economy, more domestic currency is needed to be exchanged in order to get more foreign currency. Exchanging more domestic currency in order to acquire the foreign currency needed to purchase the inflated goods of the foreign country implies the increase of domestic money supply in the foreign exchange market.

The domestic interest rate is assumed to have negative effect on the money supply. An increase in the interest rate is assumed to decrease the domestic desired money holding and increase domestic deposit. Even though it increases the level of deposit, since it is high it is unattractive for borrowers. This then reduces the level of loans made by the banks which lowers the money creation and ultimately the money supply in the economy.

Assuming equilibrium in the money market where money supply equals money demand, we have the following expression.

$$MS_t^T = MD_t^T \tag{6.7}$$

Using equations (6.3), (6.5) and (6.6) we can now derive the inflation equation as follows:

$$p_t^l = \alpha MS_t^F + \beta e_t + \phi p_t^f + u_t \tag{6.8}$$

Where $\alpha = \dfrac{\alpha}{\beta_2}$; $\beta = \dfrac{\beta_1}{\beta_2}$; $\phi = \dfrac{\phi_2}{\beta_2}$ $and\ u = \eta - \varepsilon + \upsilon$ is a random

error term. MS_t^F is captured by the extent of dollarization in the Eritrean economy. The hard currency index developed in the previous chapter can, therefore, be used here to represent the MS_t^F. According to equation (6.8), dollarization has a positive impact on the inflation; that is, inflation increases with the increase of dollarization. There are three possible explanations for this.

First, an increase in dollarization signifies

(i)   an increase in demand for dollars which in turn increases the value of the dollars;

(ii)   a decrease in demand for domestic currency which reduces the value of the domestic currency.

The outcome of (i) and (ii) shows the depreciation of the exchange rate. As the exchange rate depreciates, the foreign demand for domestic goods increases which pushes up the price of domestic goods. For this to happen, we are assuming that

1) the economy is open;

2) there is an international demand for the domestic products;

3) there is a floating exchange rate system in the economy.

Second, an increase in dollarization has the same effect as mentioned in (i) and (ii) which leads to exchange rate depreciation but this time it affects the domestic price of imported goods. The depreciation of the exchange rate means more costs for importers. In other words, importers now have to pay more domestic currency than previously to buy the same amount of foreign currency that they used to purchase before. This raises the domestic price of imported

goods which would reflect on the rise in inflation. All these consequences of the second outcome are based on the assumption that

1) the economy is open and the share of imported goods is high;

2) the domestic demand for imported goods is high;

3) there is black market of exchange rate or floating exchange rate regime;

4) there are only domestic importers.

Third, as has also been discussed by Rojas-Suarez (1992), Bahmani-Oskooee and Domac (2003) and Viseth (2001), an increase in dollarization implies an increase in currency substitution. These studies argue that the level of monetary base declines as residents substitute more domestic currency for foreign currency. Since the fall in the level of monetary base signifies the loss of seigniorage, authorities tend to increase money supply in order to raise revenue from inflation tax. An increase in money supply will raise the level of inflation in the economy.

From the three cases discussed so far, the second case is more relevant to the Eritrean economy. Equation (6.8) represents the long-run relation of the dependent and the independent variables. The determination of the short-run relation leads us to the discussion of cointegration which is presented below.

6.4.1. Cointegration

Cointegration is an econometric technique developed to test the relationship between non-stationary time series variables. The idea was initiated by Granger (1981). It was later developed by different scholars including Engel and Granger (1987), Stock and Watson (1988), Phillips and Ouliaris (1990), Phillips (1991) and Johansen (1991, 1994). Potential econometric problems such as biased estimation and inability to conduct hypothesis test arises as a result of the non-stationarity of the time series variables. Techniques of cointegration,

however, enable researchers to draw a significant long-run relationship between the non-stationary time series variables if the variables are cointegrated.

The word cointegration is different from the word correlation. When two variables are correlated, if one variable increases or decreases, so does the other variable at the same time. If two variables are cointegrated, however, it does not mean that they move together all the time. Sometimes they move in the same direction and other times they move in opposite directions but they get back into a mean distance ultimately.[20] When two or more variables are cointegrated, as Verbeek (2004) pointed out, they share the same stochastic trend. This implies that the two variables are bound by some relationship in the long run as Brooks (2002) pointed out. Although they might deviate from their relationship in the short run, they come back into their relationship in the long run. If two or more variables are cointegrated, they have long-run or equilibrium relationship. The deviation from their long-run equilibrium can be captured by equilibrium correction or error correction model as discussed below.

6.4.2. Equilibrium Correction or Error Correction

It has been argued in the above discussion that if two or more variables are cointegrated, they have a long-run relationship. However, in the short run they may deviate from their long-run equilibrium. Equilibrium or error correction is a technique developed to identify the disequilibrium of the variables in the short run. It measures the deviation of the dependent variable from the long-run equilibrium relation of the independent variables. As described by Verbeek (2004), it depicts how the dependent variable and the independent variables behave in the short-run consistent with the long-run cointegrating relationship. To

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[20] See Chan (2006) for more details.

make this clear, we are going to apply the concept in to the inflation model developed earlier. For the four time series variables of the model, we have the following expression of equilibrium correction or error correction model.

$$\Delta p_t^l = \delta_1 \Delta h_t + \delta_2 \Delta e_t + \delta_3 \Delta p_t^f + \delta_4 (p_{t-1}^l - \alpha h_{t-1} - \beta e_{t-1} - \varphi p_{t-1}^f) + u_t \quad (6.9)$$

Where Δp_t^l is the change in local inflation; Δh_t is the change in dollarization measured by hard currency index developed in Chapter 4. Δe_t is change in exchange rate; Δp_t^f is change in foreign inflation. p_{t-1}^l h_{t-1} e_{t-1} p_{t-1}^f represent local inflation, dollarization, exchange rate and foreign inflation at time t-1 respectively. The parameters δ_1, δ_2 and δ_3 capture the short-run relation of the change in the dependent variables with the change in the independent variables. The coefficient δ_4 is the error correction term or the adjustment coefficient. It measures the speed of adjustment to equilibrium. In other words, it measures by how much the equilibrium error of the previous period has been corrected. $(1-\alpha-\beta-\varphi)$ is the cointegrating vector where the parameters α, β and φ capture the long run relationship between local inflation and dollarization, exchange rate and foreign inflation respectively. In a nut shell, equation 6.9 states that local inflation is supposed to change as a result of change in dollarization, exchange rate, foreign inflation and also to correct for any disequilibrium that existed during the previous period.

The above representation of equilibrium correction or error correction model assumes that there is only one cointegrating vector. Since there are four variables, however, there is a possibility of more than one cointegrating vector existing at the same time. In the case where there is more than one cointegrating

vectors, it is essential to employ a Vector Error Correction Model which can be represented as follows:

$$\Delta Y_t = \theta + \sum_{i=1}^{k} \Gamma_i \Delta Y_{t-i} + \amalg Y_{t-1} + u_t$$

(6.10)

where Y_t is a vector of endogenous variables. The parameter Γ_i represents the parameters of the independent variables in the short run and it goes from $\Gamma_1, \ldots, \Gamma_k$ where k is the lag length. $\amalg = \alpha\beta'$ where α represents the speed of adjustment to the long-run equilibrium and β includes r cointegrating vectors. u_t is a vector of the error terms which are assumed to be normally distributed with zero mean and constant variance. In the inflation model described earlier, there is a potential that there may be more than one cointegrating equations. The gross domestic product is assumed to have influence in the cointegrating equation of dollarization. As a result, we have now five variables. In the case where r =2, and five variables, $\amalg = \alpha\beta'$ would be as follows:

$$\amalg Y_{t-1} = \alpha\beta' Y_{t-1} = \begin{bmatrix} \alpha_{11} & \alpha_{21} \\ \alpha_{12} & \alpha_{22} \\ \alpha_{13} & \alpha_{23} \\ \alpha_{14} & \alpha_{24} \\ \alpha_{15} & \alpha_{25} \end{bmatrix} \begin{bmatrix} \beta_{11} & \beta_{12} & \beta_{13} & \beta_{14} & \beta_{15} \\ \beta_{21} & \beta_{22} & \beta_{23} & \beta_{24} & \beta_{25} \end{bmatrix} \begin{bmatrix} p_{t-1}^l \\ h_{t-1} \\ e_{t-1} \\ p_{t-1}^f \\ gdp_{t-1} \end{bmatrix}$$

Each α in the above representation stands for the speed of adjustment from each variable in each of the two cointegrating equations. Each β represents the long-run equilibrium of the dependent variable with each of the independent variables. If the lag length is assumed to be one, $\sum_{i=1}^{k} \Gamma_i \Delta Y_{t-i}$ in the case of r=2 can be written as:

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$$\sum_{i=1}^{k} \Gamma_i \Delta Y_{t-i} = \begin{bmatrix} \Gamma_{11} & \Gamma_{12} & \Gamma_{13} & \Gamma_{14} & \Gamma_{15} \\ \Gamma_{21} & \Gamma_{22} & \Gamma_{23} & \Gamma_{24} & \Gamma_{25} \end{bmatrix} \begin{bmatrix} \Delta p_{t-1}^l \\ \Delta h_{t-1} \\ \Delta e_{t-1} \\ \Delta p_{t-1}^f \\ \Delta gdp_{t-1} \end{bmatrix}$$

As explained earlier each Γ_i represents the parameter of each independent variable in the short run of each of the two cointegrating equations. The overall matrix representation of the two cointegrating equations would look like:

$$\begin{bmatrix} \Delta y_t \\ \Delta x_t \end{bmatrix} = \begin{bmatrix} \Gamma_{11} & \Gamma_{12} & \Gamma_{13} & \Gamma_{14} & \Gamma_{15} \\ \Gamma_{21} & \Gamma_{22} & \Gamma_{23} & \Gamma_{24} & \Gamma_{25} \end{bmatrix} \begin{bmatrix} \Delta p_{t-1}^l \\ \Delta h_{t-1} \\ \Delta e_{t-1} \\ \Delta p_{t-1}^f \\ \Delta gdp_{t-1} \end{bmatrix} + \begin{bmatrix} \alpha_{11} & \alpha_{21} \\ \alpha_{12} & \alpha_{22} \\ \alpha_{13} & \alpha_{23} \\ \alpha_{14} & \alpha_{24} \\ \alpha_{15} & \alpha_{25} \end{bmatrix} \begin{bmatrix} \beta_{11} & \beta_{12} & \beta_{13} & \beta_{14} & \beta_{15} \\ \beta_{21} & \beta_{22} & \beta_{23} & \beta_{24} & \beta_{25} \end{bmatrix} \begin{bmatrix} p_{t-1}^l \\ h_{t-1} \\ e_{t-1} \\ p_{t-1}^f \\ gdp_{t-1} \end{bmatrix} + \begin{bmatrix} u_{1t} \\ u_{2t} \end{bmatrix}$$

6.5. Data Source and Management

As has been mentioned in the previous chapter, the independent economic history of Eritrea is fairly new. The development and setting up of the different sectors and institutions took a while after the country gained its independence. It has, therefore, been difficult to find a complete set of data for all the variables needed for the empirical analysis right from the start of official independence of the country in 1993. For this reason, a period where there seems to have information for all the variables at the same time is selected. As a result, quarterly data for the period 1996 to 2008 is used. It is important to mention here that all the variables are transformed into logarithmic form.

The Eritrean Consumer Price Index is used as a proxy for local price level. The data for CPI is a fragmented data in which some of the data are reported in their quarterly format and some in their annual format. Quarterly data from 1996

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to 2002 is obtained from the IMF Staff Country Report No. 98/91, 00/55 and 03/166: Eritrea selected issue. The remaining quarterly data are obtained by disaggregating the annual data using the INTER procedure discussed in the previous chapter. The annual data are gathered from the IMF World Economic Outlook. Since quarterly Eritrean CPI data from 2003 onwards are not available, values are interpolated using autoregressive and an INTER procedure disaggregating method.

To determine the proxy of foreign price level, the CPI of Eritrea's major trade partners is taken. Since access to the Ethiopian market has been closed since 1998, the Ethiopian CPI is excluded from the proxy of foreign price level. Due to lack of data on the proportion of imports from each trading partner, the foreign price level obtained from the CPI of the trading partner is unweighted. The CPI of each trading partners is obtained from the Financial Statistics of the IMF. In the analysis, annual Gross Domestic Product is disaggregated using the INTER procedure. The data is collected from IMF World Economic Outlook. Data for the remaining variables that is the dollarization, exchange rates of the official market as well as the black market are the same as the data used in the analysis of the previous chapter.

6.6. Econometric Results

Cointegration analysis involves several steps, including testing whether or not the variables of interest are non-cointegrated variables in the first place. One of the prerequisites before conducting a cointegration test is that the variables of interest have to have the same order of integration. Moreover, a linear combination of the variables has to be stationary; that is integrated of order zero

which is I (0). In other words, the error term expressed in terms of the linear combination of the variables is expected to be stationary.

Although the prerequisites of the cointegration are desirable, there is a case where some times some of the time series variables have different order of integration. In such cases, a different technique (Auto Regressive Distributed Lag) may be used to estimate the long-run relationship of the variables.

6.6.1. The Unit Root Test and the Integration Order

The unit root test of the hard currency index, that represents the dollarization, is carried out in the previous chapter. To identify whether the remaining variables in the inflation model are I (1) or I (0), both unit root test and stationary test on the level of the series have been conducted first. Next, the first difference of each series is tested in order to check whether or not the unit root is still an issue. The results of the unit root test and the stationary test are listed in Table 6.1.

Augmented Dickey-Fuller (ADF) tests under both selection criterion, namely the Akaike Information Criterion (AIC) and the Schwarz' Bayesian Information Criterion (SIC) as well as Philip-Peron (PP) tests are employed. Moreover, a stationarity test using Kwiatkowski, Phillip, Schmidt and Shin test (KPSS) is employed. As can be seen from the results, the p values of the variables under all forms of the unit root tests are relatively high when trend is not included. With the inclusion of the trend, although most of the p values fall in the rejection area, some are in the acceptance area when compared to their critical values.

Table 6.1: Unit root and Stationary Tests

Variables	ADF(AIC)		ADF (SIC)		PP		KPSS	
	With	Without	With	Without	With	Without	With	Without
bmr	0.972	-1.298	-1.430	-1.323	-2.549	-1.186	0.208	0.950
	(0.937)	(0.622)	(0.839)	(0.611)	(0.304)	(0.673)		
p^l	-2.188	0.809	-2.188	0.809	-1.967	1.640	0.169	0.871
	(0.485)	(0.993)	(0.485)	(0.993)	(0.604)	(0.999)		
omr	-0.674	-1.588	-0.674	-1.588	-0.769	-1.561	0.209	0.897
	(0.969)	(0.481)	(0.969)	(0.481)	(0.961)	(0.494)		
p^f	0.847	3.472	2.178	2.918	1.761	2.169	0.203	0.969
	(0.999)	(1.000)	(1.000)	(1.000)	(1.000)	(0.999)		
gdp	-1.745	-0.121	-1.745	-0.121	-2.754	-0.553	0.195	0.792
	(0.716)	(0.941)	(0.716)	(0.941)	(0.220)	(0.871)		

Note: The values in parenthesis are the p-values. * Significant at 5 percent level of significance. bmr stands for black market rate. p^l is local price level. omr stands for official exchange rate. p^f is foreign price level. gdp stands for gross domestic product.

Based on the results without the inclusion of the trend, it is therefore possible to reject the null hypothesis that there is no unit root in the series. The results of the KPSS test also show that relative to the critical values obtained from the analysis, the series are not stationary when trend is excluded. To identify the integrated order of the variables, the first difference of each variable is tested again and the results are shown in Table 6.2.

Table 6.2: Unit Root and Stationary Tests of the First Difference

Variables	ADF(AIC)		ADF (SIC)		PP		KPSS	
	With	Without	With	Without	With	Without	With	Without
bmr	-4.242***	-4.136***	-12.248***	-12.191***	-12.562***	-12.107***	0.074	0.127
	(0.008)	(0.002)	(0.000)	(0.000)	(0.000)	(0.000)		
p^l	-5.307***	-4.824***	-5.307***	-4.824***	-5.149***	-4.773***	0.077	0.501**
	(0.0003)	(0.000)	(0.0003)	(0.0002)	(0.0006)	(0.0003)		
omr	-6.436***	-6.203***	-6.436***	-6.203***	-6.435***	-6.183***	0.093	0.298
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)		
p^f	-0.687	1.074	-4.874***	-4.253***	-4.874***	-4.204***	0.219***	0.425**
	(0.967)	(0.996)	(0.001)	(0.001)	(0.001)	(0.001)		
gdp	-12.178***	-12.161***	-12.178***	-12.161***	-12.359***	-12.183***	0.050	0.144
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)		

Note: The values in parenthesis are the p-values.**Significant at 5 and 10 percent levels. *** Significant at all levels. bmr stands for black market rate. p^l is local price level. omr stands for official exchange rate. p^f is foreign price level. gdp stands for gross domestic product.

It can be noted that the p value of the p^1 series under AIC lag selection criterion of the ADF is large. However, the p values of the remaining tests of the same series are small. The p values of ADF under AIC and SIC lag selection criteria as well as the p values of the PP test for all the other variables in the table above is very small particularly without the inclusion of trend in the system. It can, therefore, be accepted the null hypothesis that there is no unit root in all the first differenced series. This indicates that the first difference of each series is now stationary. In other words each series has I (1) and its first difference has I (0). Having examined the integration order of each variable and found each series has I (1), it is now time to conduct cointegrating test.

6.6.2. Cointegration Test

Prior to the estimation procedure of the analysis, it is vital to check whether there is any cointegration between the variables or not. There are different ways of identifying the existence of any cointegrating relationship of different variables. The three main methods are:

1) The Engel and Granger or Augmented Engle–Granger test. Sometimes this is known as residual based test;

2) Phillips and Ouliaris test;

3) Johansen test.

The Engel and Granger method is the simplest method and it involves two steps. The first step is to estimate the regression equation and save the residuals. The second step is to check whether there is a unit root in the residuals using the ADF test (Gujarati, 1995). Similar to the Engel and Granger method, the Phillips and Ouliars test is also based on checking the existence of unit root on the residual. Unlike the Engel and Granger method, however, the Phillips and Ouliars

test does not rely on an ADF test. It relies on Phillip-Perron unit root tests (Karacal, 2005). The Johansen method involves maximum likelihood optimization and allows testing more than one cointegrating relationship (Brooks, 2002). From these methods, Johansen test is selected as it is more applicable and also more widely used than the other methods to identify the existence of cointegrating equations. Under Johansen method, there are two test statistics for a cointegtration test. These are:

1) $\lambda_{trace} = -T \sum_{i=r+1}^{g} \ln(1 - \hat{\lambda}_i)$

2) $\lambda_{trace} = -T \ln(1 - \hat{\lambda}_{r+1})$

According to Brooks (2002), λ_{trace} is a joint test. The null and alternative hypotheses under λ_{trace} are:

H_0: the number of cointegrating vector is less than or equal to r

H_1: the number of cointegtrating vector is more than r

where r could be less than or equal to k-1, k is the dimension of the vector. Most of the time, it is unlikely to get k cointegrating relationships. If k cointegrating relationship is found, it means all the variables are stationary which in reality is rare to happen. In contrast to λ_{trace}, λ_{max} conducts separate tests as Brooks (2002) pointed out. The null and alternative hypotheses are:

H_0: the number of cointegrating vector is r

H_1: the number of cointegrating vector is r+1

The results of the application of the above two test statistics of the Johansen method and its independent variables are listed in Table 6.3 and Table 6.4 respectively.

Table 6.3: Cointegration Test using λ_{trace} Statistic

Null Hypothesis	Alternative	OMR	BMR	5 % Critical Value
H_0: $r = 0$	H_1: $r \geq 1$	108.376* (0.002)	103.080* (0.003)	88.803
H_0: $r \leq 1$	H_1: $r \geq 2$	68.968* (0.023)	63.988* (0.048)	63.876
H_0: $r \leq 2$	H_1: $r \geq 3$	40.256 (0.076)	41.0334 (0.076)	42.915
H_0: $r \leq 3$	H_1: $r \geq 4$	23.633 (0.092)	21.742 (0.150)	25.872
H_0: $r \leq 4$	H_1: $r \geq 5$	10.483 (0.141)	12.517 (0.672)	12.517

Note: the results in parenthesis are the p-value. OMR stands for official market rate. BMR stands for black market rate.
*Significant at 5 percent level of significance.

The cointegration test results using λ_{trace} Statistic shown in Table 6.3 above indicate that there are two cointegrating equations regardless of using the exchange rate of official market or black market. The results of λ_{max} Statistic listed in Table 6.4, however, show that there is one cointegration when both official and the black market rates of exchange are used in the model.

Table 6.4: Cointegration Test using λ_{max} Statistic

Null Hypothesis	Alternative	OMR	BMR	5 % Critical Value
H_0: $r = 0$	H_1: $r = 1$	39.408* (0.062)	39.091* (0.040)	38.331
H_0: $r \leq 1$	H1: $r = 2$	28.711 (0.205)	22.954 (0.421)	32.118
H_0: $r \leq 2$	H_1: $r = 3$	16.622 (0.424)	19.291 (0.286)	25.823
H_0: $r \leq 3$	H_1: $r = 4$	13.149 (0.258)	17.268 (0.098)	19.387
H_0: $r \leq 4$	H_1: $r = 5$	10.483 (0.141)	4.473 (0.672)	12.517

Note: the results in parenthesis are the p-value. OMR stands for official market rate. BMR stands for black market rate.
*Significant at 5 percent level of significance.

6.7. The Estimated Results

The co-integration testing clearly identified more than one co-integrating vector. The existence of co-integrating equations indicates the existence of a long-run relationship linking the variables. To find out which variables are co-integrated, imposing normalizing and zero restriction is carried out. After identifying the co-integrated equations then estimation is conducted. The findings of the literature reviewed so far indicate that while partial dollarization helps reduce inflation in some economies, it increases inflation in some other economies. It can, thus, be easily seen that there is no generic outcome and conclusion when it comes to the influence of partial dollarization on inflation of an economy. To find out whether partial dollarization has positive or negative influence in the Eritrean economy, a VECM along with DOLS have been applied to the inflation model developed in this chapter. Moreover, both short-run and long-run analysis of the variables discussed in the model is made. The following sub-topics discuss the finding of the long-run relationship as well as the short-run relationships respectively.

6.7.1. The Long-Run Relationships

In analyzing the long-run relationship of the variables in the inflation model, both types of exchange rates are included to represent the exchange rate variable. This has been done to see the difference in the findings of using either official or black market exchange rates. Besides, as has been discussed in the previous chapter, the official exchange rate is fixed from the year 2003 apart from one rise in the year 2005. This, consequently, might have some impact on the findings. For this reason, the black market exchange rate has been included to see the effect.

The findings are reported in Table 6.5. The cointegration test results indicate the presence of two cointegrating equations. The dependent variable of the first cointegrating equation is inflation which is represented by p^l. The dependent variable of the second cointegrating equation is dollarization which is represented by h. To estimate the two cointegrating equations, a Vector Error Correction restriction is imposed and it has been found that the restriction is binding and found all the cointegrating vectors as reported in the table.

In the long run, the inflation equation under the official market rate (OMR) of the foreign exchange shows that dollarization has positive influence on the price level. The parameter is statistically significant as can be seen from the results of the t-ratio reported in the bracket. The result of the official exchange rate parameter also has positive influence on the price level. However, as can be seen from the t-ratio, the parameter is statistically insignificant at all levels of significance. The coefficient of the foreign price level shows that the price level in Eritrea increases with the increase in the price level of the trading partners. The t-ratio of the parameter indicates that this result is statistically significant.

In the dollarization equation, only the local price level and gross domestic product is included in the cointegrating equation. As can be seen from the results, the local price level increases dollarization as the parameter is positive and statistically significant. This finding is consistent with the findings of the studies on the impact of domestic inflation on dollarization. Both theoretically and empirically, many scholars have shown domestic inflation as one of the determinant causes of dollarization. The experience of high inflation that led to either partial or full dollarization of some Latin American countries, Asian and European countries can be mentioned here as an example. The gross domestic

product parameter indicates a negative relationship of dollarization with gross domestic product. This means that an increase in gross domestic product decreases dollarization. However, the result is only significant at 10 percent level of significance.

Table 6.5: The Long Run Relationship Results

Variables	OMR		BMR	
	p^l	h	p^l	h
p^l	1	0.9189 (0.1411) [-6.5122]	1	1.7277 (0.3815) [-4.5291]
h	0.7225 (0.0519) [-13.8967]	1	0.3143 (0.0836) [-3.7613]	1
omr	0.13013 (0.1284) [-1.0132]	0	0	0
bmr	0	0	0.3292 (0.1031) [-3.1923]	0
p^f	0.7449 (0.2076) [-3.5879]	0	0.8445 (0.0861) [-9.8073]	0
gdp	0	-0.3521 (0.1796) [1.9602]	0	-1.1436 (0.2877) [3.9756]

Note: the results in parentheses are the standard errors. But the results in brackets are the t-ratios. OMR stands for official market rate. BMR stands for black market rate. p^l is local price level. h is a hard currency index. p^f is foreign price level. gdp stands for gross domestic product.

As can be seen from the table, the results of the cointegrating equations are quite similar when the black market rate (BMR) of exchange is used. The coefficient of dollarization is positive and is statistically significant which shows that the price level increases with the increase of dollarization. Unlike the results of the inflation equation with the inclusion of OMR, however, the coefficient of BMR is positive and statistically significant. This indicates that the exchange rate of the black market has positive influence on the price level of the Eritrean economy in the long run. This means that as the Eritrean currency depreciates or

the foreign currency appreciates, it fuels the price level in the economy. This is partly due to the excessive reliance of the economy on imports. Like the findings of the model that includes the official market rate, the foreign price level has also the same effect on the Eritrean price level when the black market exchange rate is used instead of the official rate. That is, an increase in inflation of a trading partner increases the price level in the Eritrean economy regardless of whether the black market exchange rate or official exchange rate is used in the model.

In the cointegrating equation of the dollarization, the coefficient of the local price level when the black market exchange rate is used has a similar effect as when the official market rate of exchange is used. In that, the coefficient is positive and statistically significant which signifies that an increase in the local price level increases dollarization. In contrast to the results when the official exchange rate is employed in the dollarization equation, the coefficient of gross domestic product under the black market exchange rate is now statistically significant and negative.

6.7.2. Short Run Relationships

This study follows the procedure adopted by the IMF Country Report (2003) which estimated the long-run relationships of the variables using the VECM and the short-run relationships of the variables using Ordinary Least Squares (OLS) in the existence of only one variable which is not weakly exogenously related to the cointegrating vector. However, instead of OLS, this study employs Dynamic Ordinary Least Squares (DOLS) in the short run estimation. DOLS is a reformed version of OLS which was generalized by Stock and Watson (1993) and avoids the problem related with endogeneity of the variables as pointed by Kiltgaard (1999). As in the analysis of the long-run

relationships, data from both the official as well as the black markets have been used to represent the exchange rate variable. The results are reported in Table 6.6. As the results in the table depict, dollarization has a positive impact in the short run regardless of what type of exchange rate is used. This means that in the short run, inflation increases with the increase of dollarization in the Eritrean economy. Although the official exchange rate has a positive impact on inflation in the short run, it is statistically insignificant as can be seen from the result of the t-ratio. The result of the black market exchange rate, however, shows that it has a positive and significant effect on inflation in the short run. Under both types of exchange rate, foreign inflation has a positive effect on inflation in the short run but as can be seen from the results of the t-ratio the coefficient is statistically significant only when the official exchange rate is utilized.

The error correction term is denoted by ECT_{t-1}. For both types of exchange rates, the ECT_{t-1} is negative and statistically significant. The results show that about 7.6 percent and 7.2 percent of the disequilibrium is corrected in the first period when official and black market exchange rates are used respectively to represent the exchange rate variable in the model. The negative sign of the error correction term signifies that there is an adjustment back to the long-run relationship in successive periods to remove the discrepancy in the short run. The negative error correction term also shows that the adjustment process is stable and convergent towards the long-run equilibrium which implies that there is guaranteed long-run relationship between inflation and the remaining variables including dollarization.

The presence of long- and short-run relationship between inflation and dollarization suggests that policy makers should take dollarization into

consideration in the process of fighting inflation in the Eritrean economy. As long as dollarization is a monetary phenomenon, its relationship with inflation indirectly affirms that inflation is a monetary phenomenon. There is, therefore, a lesson for the Central Bank of Eritrea in its money management of the economy.

Table 6.6: The Short-Run Relationship Results

Variables	OMR Δp^l	BMR Δp^l
Δp^l_{t-1}	0.63	0.57
	(0.233)	(0.107)
	[2.735]	[5.277]
Δp^l_{t-2}	-0.25	-0.37
	(0.185)	(0.079)
	[-1.325]	[-4.828]
Δp^l_{t-3}	0.19	0.19
	(0.090)	(0.056)
	[2.079]	[3.461]
Δp^l_{t-4}	0.20	-0.02
	(0.065)	(0.045)
	[2.996]	[-0.497]
Δh_t	0.07	0.07
	(0.032)	(0.031)
	[2.181]	[2.121]
Δomr_t	0.12	
	(0.133)	-
	[0.095]	
Δbmr_t		0.34
	-	(0.131)
		[2.585]
Δp^f_t	0.68	0.29
	(0.276)	(0.489)
	[2.489]	[0.588]
ECT_{t-1}	-0. 076	-0.072
	(0.027)	(0.032)
	[-2.819]	[-2.686]

Note: the results in parentheses are the standard errors. But the results in brackets are the t-ratios and are based on HAC. OMR stands for official market rate. BMR stands for black market rate. p^l is local price level. h is a hard currency index. p^f is foreign price level. gdp stands for gross domestic product. ECT is an error correction term.

To examine the robustness of the results, a diagnostic test is carried out by checking the actual values against the fitted values of the dependent variable. The best way of looking at the actual versus fitted values is to plot the values together with the residual values. Figure 6.5 shows the results when official exchange rate is included in the model. While the actual and fitted values are plotted against the vertical axis on the right, the residuals are plotted against the left vertical axis.

Figure 6.5: Actual, Fitted and Residual Values of the Dependent Variable-OMR
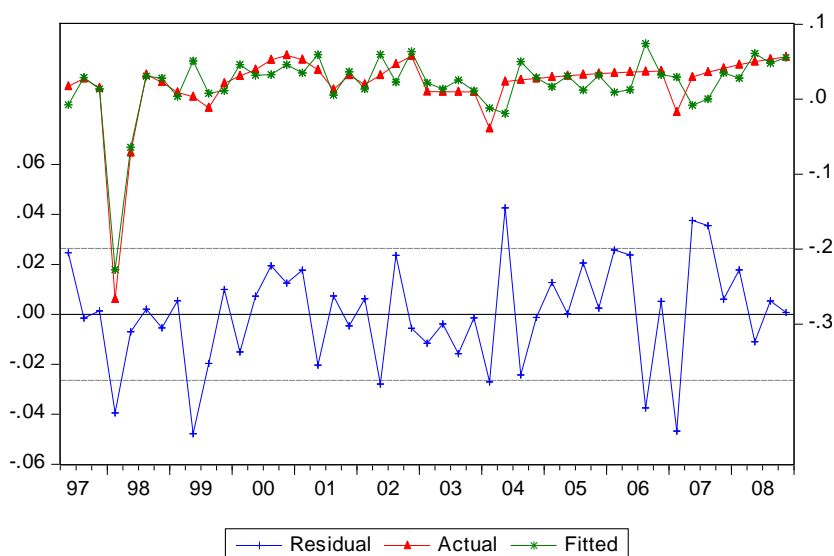
It can be seen from the figure that the fitted values are very close to the actual values. Although in some cases the fitted values are above or below the actual values, it can be inferred that on average there is a good fit of the model. The plot of the residuals shows that, on average, the residuals in absolute values are very small. There are very few residuals which are beyond the boundary value which confirms that the fitness of the actual and estimated values of the dependent variable is well.

In order to see how well the model with the inclusion of black market exchange rate (BMR) fits, the same diagnostic test is carried out. The results are demonstrated in Figure 6.6. It is evident from the figure that the fitted values

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cover the actual values quite closely. As in Figure 6.5, there are some departures of the fitted values above or below the actual values but the departures are not large. The residuals' plot again shows that the values are very small and very few values are beyond the boundary. This indicates that the model explains the actual values of the dependent variable quite well.

Figure 6.6: Actual, Fitted and Residual Values of the Dependent Variable-BMR
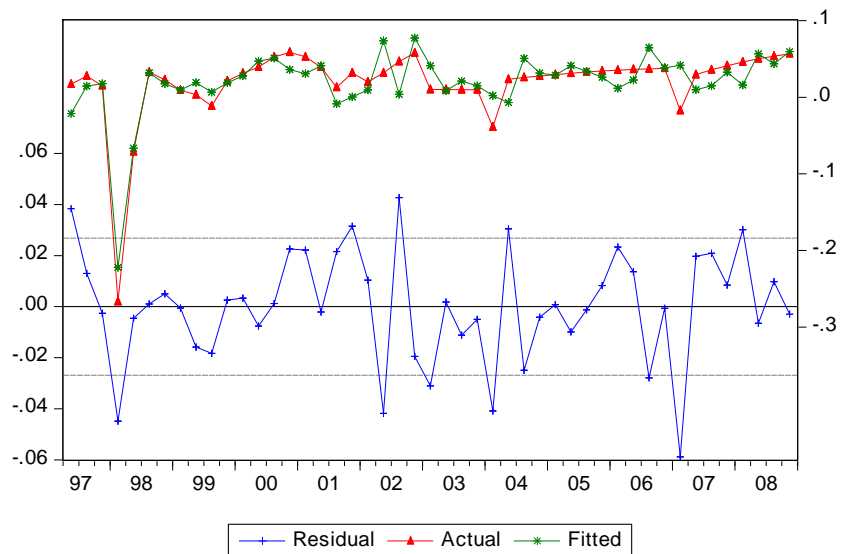
6.8. Conclusion

The conventional theories of inflation concentrate their studies on monetary, real and structural factors in investigating the determinants of inflation. Such studies, however, overlook the influence of dollarization on inflation. Although inflation might not be the byproduct of dollarization, it is likely to be fueled by the degree of dollarization in the economy. As a result, many contemporary studies of inflation devote their efforts to analyzing the effect of dollarization on inflation. The findings of these studies show that full dollarization reduces inflation in general. Partial dollarization on the other hand may or may not reduce inflation.

While some of the studies reviewed so far have found that partial dollarization reduces inflation, others have found the opposite. Particularly those studies that incorporate the exchange rate pass-through effect in the dollarized economy show that inflation is high in partially but highly dollarized economies. This chapter provides potential economic reasons for the discrepancies in the findings of the literature on partial dollarization. In addressing that, this study has noted that the balance sheet effect, the purchasing power effect, which may or may not lead to real dollarization and the currency substitution effect could be the potential explanation.

In this chapter, an analysis of the effect of partial dollarization on the Eritrean inflation is carried out. Before examining the effect of dollarization on inflation, the dynamics of inflation in Eritrea was investigated first. It has been observed that inflation in Eritrea has been a major economic problem. The average annual inflation rate jumped from 4.6 in the 1980s, prior to the

dismantling of the Derg regime, to 8.83 in the 1990s. It continued to grow rapidly especially after 1997, reaching its maximum in 2004 which was 25.11.

The rises in the aggregate demand in the early development stage of the economy as well as the devaluation of the Birr in 1994 are some of the factors that drive high inflation. Moreover, inflation has been fueled due to the independence of the monetary system expressed in the form of new currency issuance and the second war with Ethiopia. The persistent devaluation of the new currency together with unexpected expansion of the monetary policy have also played their role. In addition to this, expansionary fiscal policy in the form of the rise in the government expenditure from an average of 32.7 percent of total GDP prior to 1997 to an average of 54.3 percent of total GDP in the period 1998 to 2004 has been another factor.

Besides the factors mentioned above, dollarization has been identified as an influential factor in the Eritrean economy. To analyze the relationship between inflation and dollarization, an inflation model is constructed first. The estimation result of the cointegration equation showed that dollarization has a positive effect on inflation both in the short run and the long run. This shows that Eritrea's partial dollarization has not led the economy into complete real dollarization which otherwise might ease the growth of inflation in the economy. The error correction term is negative implying that the adjustment process towards the long-run equilibrium is stable and convergent. These results are in line with the majority of the findings in the existing literature on partial dollarization.

Appendix

6.1: Balance Sheet Effect Framework
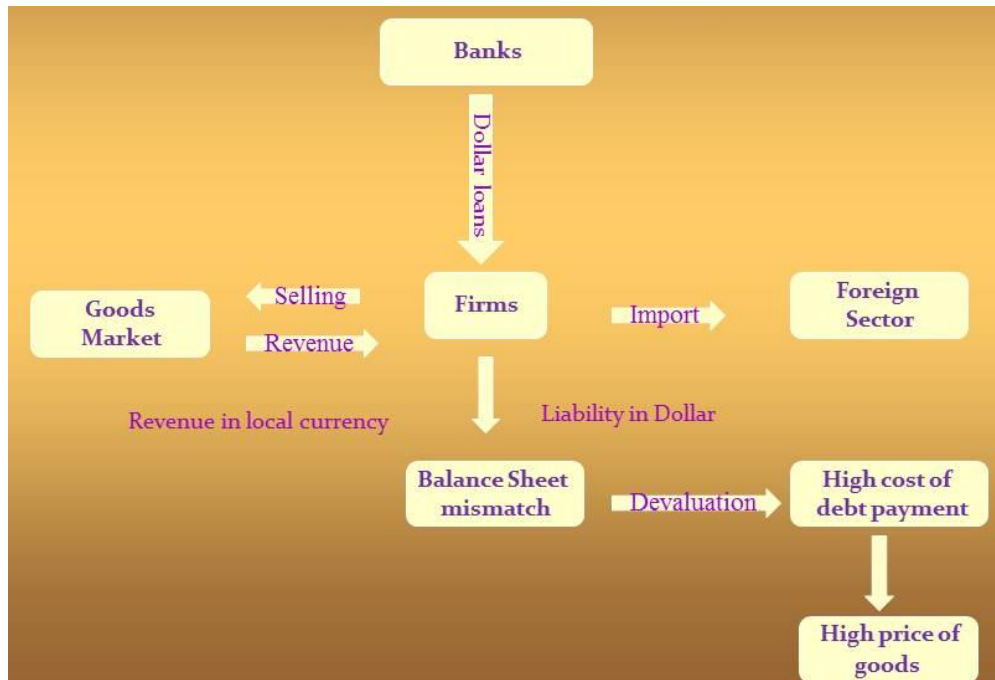
6.2: Purchasing Power Effect Framework

Chapter 7- Does Dollarization Facilitate or Complicate the Monetary Policy Transmission Mechanisms?

7.1. Introduction

Monetary policy is one of the most powerful and influential policy instruments available for an economy through which macro-economic and financial systems can be controlled or damaged depending on its design. A flawless and carefully designed monetary policy might assure sound economic and financial systems. On the other hand, a monetary policy that is built on less consideration of the factors that affect its effectiveness might have a counter effect. In order to run a healthy economy, therefore, it is crucial to understand how monetary policy works, through what mechanisms its policy actions are transmitted, what factors affect its transmission mechanisms, which channels are most effective and why they are effective.

The effectiveness of monetary policy relies on the effectiveness of its transmission mechanism through which monetary policy instruments achieve the objectives of monetary policy. A smooth transmission mechanism smoothes the process of achieving monetary policy objectives, whereas complicated transmission mechanism hinders its effectiveness. The smoothness or the vagueness of the transmission mechanisms are determined by, among other things, the degree of dollarization, the level of financial institutions development, the extent of capital inflow, the degree of monetization and the size of the banking system. This research specifically examines whether dollarization impedes or expedites the transmission mechanisms and thereby the effectiveness of monetary policy.

From the literature, it is clear that previous studies in this area are debatable and divisive. The conventional view is that dollarization restrains the transmission mechanisms and hence the effectiveness of the monetary policy in terms of achieving its targeted policy objective. While recent studies by scholars such as Isakova (2008), Dabla-Norris and Floerkemeier (2006), Acosta and Coble (2011) adhere to this view, other studies by Armas and Grippa (2005), Leiderman et al., (2006) strongly differ from this. The studies on African economies by Buigut (2009) and Mugume (2011) also show weak interest rate channel and ineffective exchange rate and credit channels. Cheng (2006) and Ngalawa (2009), on the other hand, show different results. In the author's view, whether these studies oppose or support the conventional view, they have commonly missed certain things which might make some difference in the study of monetary policy and its transmission mechanisms.

First, on the literature outlined above, the word effectiveness is merely used as achievement without considering the time spent to achieve and the stability of the achieved policy objective. Second, more emphasis is given to low inflation. Monetary policy, however, does not only have this target, but also stable financial and exchange rate systems. Third, relative comparison of pre- and post-dollarization's performance of the monetary policy transmission mechanisms using econometric techniques is absent.

This study develops the debate by considering the case of Eritrean monetary policy transmission mechanisms. It should be noted here that there are fewer studies on the African economies than there are on transition and emerging economies. It should also be noted that neither the studies on the transition and emerging economies, nor the studies on the African economies reviewed so far

has covered the Eritrean monetary policy transmission mechanisms. This study, therefore, is the first study and expected to contribute to the broad literature. It is also expected to provide information to the policy makers of Eritrea to help improve the economy. A brief descriptive analysis of the monetization and financial intermediation of the banks measured as a percentage of gross domestic products shows an exceptional growth of domestic credit relative to other indicators. The share of the private sector credit, however, is negligible compared to the share of the government sector credit.

The main monetary policy instrument used by the Bank of Eritrea is the reserve requirement ratio which originally was 20 percent but later on dropped to 10 percent. The Bank of Eritrea also uses the government treasury bills traded at a rate of 3 percent prior to March 2006 and 2.5 percent thereafter. For this reason, reserves are used in the empirical analysis. Quarterly data from 1996 to 2008 are used and a Vector Autoregressive (VAR) model has been applied together with the Toda and Yamamoto (1995) procedure.

As is the case in most dollarized economies where the official exchange rate is most effective, this study finds that there is an effective exchange rate channel through the black market rate in terms of managing prices. Unlike the studies of most dollarized economies, however, this study finds an effective credit channel. When the base line model is examined by adding government and private sector's credit separately, the source of the effectiveness has been found in the government sector's credit. Except for the exchange rate channel, the results with respect to prices are similar when the Toda and Yamamoto procedure is used. In terms of the output, however, the results indicate insignificant impulse responses of the output to all the shocks given in the system.

The next section provides the literature review followed by the monetary policy and its transmission mechanisms in Eritrea. Section 7.4 discusses the model specification followed by data collection. Section 7.6 details the estimation method. The findings are reported in Section 7.7. The conclusion is given in section eight.

7.2. Literature Review

The study of monetary policy and its transmission mechanism is a broad research area and it has been extensively covered by many researchers. This research has critically scrutinized some of the literature on their findings and discussions against the fundamental economic theories and reasons on the effectiveness of monetary policy and its transmission mechanisms with respect to dollarized economy. Before proceeding to the critical discussion of the findings in the literature, however, it is important to address what the monetary policy transmission mechanisms are, what factors affect the monetary policy transmission mechanisms, how dollarization affects the monetary policy transmission mechanisms, why some channels are more effective than others and what the central banks need to do under dollarization. The literature review is structured as follows: first the what, how and why questions on the monetary policy transmission mechanisms are discussed followed by the discussion of the empirical findings. At last, the gap in the literature is reflected.

7.2.1. Theories

7.2.1.1. What are the Monetary Policy Transmission Mechanisms?

Monetary policy transmission mechanisms refer to the different ways through which monetary policy operating targets are transmitted to have influence on inflation, growth and financial systems. Although the transmission mechanisms differ across countries, Dabla-Norris and Floerkemeier (2006) discuss six channels in general. These are the *interest rate channel, exchange rate channel, bank lending channel, balance sheet channel, asset price channel and expectation channel* (Dabla-Norris & Floerkemeier, 2006; Horvath & Maino, 2006; Samkharadze, 2008).

The interest rate channel works primarily through the influence of the policy rate on the market interest rates, such as the lending and deposit rates. It then affects the level of investment, consumption and savings through which prices and outputs are influenced. *The Exchange rate channel* on the other hand operates through the impact that the changes in monetary policy and/or direct foreign exchange market intervention have on the exchange rate movements. As the exchange rate moves, so do the prices of imported goods and the volume of imports and exports which in turn changes the aggregate output.

The bank lending channel was developed by Bernanke and Blinder (1988, 1992) and affects inflation and aggregate output through the amount of loans rather than the cost of loans. A change in the monetary policy, for instance, changes the banks' reserve and this changes the amount of loans available for firms and households. The fourth channel, *the balance sheet channel,* works through the impact of monetary policy on the net worth of firms and households.

Contractionary monetary policy reduces the financial as well as physical asset prices, net worth of firms and households, the collateral value and credit worthiness. As a result of these reductions, the level of lending reduces which reduces consumption and investment and thereby changes the aggregate output and inflation.

The asset price channel functions through the Tobin's q theory of investment and the wealth effects on consumption which is based on the life cycle model of Modigliani (Mishkin, 1995). A contractionary monetary policy reduces price of equity which reduces Tobin's q and wealth. The reduction in Tobin's q reduces investment and the reduction in wealth reduces consumption which in turn reduces aggregate output. The last channel is *the expectation channel*. This channel works through the impact that monetary policy has on the confidence and expectation of firms, banks, households and the public sector about future economic conditions. More detailed discussions on all the channels can be found in the studies by Dabla-Norris and Floerkemeier (2006), Horvath and Maino (2006) and Samkharadze (2008).

Having seen the different channels, it is essential to find out what factors affect these channels. In addition to dollarization, the channels are affected by the level of financial institution's development, the extent of capital inflow, the degree of monetization, the size of the banking system measured as the ratio of bank assets and deposits to GDP as well as bank credit to the private sector. The existence of administered economic and financial system in terms of exchange rate, interest rate, credit and price control can also affect the transmission mechanisms. In addition to all this, the presence of excessive reserve, shadow economy and remittance can also have their impact on the transmission

mechanisms. Although it is essential to discover how these factors might play their role in the transmission mechanisms, this study is particularly interested in how dollarization can affect the transmission mechanisms and in what ways.

7.2.1.2. How Does Dollarization affect the Transmission Mechanisms?

Dollarization creates currency mismatch in the balance sheet of banks, if they are receiving dollar deposits but not issuing dollar loans. Dollarization also makes exchange rate more volatile and money demand more unstable, Havrylyshyn and Beddies (2003). The volatility of the exchange rate together with the instability of the money demand makes banks, firms and households vulnerable to currency risk or exchange rate risk in times of expansionary policy.

The presence of currency mismatch coupled with the exchange rate risk might make firms, households and banks unable to cope with their debt payments and hence cause credit risk. While the credit risk affects the availability of credit and therefore the lending channel, the default itself reduces credit worthiness and the effectiveness of the balance sheet channel. Moreover, the volatility of the exchange rate and the instability of money demand make individuals less sensitive to changes in the domestic interest rate. The interest rate, therefore, becomes less effective in the presence of dollarization.

One might argue that these outcomes are only in times of expansionary monetary policy. What if there is contractionary monetary policy, will dollarization impede the effectiveness of monetary policy? The answer to this question depends on what contractionary monetary policy leads to. If contractionary monetary policy encourages liability dollarization, then monetary policy might be less effective. There are two ways whereby contractionary

monetary policy leads to liability dollarization. First, if domestic interest rate is higher relative to the interest rate on foreign currency then individuals tend to shift to dollar loans. Second, since domestic currency appreciates with the rise in the domestic interest rate, the debt payment on dollar loans becomes cheaper. This reduces the domestic credit and, therefore, might weaken the credit channel.

The discussion of how dollarization affects the transmission mechanisms reported above in some ways answers the question why some of the channels are more effective than others. The existence of dollarization generally makes the credit, balance sheet and interest rate channels less effective, while the exchange rate channel is more effective. Openness, remittance and availability of external funds for loans give individuals a wider opportunity to finance their consumption as well as investment. As a result, even if there is a change in domestic monetary policy, the response might be slow which makes the interest rate and lending channels less effective.

7.2.1.3. What Should the Monetary Authorities do under Dollarization?

It has been noted that dollarization makes the exchange rate more volatile. Therefore, the monetary authorities should ensure the stability of the exchange rate through direct intervention in the foreign exchange market. This "leaning against the wind" action or "fear of floating" according to Calvo's terminology, however, is effective only if the economy does not run black or parallel markets for exchange rate. Using a quarterly forecasting model for the Peruvian economy, Rossini and Vega (2008) show that contractionary monetary policy reduces inflation more with monetary authorities' intervention than without.

As also pointed out by Armas and Grippa (2005) the monetary authorities should have to maintain high levels of international reserve. Maintaining high level of international reserve helps the monetary authorities to intervene in the foreign exchange market in times of buffering the instability. It also guards banks against bank run in times of having not enough foreign currency assets that backs their foreign currency liabilities.

In addition to fear of floating and maintaining high levels of international reserve, the monetary authorities might impose a high reserve requirement ratio on foreign currency. Requiring banks to lend their dollar deposits to credit worthy foreign banks, as in the case of Croatia, is also effective in helping banks minimize currency mismatch, currency risk and credit risk. Moreover, requiring banks to issue dollars only to firms that potentially generate dollars is essential.

7.2.2. Empirical Findings

The effectiveness of monetary policy indirectly implies the effectiveness of the channels through which its operational targets are transmitted. If monetary policy is effective, it means the channels are effective enough to transmit the required operational target and attain the policy objectives. The opposite is true if it is less effective. The conventional or widely held view on dollarization and monetary policy is that dollarization impedes the effectiveness of monetary policy. This view is based on the early studies of currency substitution. Although this view has been debated by many scholars, empirical evidence has shown the ineffectiveness of most of the transmission channels as a result of dollarization.

7.2.2.1. Findings in Favour of the Conventional View

Among others, Mora (2007), Samkharadze (2008) and Isakova (2008) find a weak credit channel as a result of dollarization in Mexico, Georgia and countries of central Asia such as Kazakhstan, the Kyrgyz Republic and Tajikistan. In particular, Mora (2007) finds that the Mexican banks with higher foreign currency deposits are less sensitive to domestic monetary shocks but highly sensitive to the U.S. interest rate shocks. The study by Ghalayini (2011), employing Granger causality test, also finds that dollarization has negative impacts on the effectiveness of monetary policy.

Similarly, using VAR models, Isakova (2008), Horvath and Rodolfo (2006), Dabla-Norris and Floerkemeier (2006), and Acosta and Coble (2011) find a weak interest rate channel but strong exchange rate channel due to dollarization in Kazakhstan, the Kyrgyz Republic, Tajikistan, Belarus, Armenia, Peru and Uruguay respectively. Ize and Yeyati (2005) have also pointed out that the interest rate channel is less effective if there is dollarization. Apart from these scholars, Balino et al., (1999) and Alvarez-Plata and Gracia-Herrero (2008) have also argued that the pursuit of consistent and independent monetary policy is challenging as a result of dollarization. In line with these arguments, Isakova (2008) finds the hindrance of effective transmission of the monetary policy instruments in the economies of Central Asia as a result of dollarization.

7.2.2.2. Discussions against the Conventional View and Counter Arguments

A) The Issue of Asset versus Currency Substitution

Of those who disagree with the conventional view, Quispe (n.d.) as well as Billmeier and Banoto (2004) distinguish currency and asset substitution and argue that if dollarization takes the form of asset substitution, it does not hamper the effectiveness of monetary policy. This is because domestic currency is still used as a medium of transactions even if there is asset substitution which is merely the holdings of dollars as a store of value. In contrast, if dollarization takes the form of currency substitution then it does hinder the effectiveness of monetary policy mainly due to the function of foreign currency as a medium of domestic transaction.

It should be noted here that although it is important to distinguish the two forms of substitutions, it is also equally important to understand the interdependence of the loan and dollar deposits. The presence of asset substitution implies that banks are receiving dollar deposits unless individuals are holding dollars under mattresses. As a result, banks are encouraged to issue dollar loans due to their risk adverse behaviour. The issuance of dollar loans, therefore, might cause credit risk in times of expansionary monetary policy due to currency risk resulting from devaluation. This, therefore, might weaken the credit channel and hence the effectiveness of the monetary policy, even if transactions are settled in domestic currency.

Moreover, it can be argued that if the economy relies more on imported goods, importing firms are most likely to issue dollar denominated debts. Since the cost of borrowing is high for firms that issue dollar loans in times of

devaluation, firms pass on their debt burdens by increasing the price of domestic goods. As a result, even if domestic transactions are conducted using domestic currency, the effectiveness of monetary policy will be affected by the volume of dollar loans issued to the importing sector. It is also important to understand the nature of substitution that exists in a dollarized economy. As pointed out by Horvath and Maino (2006), in the dollarized economy empirical evidence shows that the substitution is not only between domestic currency and dollar assets but also between domestic dollar assets and foreign dollar assets. There is, therefore, a leakage of domestic credit in the form of capital outflow resulting in a very small rise in credit to the private sector.

Whether dollarization takes the form of currency substitution or asset substitution, it should be noted that dollarization makes the demand for domestic money more volatile, as noted by Balino et al., (1999). Dollarization also makes the demand for reserve money more sensitive to the variation in exchange rate as well as monetary expansion, as Yeyati (2006) argues. Dollarization also inflates the exchange rate volatility, as Calvo and Carlos (1996), as cited in Schaub (2009) indicate. In comparison to the argument of Quispe (n.d.) and Billmeier and Banoto (2004), therefore, these factors can weaken the effectiveness of monetary policy transmission.

In addition to what has been discussed so far, the argument that monetary policy is effective if dollarization takes the form of asset substitution seems to overlook the inability to control the broad money due to the presence of the foreign currency component within the broad money. The inclusion of foreign currency in the broad money usually complicates the effectiveness of the central banks in controlling inflation and also other monetary policy objectives.

Controlling narrow monetary aggregates can also be hard, as shown by Zamaroczy and Sa (2003) in the case of Cambodia, which hinders the effectiveness of the monetary aggregate channel.

B) The Issue of Inflation Targeting and Dollarization

Another argument by those who oppose the conventional view is that dollarization has not prevented Peru from successful implementation of its inflation targeting monetary policy (see Armas & Grippa, 2005; Leiderman et al., 2006 and Rossini & Vega, 2005). Careful examination of the case of Peru in the study by Leiderman et al., (2006), Quispe (n.d.), Armas and Grippa (2005), however, indicates firstly that the successful reduction of inflation in Peru cannot be attributed to monetary policy inflation targeting alone. Fiscal policy was actively used alongside the monetary policy during the stabilization program as the fundamental source of inflation was lack of fiscal discipline. Secondly, from the case analysis, there was a decline in the level of financial dollarization which helped improve the impact of exchange rate pass through. Armas and Grippa (2005), however, attribute the fall in financial dollarization to the adoption of inflation targeting. According to the figures reported in Armas and Grippa (2005), nevertheless, financial dollarization in Peru began to slow down in 2001 whereas inflation targeting began in 2002.

In line with the above studies, Reinhart et al., (2003) have argued that hysteresis (the persistent existence of dollarization while there is low inflation) is "prima facie" evidence of the effectiveness of monetary policy under dollarization. Although this argument seems to be plausible, the fact that dollarization is driven by the instability of inflation should not be forgotten. Even if inflation is low, its volatility might not be so if dollarization continued to exist

in the economy. According to the finding of Ize and Yeyati (2005), hysteresis exists if the expected volatility of inflation is higher than the expected volatility of exchange rate. The notion that hysteresis implies the effectiveness of monetary policy while inflation volatility exists, therefore, remains for further consideration.

It is vital to note here that inflation, as pointed out by Schaub (2009), is more volatile and less controllable due to the presence of higher pass through which normally is high with a highly dollarized economy. Even the study by Reinhart et al., (2003), Table 5 and 6, indicates that the average inflation rate is higher and more variable in countries with a high degree of dollarization than in countries with a low degree of dollarization. They have also found that there is high exchange rate pass through in a highly dollarized economy. This evidence contradicts the argument that hysteresis is prima facie evidence of the effectiveness of monetary policy in a dollarized economy.

Like the above studies, Billmeier and Bonto (2004) argue that monetary policy in Croatia, a highly dollarized economy, has been effective in reducing inflation by using the exchange rate as the nominal anchor. It is crucial to mention here that the presence of administered price during the study period, which might partially have contributed to such a finding, has not been considered in the study.

7.2.2.3. Other Studies

On the study of full dollarization and monetary policy transmission mechanisms, Swiston (2011) shows that full dollarization does not preclude the monetary policy transmission mechanisms in El Salvador, Ecuador and Panama. Swiston (2011) also finds that the pass through of the U.S. monetary policy to commercial interest rates in El Salvador is similar to the pass through of the

Central American countries' domestic monetary policy rates to commercial interest rates. Likewise, Uanguta and Ikhide (2002) find effective interest rates as well as credit channels of Namibia in response to the changes in the monetary policy conducted by the South African Reserve Bank.

On the studies of African economies, some empirical findings show both weak interest rate channels and weak credit channels. In particular, by using VAR analysis, Buigut (2009) finds an insignificant interest rate channel in three East African Countries, namely Kenya, Uganda and Tanzania. The study by Mugume (2011) also demonstrates a weak interest rate channel and ineffective exchange rate and credit channels in Uganda. Likewise, Saxegaard (2006) finds a weak transmission mechanism in three Sub-Saharan African countries, namely Kenya, Nigeria and Uganda. Although these studies do not specifically address dollarization in the transmission mechanism of these countries, the economies are recognised as dollarized economies. It is, therefore, likely that dollarization, together with the financial and economic structures of these economies, might have contributed to their findings. Among other factors, the study by Christensen (2011) points out that an underdeveloped financial market has undermined the monetary policy transmission mechanisms in most African countries, including the financially developing low income African countries of Angola, Ethiopia and Malawi.

Slightly different from these studies of the African economies, the results of Cheng (2006) indicate that while prices respond significantly to the changes in the short-run interest rate, output reacts insignificantly in the Kenyan economy. The study by Ngalawa (2009) suggests strong responses by prices to the changes

in the exchange rate in Malawi. Prices, however, react weakly to the monetary variables, namely the bank rate and reserve requirement ratio.

7.2.3. Reflection on the Literature

If the exchange rate channel is most effective in a highly dollarized economy what does that imply in terms of policy implication? Does that mean the central bank should frequently intervene in the foreign exchange market? If the exchange rate channel is effective in a partially dollarized economy as in the above findings, can we say that monetary policy is still effective under partial dollarization using an exchange rate target?

In the author's view, the answer for these questions depends on how long a particular monetary policy takes to achieve its policy objectives. A particular monetary policy might achieve its objectives but whether the achievement was within a reasonable period of time or after spending a lengthy amount of time matters much. It is not only the achievement and the time period spent to achieve the policy objectives that matter most but also the persistence or the stability of the achieved objectives. That is whether or not the attained policy objective lasts for a long period should be considered. So there should be a clear difference between the word "*effective*" that merely implies "*achievement*" and "*effective*" that includes the "*achievement*", "*time spent*" to achieve the objectives and "*stability*" of the achieved objectives. Moreover, it is worth noting that even if the economy uses an exchange rate target, as long as the economy is open and dollarization is an issue, monetary policy might be less controllable due to the influence of foreign interest rates on the exchange rate.

Most of the literature on the inflation targeting monetary policy in the case of Peru and the nominal anchoring of the exchange rate in Croatia have focused on the effectiveness of monetary policy in keeping inflation low. However, monetary policy does not only have one goal even though low inflation could be the primary objective. To see the effectiveness of the monetary policy, other monetary policy objectives should also be considered if data permits. Another important thing that needs to be considered in the study of monetary policy transmission mechanisms is to analyse the transmission mechanisms before and after dollarization and then compare the performance.

7.3. Monetary Policy and its Transmission Mechanisms in Eritrea

As in the economies of many developed countries, monetary policy and its transmission channels are expected to be a useful policy instrument in the general development framework of developing countries. Although the procedure varies from country to country depending on the socio-economic and political settings, there are some generic layouts that some economies could rely on. In this section, an exploration has been made on what kind of monetary policy that the Eritrean economy pursues. Moreover, an examination has also been made on how the Eritrean monetary policy transmission mechanisms look like.

7.3.1. Monetary Policy in Eritrea

Prior to its official independence in 1993, the story of Eritrea's monetary policy was related to the story of monetary policy in Ethiopia. The management of money, including the issuance of currency and its distribution, interest rate and other instrument of monetary policy, was determined by the central bank of Ethiopia. Right after independence, although different proclamations were introduced, the implementation of independent monetary policy was still limited

due to de facto currency union with Ethiopia. In order to have autonomous monetary management, therefore, a new Eritrean currency was introduced. After the introduction of the new currency, the Bank of Eritrea has been able to manipulate money and credit without the influence of the central bank of Ethiopia.

Being independent from the central bank of Ethiopia, the Bank of Eritrea set its own monetary policy objectives. Its main monetary policy objectives, according to the proclamation of Article 5 as reported in the IMF Country Report No 03/166, are to pursue stable prices, maintain a sound exchange rate policy, foster economic growth and promote financial systems. To meet these objectives, the main monetary policy instrument used by the Bank of Eritrea is the reserve requirement ratio. According to the IMF Staff Country Report No 03/166, Eritrean banks were required to hold reserves of 20 percent of local currency deposits without remuneration. In November 2002, however, the reserve requirement ratio reduced to 10 percent due to the need to finance government expenditure. Another policy instrument which was set to 5.5 percent by the Bank of Eritrea in 1994 was the rediscount window. In spite of this, the Bank of Eritrea could not implement this particular policy due to excessive cash holdings of the banks.

In addition to the reserve requirement ratio, the Bank of Eritrea uses government treasury bills as a monetary policy instrument. According to the Bank of Eritrea's information, the bills were traded at a rate of 3 percent. The rate, dropped to 2.5 percent on March 2006 and it has been fixed since then. Initially, the Bank of Eritrea was trading the government treasury bills directly. After the dramatic rise in the financial need of the government due to war and drought,

however, the Bank of Eritrea securitised the government loan and sold it to the commercial banks of Eritrea. An excessive cash holding of the banks, therefore, was observed by excessive financial need of the government.

Although the Bank of Eritrea had these monetary policy instruments available to implement, the performance of the monetary policy with respect to its policy objectives is rather unexpected. The growth of the economy, though impressive in the beginning, was hampered by several factors. According to the IMF World Economic Outlook data, GDP of the country grew by 13 percent and 21 percent in 1993 and 1994. It continued to grow at an average of 10.8 percent prior to the introduction of new currency but dropped to an average of 0.2 percent after the introduction of its currency.[21] The fall in the growth of the economy is primarily due to the unexpected outcome of the war that left multiple side effects in the economy and weakened the effectiveness of monetary policy in the economy.

The performance of monetary policy in terms of inflation control has also been complicated as evidenced from the double digit figures of the inflation rate. Inflation as discussed in the previous chapter was moderate prior to the issuance of the new currency. Since then, it has grown faster and reached to the point that monetary policy is unable to bring it down to what it was. Another outcome through which monetary policy can be evaluated is the exchange rate stability. Although the monetary authority has fixed the official exchange rate, it has encouraged the development of a black market in the economy. The exchange rate in the black market, however, is determined by the demand and supply of the currency within the market which is highly influenced by the international market.

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[21] Average estimation is made from the data reported by IMF Country Report on Eritrea and World Bank group database.

As a result, the exchange rate has been unstable in the black market and it has also been beyond the control of the monetary authority.

Apart from the foreign currency reserve crisis, the accomplishment of monetary policy with respect to its objectives of regulating and managing the financial sector and domestic currency has been reasonable in the economy. This has partly been due to an increase in household savings and deposits that boost the cash holding of the banks. Moreover, the reasonable performance may partly be due to the strict requirements for the issuance of credit to investors.

The overall financial performance including monetization and the financial intermediation of the banks measured as the percentage of gross domestic product is shown in Figure 7.1 below. As can be seen from the figure, there is apparent fluctuation in all the monetary indicators. Although they sharply rise in the second quarter of 2002, they drop and rise again in the consecutive periods. Prior to those periods, there was also a sharp rise and fall in all the monetary indicators in 1998. In particular, there is a drastic fall of the reserves compared to the remaining indicators. Of all the series, the domestic credit has shown exceptional growth relative to the other indicators.

Figure 7.1: Financial Performance of the Eritrean Economy
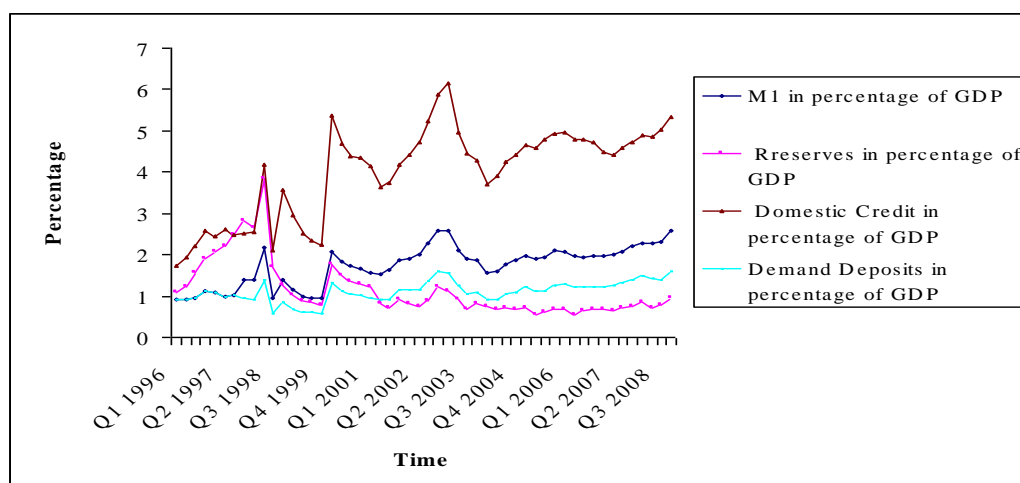
Source: data are collected from IMF, Financial Statistics and then transformed in percentage of GDP.

The exceptional growth of the domestic credit can further be depicted by its constant growth after its brief drop in the first quarter of 2004. Along with the growth of the domestic credit, the figure shows that the demand deposit has also been growing which sustains the financing of the domestic credit. One might infer that the rise in the domestic credit together with the rise in demand deposits indicate sound financial intermediation in the Eritrean economy. It is, however, vital to see the share of the private sector vis a vis the share of the public sector in the overall domestic credit. If the private sector is crowded out by the public sector, the effect of domestic credit on the economy may not be significant.

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Figure 7.2: Government versus Private Sector Credits
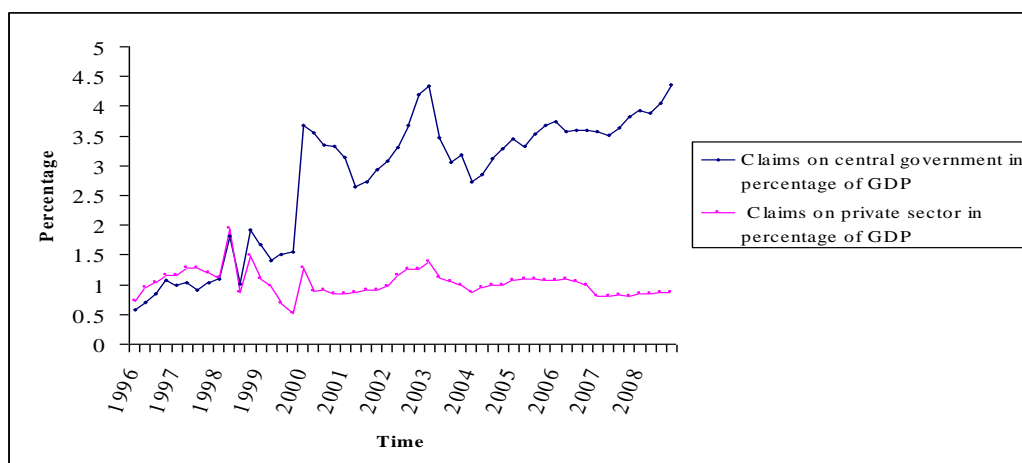
Source: data are collected from IMF, Financial Statistics and then transformed in percentage of GDP.

As can be seen from Figure 7.2, which is a replication of Figure 2.7, prior to 1998 the claims on the private sector measured as the percentage of GDP were higher than the claims on the central government. The claims on the central government, however, grow faster thereafter and reached its high peak in 2003. The rapid increase in the credit issued to the government sector right after 1998 could be due to the need to finance military expenditure in the 1998 war. The persistent rise of the government sector loans after the war, however, shows the fiscal dominance on one hand. On the other hand, it shows that there is fiscal deficit due to a lack of generating enough revenue in the economy. Relatively speaking, the growth of credit issued to the private sector is quite low as shown in the figure. The issuance of less credit to the private sector might be less productive. Possibly, it would have been by far more profitable if more credit was given to the private sector than the government sector, unless the government sector invests on more productive projects.

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7.3.2. The Monetary Policy Transmission Channels

In Eritrea, the channels through which the monetary policy is transmitted to achieve its policy objectives are slightly different relative to the channels of most economies. The absence of the stock market makes the asset pricing channel completely inoperative in the transmission mechanisms. The expectation channel is also not well known due to the absence of a free market economy. The next section discusses whether or not the other channels such as interest rate channel, credit channel and exchange rate channel have potential impact on the Eritrean economy.

7.3.2.1. The Interest Rate Channel

Unlike the economies where the rediscount window is actively used as a monetary policy instrument to control inflation, the Eritrean economy has not been able to use this instrument since its inception. As discussed before, although the Bank of Eritrea set a 5.5 percent of rediscount window right after the official independence, the rate was not implemented due to excessive cash holdings of the banks. It is, therefore, clear that the interest rate pass through does not prevail in the mechanism.

When it comes to the interest rates on loans and deposits, according to article 26 of the proclamation, the initial setting was that these rates were to be determined by the market without any intervention and distortions from the monetary authorities. Based on article 26 of the proclamation, the responsibility of the monetary authority was only to set terms and conditions of the credits and deposits. This, however, was changed later and the rates are now set by the Bank of Eritrea. The rates are fixed for specific periods of time, although they get modified after lengthy periods of time and again remain fixed for another long

period of time. With the constant growth of inflation in the economy, the rigidity of the rates has in fact resulted in the presence of negative real interest rates.

The lending rates on the loans of the government sector are different from the lending rates that the private sector receives. Considering the minimum lending rates on the loans of the private sector, the spread between these two lending rates ranges from 5 to 5.5 percent. The private sector pays far higher interest rates than the government sector. The private sector on the other hand earns more interest on its deposits relative to the government sector as its deposits do not bear any interest. Provided that there is no rediscount window and that there are rigid lending and deposit rates, the interest rate channel is expected to be ineffective in the monetary transmission mechanisms of the Eritrean economy.

7.3.2.2. The Exchange Rate Channel

In order to see how this channel works, it is essential to briefly examine how the Eritrean Exchange Market is framed. Prior to 1991, the Eritrean exchange rate was determined by the central bank of Ethiopia. The exchange rate was framed in such a way that the market forces were constrained to have any impact on its determination. According to the IMF's Financial Statistics report, the exchange rate against U.S. dollars was fixed at 2.07 during the entire 1980s. Despite the operation of the official market at this fixed rate, there was an unofficial market running in the economy to meet the demand of small importing businesses. The official rate continued to be fixed at 2.07 during 1991 but devalued to 5.0 towards the end of 1992 and remained fixed up until mid-1994. From then onwards, managed floating exchange rate system was adopted by the Ethiopian monetary authority to which the Eritrean monetary authority had to follow the suit. It is important to mention here that although the Eritrean banks

were following the suit, the Eritrean exchange market was liberal while the Ethiopian exchange market was highly regulated during those periods.[22]

A completely different exchange rate system framework was established by the Bank of Eritrea after complete monetary independence from the central bank of Ethiopia. The new system allowed banks and foreign exchange bureaus to set their own exchange rates. The IMF Country Report No 03/166 indicated that alongside the official exchange rate set by the two commercial banks and Himbol foreign exchange agency, competitive rates were offered by twelve competitive licensed foreign exchange bureaus. The exchange rate was, therefore, freely floating without any intervention of the monetary authorities. As such, the economy was performing reasonably well for a short period of time though it was interrupted by the second war with Ethiopia.

Provided that the level of dollarization was low during those periods, the inflation rate was below the inflation rate of the Sub-Saharan African economies, as the IMF World Economic Outlook data indicates. Although an econometric analysis is required, the moderate level of the Eritrean inflation relative to Sub-Saharan economies indicates that the pass through effect of the exchange rate to inflation given the freely floating nature of the exchange rate was not so high. This may be as a result of the low level of dollarization in the early stages of the new currency. It could also be due to the monetary policy's main focus on price stability by leaving the exchange rate determination to the market forces.

The economic and political conflict that led to the second war with Ethiopia had transformed the country's economy which made the monetary

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[22] According to the information found in the interview held by Mckinley (1996) to the Bank of Eritrea's governor.

authorities introduce new foreign exchange regulations. As reported by the IMF Staff Country Report (2003), the legal notice number 44/2000 permitted the Bank of Eritrea to fix the exchange rate and required the foreign exchange bureaus to sell foreign exchange only to the Bank of Eritrea. After a little while, this regulation was replaced by the new legal notice number 49/2001 through which the market forces were permitted to determine the exchange rate depending on the demand and supply of the foreign currency. The rate was, therefore, flexible up until the first quarter of 2003.

Although by rule the determination of the exchange rate was left to the invisible hand of the market, the official rate was fixed starting from the second quarter of 2003, apart from a brief break in the first quarter of 2005. A number of unpredicted economic changes such as unprecedented rise of relying on imports, slowing the growth of the export sector and a shortage of supply occurred during these periods. As a result, the demand for hard currency was boosted to finance the import expenditure which ultimately depleted the foreign exchange reserve of the economy. To address these issues, legal notice number 101/2005 was introduced. According to this regulation, exclusive right on foreign exchange currency matters was given to Himbol and the commercial banks. The regulation implicitly discouraged the activities of private foreign exchange bureaus.

Fixing the official exchange rate coupled with the prohibition of the private foreign exchange bureaus encouraged the growth of an unofficial market that buys and sells hard currency at a competitive rate. It has also encouraged the

development of *franco valuta*, a system through which hard currency is transferred from overseas to Eritrea through informal means.[23]

The most important question that can arise here is what does fixed exchange rate imply to the monetary policy objectives? It is noticeable that inflation targeting and fighting against inflation would be the most challenging policy objective to achieve. It has been observed that although the official exchange rate is fixed, an unofficial exchange rate is not. Consequently, the value of the domestic currency depreciates quite often in an unofficial market through which most import expenditure is financed. The depreciation of the domestic currency makes the economy liable to the exchange rate pass through effect on inflation. Whenever the domestic currency depreciates, the Bank of Eritrea could have drained any excess domestic money supply by selling more hard currency. This, therefore, might have reduced inflation because of the reduction in domestic money supply. The Bank of Eritrea, however, does not have enough foreign exchange reserve to do so. Moreover, the rigidity of the official exchange rate makes the Bank of Eritrea unable to be flexible to adjust to the changing economic environment.

Another important question that can arise here is what do all these behaviours of the exchange rate, driven by the participants of the official and unofficial, market imply? If the official market is involved in the unofficial exchange rate market by buying foreign currency at unofficial rate, what does that imply for the effectiveness of the exchange rate channel?

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[23] The restriction made the availability of foreign currency more scarce to the point that the official markets had to buy hard currency from the unofficial markets, according to IMF Country Report number 03/166.

While it is essential to address these questions by conducting an empirical analysis, it can easily be seen that the effectiveness of monetary policy might be impeded by the dependence of the official market on the unofficial market. It has been seen that the value of the domestic currency has been undermined by the growing demand for hard currency in the unofficial market together with an ineffective operation of the official market. The devaluation of the domestic currency, therefore, passes its effect into domestic prices. The pass through effect becomes another policy burden that the Bank of Eritrea needs to deal with.

7.3.2.3. The Credit Channel

The Eritrean credit channel through which government and private sector determine the growth of output and inflation seems to play its part in the economy. As has been discussed before and also shown in the diagram below, the overall domestic credit has grown particularly since the issuance of the domestic currency. Total domestic credit in the economy grew by about 32 and 57 percent annually over 1997-1998 and 1998-1999 respectively.

On one hand, the growth shows the freedom of the Bank of Eritrea from the central bank of Ethiopia to print as much money as it needs to support the financial need. On the other hand, it shows the lack of immunity of the Bank of Eritrea from financing the government needs. Later on, the domestic credit growth rate subsided to 25 and 11 percent over the successive periods. Although the growth rate dropped from its highest, it still shows upward trend during the study period. The proportion on who gets how much, however, varies significantly.

Figure 7.3: Claims on Central Government, Public Enterprises and Domestic Credit
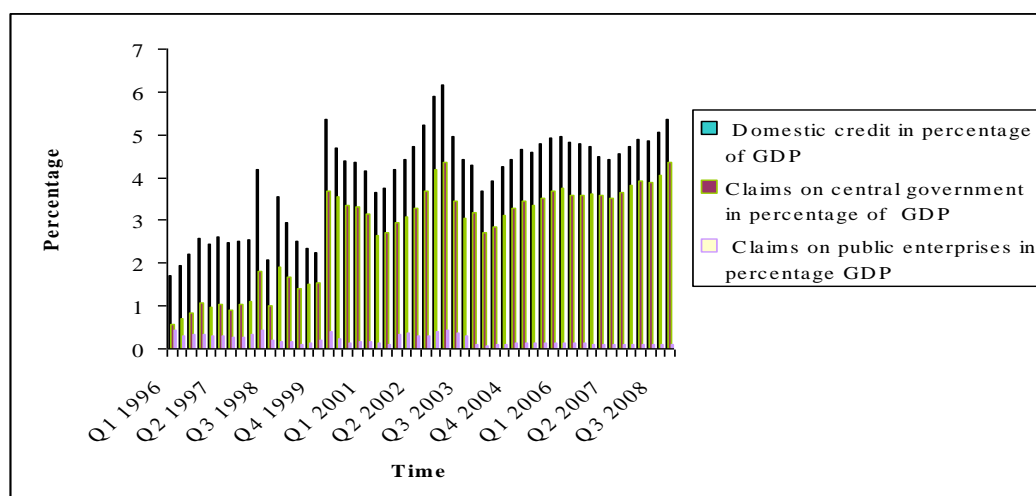
Source: data are collected from IMF, Financial Statistics and then transformed in percentage of GDP.

As has been shown and discussed before, the highest proportion of the domestic credit is dominated by the credit issued to the government sector. Relative to the overall credit issued to the government sector, as shown in the diagram above, the credit issued to the public enterprise is very minimal. This indicates that the largest portion of the government sector's claim is dominated by the government sector's spending on other than the public enterprises.

The diagram shows that the claims by the public enterprise tapered off from the second quarter of 1996 apart from its sharp rise in 1998. The claims, however, began to rise starting from the fourth quarter of 2001, though they declined briefly and rose again, which again began to fall from the second quarter of 2003. The reduction on the claims after the second quarter of 1996 as well as after the second quarter of 2003 suggests that some public enterprises were self-sufficient. If the public enterprises are productive enough they are likely to contribute to the growth of the economy.

The issuance of credit to either the government sector or private sector and controlling credit is expected to have an impact on the growth of output and inflation. Whether their contribution to growth and effect on inflation is significant or not is a matter of an empirical investigation to which the next procedure and discussion is diverted to.

7.4. Model Specification

The most commonly and widely used econometric technique in analysing the monetary policy transmission mechanism is the vector autoregressive (VAR) model. The same technique has been adopted in this research to carry out the analysis of the Eritrean monetary policy transmission mechanisms. The specification of the VAR model is given by

$$Z_t = A(L)Z_{t-1} + B(L)X_t + u_t \tag{7.1}$$

Where A (L) and B (L) are the polynomial matrices expressed in lag operator L. Z_t is a vector of endogenous variables and X_t is a vector of exogenous variables. The random error term is represented by u_t. The baseline model includes consumer price index, gross domestic product and reserves and it can be expressed as:

$$Z_t = [Y_t\ P_t\ R_t\ ] \tag{7.2}$$

As discussed earlier, the main monetary policy instrument used by the Bank of Eritrea is the reserve requirement ratio. For this reason, the main policy variable in the baseline model is expressed by the reserves. Following Dabla-Norris and Floerkemeier (2006), the ordering of the endogenous variables is based on the assumption that gross domestic product reacts to policy variables more

sluggishly than consumer price index. To analyse the effectiveness of the channels, domestic credit and black market exchange rate is added to the baseline model each at a time. To control the external shocks that might affect the dynamics of the model, the vector of exogenous variables is given by

$$X_t = [P_t^{us} \; FF_t] \qquad\qquad (7.3)$$

where P_t^{us} stands for U.S. consumer price index and FF_t represents Federal Funds Rate. Since the Eritrean remittances are mainly denominated in U.S. dollars, these variables are likely to influence the foreign currency flow into the economy and thereby the aggregate demand of the economy. However, these variables are considered as exogenous as the Eritrean economy is too small to have influence on these variables.

7.5. Data Collection

In the same manner as the previous chapters, nominal quarterly data from 1996 to 2008 are used. The data on consumer price index (P), gross domestic product (GDP), hard currency index (DI), U.S. consumer price index (PUS), official and black market exchange rate (OMR and BMR) are the same data as the data in the previous chapters. The procedures and details of data sources and collections on these variables can be found in the previous chapters. Money supply represented by M1, demand deposit, the Federal Funds Rate (FF), reserves, domestic credit (DC) that comprises both credit issued to the government sector (GL) and private sector (PL) are gathered from the Financial Statistics of the International Monetary Fund.

7.6. Estimation Method

All the data are transformed into logarithmic forms before running the VAR model specified above. The unit root test using Augmented Dickey Fuller (ADF) (Akaike Information Criteria (AIC) and Schwarz Information Criteria (SIC)) as well as Phillips Perron and the stationary test using Kwiatkoski-Phillips-Schmidt- Shin indicate all the variables are non-stationary. All the variables are I (1) except the Federal Funds Rate which is stationary using KPSS.

Table 7.1: Unit Root Tests in Levels

	Variables				
Tests	FF	R	DC	GL	PL
ADF (AIC)	-1.546	2.291	1.978	2.137	-1.193
	(0.503)	(0.999)	(0.996)	(0.998)	(0.671)
ADF(SIC)	-1.546	0.287	1.745	2.635	-1.193
	(0.503)	(0.975)	(0.995)	(0.999)	(0.671)
PP	-1.425	0.359	2.035	3.371	-1.193
	(0.563)	(0.979)	(0.999)	(0.999)	(0.671)
KPSS	0.353*	0.935***	0.972***	0.968***	0.916***

Note: the values in parenthesis are the p-values. *** Statistically significant at all levels. * Statistically significant at 10 percent. FF stands for Federal Funds Rate. R is the reserve. DC is domestic credit. GL stands for credit issued to the government sector. PL is the credit issued to the private sector.

Table 7.2: Unit Root Tests in First difference

	Variables				
Tests	FF	R	DC	GL	PL
ADF (AIC)	-2.252	-2.824***	-3.338***	-2.973***	-6.747***
	(0.191)	(0.063)	(0.019)	(0.045)	(0.000)
ADF(SIC)	-2.252	5.253***	-5.527***	-6.198***	-6.747***
	(0.191)	(0.000)	(0.000)	(0.000)	(0.000)
PP	-2.291	5.812***	-5.239***	-5.384***	-6.747***
	(0.179)	(0.000)	(0.000)	(0.000)	(0.000)
KPSS	0.091	0.184	0.346**	0.525**	0.091

Note: the values in parenthesis are the p-values. *** Statistically significant at all levels. . **Statistically significant at 5 and 10 percent. FF stands for Federal Funds Rate. R is the reserve. DC is domestic credit. GL stands for credit issued to the government sector. PL is the credit issued to the private sector.

To test the existence of co-integration among all the variables needed for the analysis, the Johansen test is used. The lag length is one based on SIC lag length selection criteria. The results of λ_{trace} statistic as well as λ_{max} statistic indicate the presence of one cointegration. The results are given in Table 7.3 and Table 7.4 below.

Table 7.3: Cointegration Test using λ_{trace} Statistic

Null Hypothesis	Alternative Hypothesis	Results	5 percent critical value
H_0: r = 0	H_1: r ≥ 1	134.84*** (0.000)	95.75
H_0: r ≤ 1	H_1: r ≥ 2	67.73* (0.072)	69.82
H_0: r ≤ 2	H_1: r ≥ 3	40.19 (0.215)	47.86
H_0: r ≤ 3	H_1: r ≥ 4	20.36 (0.398)	29.80
H_0: r ≤ 4	H_1: r ≥ 5	8.20 (0.444)	15.49

Note: the values in parenthesis are the p-values. *** Statistically significant at all levels. * Statistically significant at 10 percent.

Table 7.4: Cointegration Test using λ_{max} Statistic

Null Hypothesis	Alternative Hypothesis	Results	5 percent critical value
H_0: r = 0	H_1: r ≥ 1	67.12*** (0.000)	40.08
H_0: r ≤ 1	H_1: r ≥ 2	27.55 (0.235)	33.88
H_0: r ≤ 2	H_1: r ≥ 3	19.82 (0.353)	27.58
H_0: r ≤ 3	H_1: r ≥ 4	12.17 (0.531)	21.13
H_0: r ≤ 4	H_1: r ≥ 5	6.81 (0.511)	14.26

Note: the values in parenthesis are the p-values. ***Statistically significant at all levels.

Most empirical analysis of the monetary policy transmission mechanisms are conducted by estimating the VAR models in levels. In line with the techniques

used by the majority, this research follows the same procedure. Some of the reasons for estimating a VAR model in levels are that estimating a model in the first differences when co-integration exists throws away the information found in the levels and leads to model misspecification (Ericsson, 1997). Moreover, it may bias impulse responses (Ramaswamy & Slok, 1998) and presents no information on the relationships between levels of the variables in which economic theory is most informative (Poddar et al., 2006).

Other reasons for adopting VAR in levels are that first, recent studies of Ashley and Verbrugge (2009) show robust performance of VAR in levels and lag-augmented VAR in terms of impulse response function relative to the remaining techniques of their study, even though the data are non-stationary and co-integrated. Second, estimating VAR in levels allows an implicit cointegration relationship in the data (Dabla-Norris and Floerkemeier (2006). In addition to this, the study by Sims et al., (1990) showed that estimating the VAR model in levels is an appropriate method since the estimator efficiently estimates the co-integrating relationship. Third, coefficients estimated in a VAR model in levels are consistent and have the same asymptotic distribution as the estimates of the first differenced (Pobre, 2003). Fourth, the impulse response function produced from VECM is likely to imply that the impacts of the shocks are permanent, whereas the unrestricted VAR lets the data to work out on whether the effects of the shocks are permanent or temporary (Ramaswamy & Slok, 1998).

In addition to all that has been mentioned so far, estimating a VAR model in levels makes comparison with the other literature straightforward as most of the studies on the monetary policy transmission mechanisms have used this technique (see Sims, 1992; Bernanke & Mihov, 1995; Cushman & Zha, 1997; Bernanke &

Blinder, 1992; Christiano et al., 1996; Leeper et al., 1996; Ramaswamy & Slok, 1998; Clements et al., 2001; Pétursson,2001; Pobre, 2003; Dabla-Norris & Floerkemeier, 2006; Poddar et al., 2006; Samkharadze, 2008; P. & Enisan, 2010; Tsangarides, 2010 among others).

7.7. The Empirical Findings

To examine the effectiveness of the channels of monetary policy transmission in the Eritrean economy, a shock to the policy variable as well as the variable relevant to the channel is given separately. In addition to this, variance decomposition has been conducted for each channel. Based on the SIC, the lag length of VAR is one. The results of impulse responses and variance decomposition are reported and discussed below respectively.

7.7.1. Impulse Response

The shock to the base line model and the response of prices and gross domestic product is given in Figure 7.4. The dotted lines are indicative of a 95 percent confidence interval. The values on the vertical line represent the deviation from the baseline level of the variable that reacts to the shock in response to a given shock on the policy variable. The results on the horizontal line represent the time passed after the introduction of the shock. As can be seen from the figure, GDP reacts positively to the reserves for the first four quarters and becomes negative after the fifth quarter. The confidence interval, however, indicates that the results are statistically insignificant. On the contrary, the response of prices to a shock on the reserves is negative and statistically significant. This means that an increase in the reserve requirement ratio will reduce prices and vice versa. It also implies that there is a room for the Bank of Eritrea to manipulate inflation using its policy variable.

Figure 7.4: Impulse Responses of the Base Line Model

Response to Cholesky One S.D. Innovations ± 2 S.E.

Response of GDP to RESERVE

Response of P to RESERVE
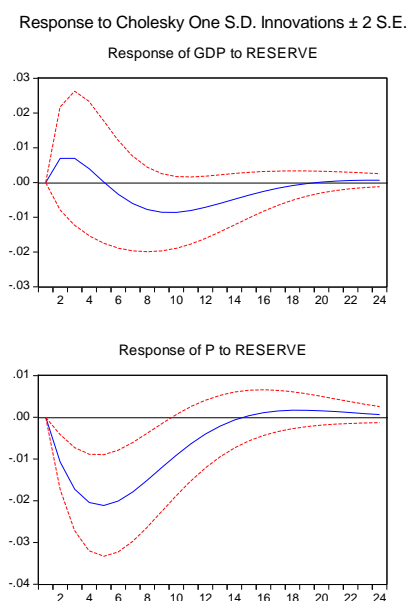
To see the effectiveness of the exchange rate channel, official rate of foreign exchange was considered for inclusion in the base line model. Since the official exchange rate is fixed starting from 2003, however, black market exchange rate is used in lieu. The results are shown in Figure 7.5.

The results indicate that prices react positively and significantly to a shock on the black market exchange rate. This shows that there is significant pass through effect from the black market exchange rate to prices in the Eritrean economy. The Bank of Eritrea, therefore, needs to address this issue through its exchange rate policy and regulation. Although the black market exchange rate is beyond the policy control of the Bank of Eritrea, easing the official exchange rate rigidity might bring a difference to the outcome. Fixing the official exchange rate might have been seen as easing the external debt payment that the economy has to make. Although external debt payment burden is an issue, fixing the exchange rate may not generate enough hard currency provided that the market is

constrained from operating effectively. It is important to see the big picture and consider the negative side effect of fixing the exchange rate and putting restrictions on the exchange rate market at large. Therefore, without losing of generality, it is crucial to introduce different techniques of monetary policy instruments and also manage the exchange rate system of the economy.

Figure 7.5: Impulse Responses of P and GDP to BMR and Reserves

Response to Cholesky One S.D. Innovations ± 2 S.E.
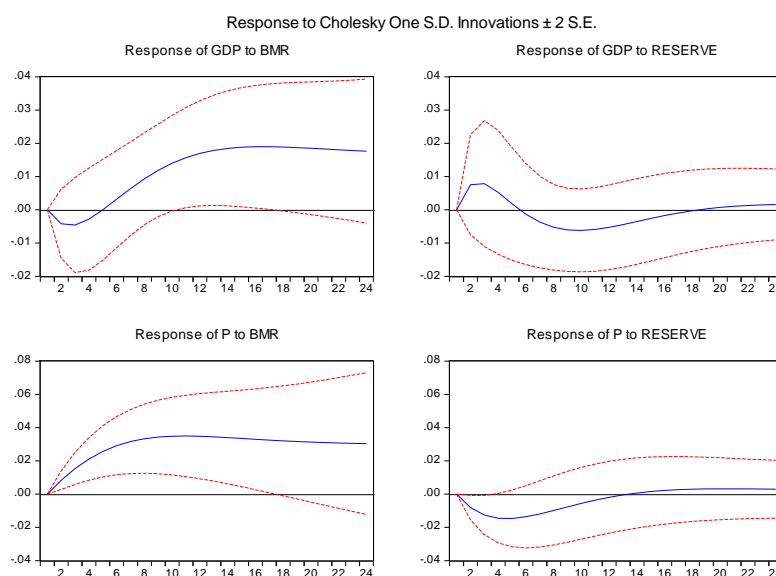
According to the findings in the literature, it is important to note here that the exchange rate channel is effective in most dollarized economies. Unlike the Eritrean economy, however, the effect of the shock on the prices in most dollarized economies dies after a short period of time. It is also equally important to note here that the central banks of these economies have great control over their official exchange rate. The Bank of Eritrea, however, has very minimal control over the black market exchange rate that prevails in the economy. This disparity could, therefore, explain the persistence of the pass through effect in the Eritrean economy relative to the other dollarized economies.

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To examine the credit channel, total domestic credit is added into the base line model. The responses are reported in Figure 7.6. Unlike the findings of the majority of the studies on the effectiveness of the credit channel in dollarized economies, the results demonstrate a different outcome. Prices react to the domestic credit significantly and positively. While the positive reaction of prices to the domestic credit is common with the findings of earlier studies, the significant result is different. This implies that the credit channel is effective in the Eritrean economy. Nonetheless, most studies have shown the ineffectiveness of the credit channel in a dollarized economy. To see where the significant and effective response of prices to domestic credit is coming from, the total domestic credit is decomposed into the credit issued to the government sector and credit issued to the private sector.

Figure 7.6: Impulse Responses of P and GDP to Domestic Credit and Reserves
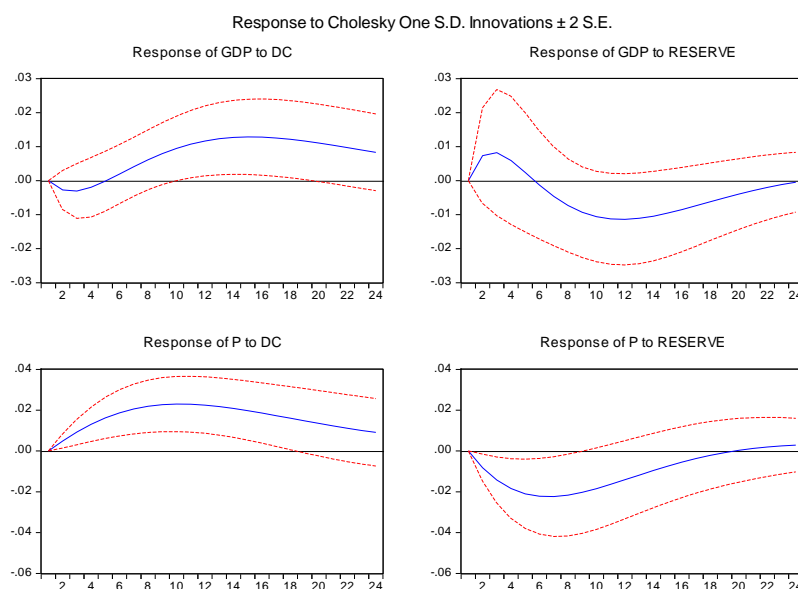
The results of the impulse responses of the variables to shocks on the credit issued to the government sector are shown in Figure 7.7. It can be seen

from the results that prices react not only positively but also significantly and persistently.

Figure 7.7: Impulse Responses of P and GDP to Government Sector Credit and Reserves

Response to Cholesky One S.D. Innovations ± 2 S.E.
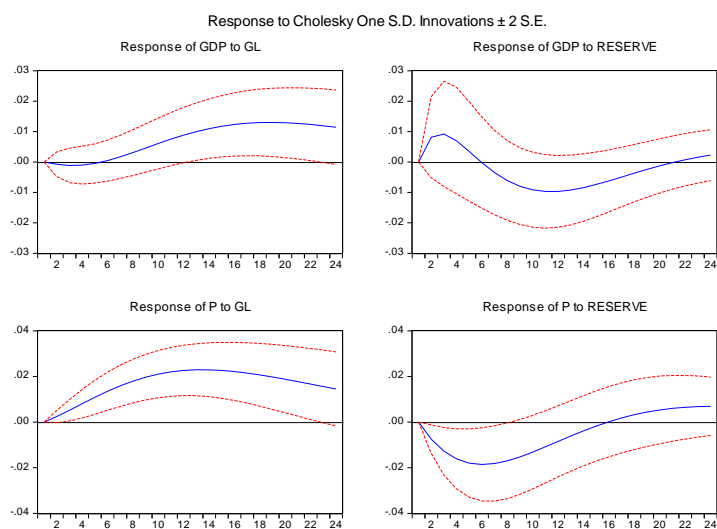
In contrast to the response of prices to the government sector's credit shown above, prices do not respond significantly to the private sector's credit. This result is consistent with the finding of the majority of the studies. The ineffectiveness of the credit channel through the private sector indicates that the private sector might have external sources of financing its expenditure.

The effectiveness of the credit channel through the government sector could be due to the fact that credit issued to the government sector is larger than credit issued to the private sector. This implies that fiscal discipline and the independence of the Bank of Eritrea is crucial if monetary policy objectives are going to be materialized.

Figure 7.8: Impulse Responses of P and GDP to Private Sector Credit and Reserve

Response to Cholesky One S.D. Innovations ± 2 S.E.
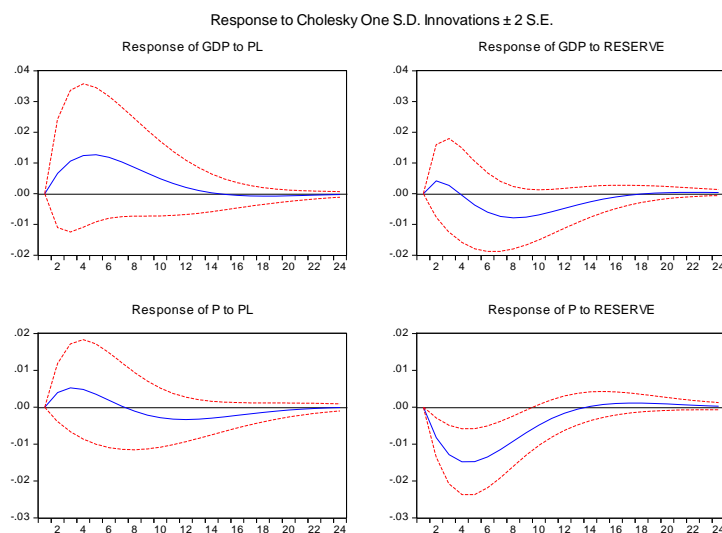
It is clear from all the figures that although the response of GDP to some of the shocks is insignificant, it responds significantly to most of the shocks. It, however, reacts sluggishly unlike the response of prices to the shocks. In terms of the effectiveness of the credit channel, its significant reaction lasts for about seven quarters. When black market exchange rate is added to the baseline model, the duration of its significant response is from the tenth to the sixteenth quarter. When the credit issued to the government sector is added, however, the duration of the same response is from twelve to twenty-two quarters.

To see the robustness of the results, a Structural Vector Autoregressive (SVAR) model is applied. A SVAR model contains contemporaneous variables. The contemporaneous variables are variables at time t instead of t-1. If u_t is the vector of the residuals from the reduced form VAR model, the relationship between the structural shock and these residuals can be written as

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$$u_t = A^{-1}B\epsilon_t \; or \; Au_t = B\epsilon_t \qquad (7.4)$$

If the model is recursive then A is an identity matrix and B is a lower triangular matrix. If the model is non-recursive, however, A is a lower triangular matrix but B is an identity matrix. For example, the non-recursive model with endogenous variables of

$$Z_t \; = [y_t, p_t, e_t, r_t] \qquad (7.5)$$

will look like the following:

$$\begin{bmatrix} 1 & 0 & 0 & 0 \\ a21 & 1 & 0 & 0 \\ a31 & a32 & 1 & 0 \\ a41 & a42 & a43 & 1 \end{bmatrix} \begin{bmatrix} u_t^y \\ u_t^p \\ u_t^e \\ u_t^r \end{bmatrix} = \begin{bmatrix} \varepsilon_t^y \\ \varepsilon_t^p \\ \varepsilon_t^e \\ \varepsilon_t^r \end{bmatrix} \qquad (7.6)$$

Following Samkharadze (2008), the restrictions are imposed based on the assumption that GDP and prices react sluggishly to the policy variables; that is there is no contemporaneous effect of the policy variables on GDP and prices. The exchange rate in the black market, on the other hand, is assumed to react contemporaneously to GDP and prices as the market is assumed to be sensitive to the changes in the later variables. It is, however, assumed that the same variable reacts sluggishly to the policy variable. This assumption is based on the assumption that GDP and prices, to which the black market exchange rate reacts contemporaneously, respond sluggishly to the policy variable. In other words if GDP and prices react sluggishly to the policy variable, it takes time for the black market exchange rate, which is also affected by the changes in GDP and prices, to respond to the policy variable. These assumptions are based on the idea that the black market dealers have high awareness of the impact that prices and GDP can

have on their business. However, the dealers are assumed to have little awareness on the impact that the reserve requirement ratio can have on the economy. Accordingly their reactions vary significantly. The estimation results of the SVAR are reported in Appendix 7.1 and have shown similar outcomes to those reported above.

Apart from VAR and SVAR, the Toda and Yamamoto (1995) lag-augmented vector autoregression (TY) is applied. According to this procedure extra lag of each endogenous variable is added in the exogenous VAR specification. The numbers of extra lags that are required to be added in the model are determined by the highest number of the order of integration in the model. Toda and Yamamoto (1995), however, suggest that their procedure is inefficient and suffers some loss of power the less the number of lags and the more the number of variables to be estimated in the VAR model. The results of the estimation using this procedure are reported in the second section of Appendix 7.2.

Like the results of VAR and SVAR, the results of TY procedure indicate significant reaction of prices to the shock of reserves. It can also be seen from the results that the credit channel with respect to the reaction of price is effective. The source of this effectiveness is found to be in the credit issued to the government sector. According to the results, there is a positive relationship between the black market exchange rate and prices measured by the consumer price index though it is insignificant.

Using a TY procedure, the response of GDP to all the shocks is insignificant. This shows that monetary policy is ineffective at having a significant effect on the GDP of the economy. It also indicates that there might be

some other more significant factors that determine GDP in the economy rather than the instruments of monetary policy. It is, therefore, crucial for the economy to target those factors in order to manipulate the growth of the economy.

Lastly, dollarization is added to the base line model to see how GDP and prices react to the shock given to the dollarization in the system. The results using both VAR model and TY procedure are reported in Appendix 7.3. As can be seen from the figures, the first part of the results demonstrates that prices react positively and significantly to a shock in dollarization. The significance of the reaction, however, dies out after the seventh quarter. In contrast to this, the results of the second part; that is the TY procedure, show that prices react slowly. Moreover, its significant response is short lived; that is from third to fifth quarter. The response of GDP in both cases is insignificant.

7.7.2. Variance Decomposition

The impulse response functions pin down the effects on the remaining variables in the VAR model as a result of a shock given to one variable. Variance decomposition, on the other hand, splits the variation in a variable into the component shocks to the VAR. The variance decomposition, therefore, gives information on the relative importance of each shock in influencing the variables in the VAR model.[24]

It can be seen from the results reported in Table 7.5 below that, in general, the variations of GDP and prices come mainly from their own shocks rather than the shocks of the other variables. After the first quarter, the table shows that 100 percent and 99.58 percent of the variations in GDP and prices are as the result of their own shocks. After the fourth quarter, 4.55 percent of the variation in GDP is

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[24] For more discussion on this, see Eviews 7 User's Guide II.

explained by the shock applied to the prices. The effect of a shock on the reserves is very minor. It only accounts 0.81 percent on the variation in GDP.

Table 7.5: Variance Decomposition of GDP and Prices using Base Line Model

Variance Decomposition of GDP

Period	GDP	P	R
1	100.0000	0.000000	0.000000
4	94.62936	4.551880	0.818764
6	91.71905	7.415999	0.864949
8	89.89906	8.586980	1.513959
10	88.72200	8.787423	2.490572

Variance Decomposition of Prices

Period	GDP	P	R
1	0.415936	99.58406	0.000000
4	2.287237	77.26499	20.44777
6	3.154278	63.77444	33.07128
8	3.548456	57.18407	39.26748
10	3.663684	55.05593	41.28039

Unlike the effect of prices on the variation of GDP after the fourth quarter, a shock on GDP explains about 2.29 percent of the variation in prices. Relative to the impact of a shock on the reserves on GDP, a shock on reserve requirement has a large effect on the fluctuation of prices. About 20.45 percent of the variation on prices is sourced from a shock on the reserves after the fourth quarter.

Table 7.6: Variance Decomposition of GDP and Prices–BMR

Variance Decomposition of GDP

Period	GDP	P	BMR	R
1	100.0000	0.000000	0.000000	0.000000
4	93.34141	5.254549	0.338179	1.065861
6	87.93395	10.65610	0.384429	1.025523
8	82.43624	15.16300	1.176509	1.224244
10	77.07309	18.23685	3.103322	1.586735

Variance Decomposition of Prices

Period	GDP	P	BMR	R
1	0.496208	99.50379	0.000000	0.000000
4	1.707505	82.76311	9.836917	5.692465
6	3.294827	70.79824	18.91363	6.993310
8	4.919064	61.90150	26.63391	6.545527
10	6.284918	55.64235	32.48669	5.586040

When the black market exchange rate (BMR) is added into the model, the results are slightly different, as shown in Table 7.6 above. The variation in GDP due to the shock on prices and reserves is slightly up from the previous results. About 5.25 percent and 1.07 percent of the variation in GDP comes from the shocks on prices and the reserves after the fourth quarter of the application of the shocks. In the same time period, a shock on the black market exchange rate accounts for 0.34 percent of the variation in GDP.

Table 7.7: Variance Decomposition of GDP and Prices–DC

Variance Decomposition of GDP

Period	GDP	P	DC	R
1	100.0000	0.000000	0.000000	0.000000
4	93.56069	4.943643	0.213940	1.281723
6	88.04460	10.48307	0.216122	1.256208
8	82.87905	15.03517	0.496125	1.589657
10	78.24978	17.77774	1.342013	2.630467

Variance Decomposition of Prices

Period	GDP	P	DC	R
1	0.258873	99.74113	0.000000	0.000000
4	0.116157	86.84091	4.317256	8.725672
6	0.319000	75.23384	9.361164	15.08599
8	0.928444	65.16293	14.70014	19.20849
10	1.923410	57.24672	19.65322	21.17665

Conversely, the variance decomposition of prices in Table 7.6 shows that the variation of prices due to the shocks on the GDP and reserves is less than the previous results. The shock on the black market exchange rate, however, explains about 9.84 percent, which is significantly larger than the variation in GDP. Finally, domestic credit (DC) is added to the base line model to see how the

variation in GDP and prices might differ by the shock applied to the domestic credit. The results are given in Table 7.7 above.

The variation in GDP as a result of a shock on domestic credit accounts for about 0.21 percent, whereas the shocks on prices and reserves accounts for about 4.9 percent and 1.3 percent respectively. On the prices side of the table, about 4.3 percent of the variation on prices is explained by a shock on the domestic credit. While a shock on the reserves amounted to 8.7 percent in the variation of prices, a shock on GDP accounted for 0.11 percent.

In the base line model it has been seen that the contribution of the change in the reserves to the variation in the GDP is less than the contribution of prices to GDP's variation. However, the contribution of the change in the reserves to the variation in prices is higher than the contribution of the change in GDP to the variation in prices. This implies that controlling prices using the reserves would implicitly ease the variation in GDP. When the BMR is included in the base line model, the explanation of the change in BMR to the variation in GDP is less than the explanation of the change in prices and the reserves. On the other hand, the change in the BMR explains the variation in prices more relative to the change in the reserves and GDP. These results indicate that managing BMR might improve prices which in turn might improve GDP of the economy.

As in the case of BMR, the change in DC contributes more to the variation of prices than to the variation of GDP. The largest contributor to the variation in GDP, however, is prices. It can be seen that in all cases the variation in GDP is highly influenced by the change in prices besides the variation that comes from its own change. However, the variation in prices is highly influenced by the reserves,

BMR and DC. This shows that there is a room for the Bank of Eritrea to manage

GDP by managing prices through the reserves, BMR and DC.

7.8. Conclusion

Whether dollarization facilitates or complicates the monetary policy transmission mechanisms is a debateable research topic. From the earlier studies of currency substitution by Miles (1978), Brillembourg and Schadler (1979) as well as Girton and Don (1981) to the recent studies of dollarization by Isakova (2008), Dabla-Norris and Floerkemeier (2006) and Acosta and Coble (2011), the majority of the scholars have shown the ineffectiveness of monetary policy one way or the other. A number of scholars including Armas and Grippa (2005), Leiderman et al., (2006) and Rossi and Vega (2005), however, counter argued against the widely held view of the effectiveness of monetary policy. This study has carefully examined the debate and extended it empirically by taking the case study of the Eritrean economy. More specifically, this research has focused on the monetary policy transmission mechanisms to investigate the effectiveness of monetary policy in the Eritrean economy.

In contrast to the existing studies on monetary policy transmission mechanisms in dollarized economies, this study introduces the application of the TY procedure developed by Toda and Yamamoto in addition to employing VAR and SVAR models. The results suggest that the Eritrean monetary authority can manipulate the reserve requirement ratio in order to control inflation in the economy. The effectiveness of the reserve requirement ratio, however, is short lived especially when the exchange rate channel is included in the base line model.

On the other hand, the effectiveness of the reserves to manage GDP is very limited which shows the ineffectiveness of the monetary policy to achieve this

goal. This study finds an effective credit channel through the credit issued to the government sector which implies that the Bank of Eritrea has to be independent and that there should be fiscal discipline. In line with the findings of most of the previous studies, there is an ineffective credit channel through the credit issued to the private sector. This demonstrates that the private sector might have external sources of financing its expenditure as a result of underground dollarization. It also indicates that monetary policy is ineffective to operate through this channel.

The inclusion of dollarization in the model shows a positive and statistically significant response of prices to the shock given to dollarization. This signifies that the monetary authority should manage the extent of dollarization in the economy by using different policy measures. The findings also suggest that there is a high pass through effect as a result of the black market exchange rate that lasts for a long period of time. This shows that there is a need for the Bank of Eritrea to issue new policy aimed at making the official market more competitive and operative.

It can be noted from the results of this research, which coincides with most of the studies reviewed so far, that in a partially dollarized economy, the exchange rate channel is mostly effective, though through the black market exchange in the case of the Eritrean economy. On the other hand, the credit channel through the private sector and the interest rate channels are ineffective and inoperative. If the exchange rate is the most effective channel, one might argue that monetary policy can still be effective under a partially dollarized economy using its exchange rate target instrument. This argument, however, needs to consider how long a particular monetary policy instrument takes to achieve its policy objectives. It is not only the achievement and the time period spent to achieve the policy
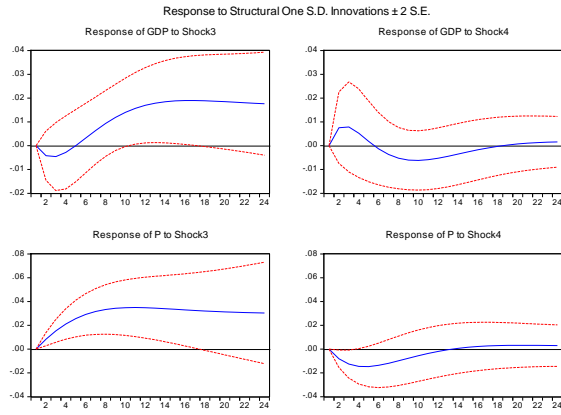
objectives that matter most, but also the persistence or the stability of the achieved objectives. The word effectiveness, therefore, should be comprehensive enough to address "*achievement*", "*time spent*" to achieve and "*stability*" of the achieved objectives. It should also be comprehensive enough to address most of the objectives of monetary policy instead of focusing only on inflation.

Moreover, it is important to consider whether or not the economy is free from any black market foreign exchange activity. Active operation of the black market foreign exchange is likely to hinder the monetary authorities' ability to control the effectiveness of the official exchange rate and thereby its effective achievement of the monetary policy objectives.
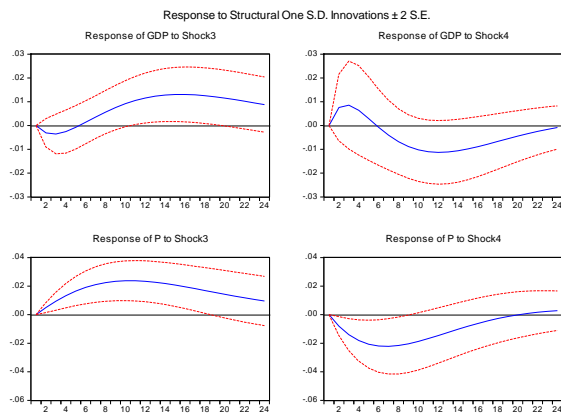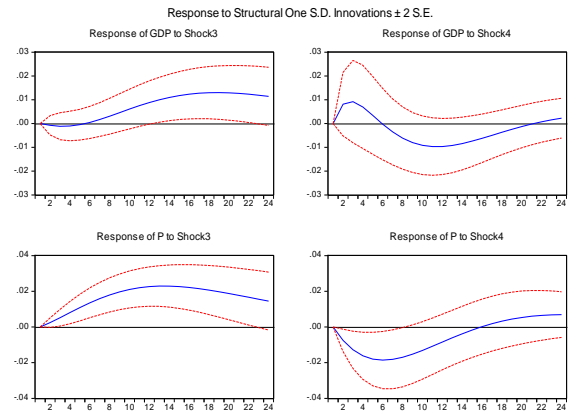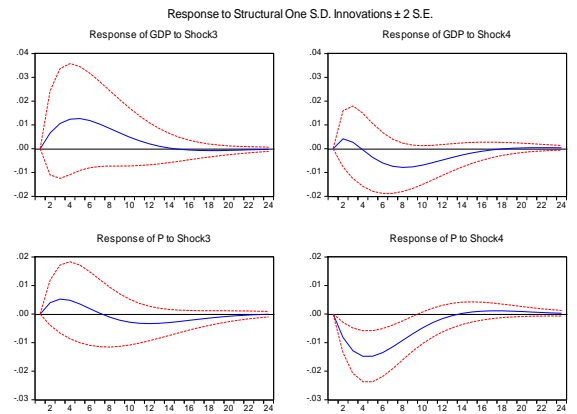
Appendix

7.1: SVAR

7.1.1: Responses to BMR

Response to Structural One S.D. Innovations ± 2 S.E.

7.1.2: Responses to DC

Response to Structural One S.D. Innovations ± 2 S.E.

7.1.3: Responses to GL

Response to Structural One S.D. Innovations ± 2 S.E.

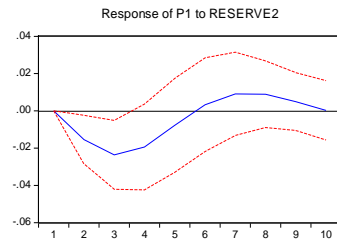### 7.1.4: Responses to PL

Response to Structural One S.D. Innovations ± 2 S.E.
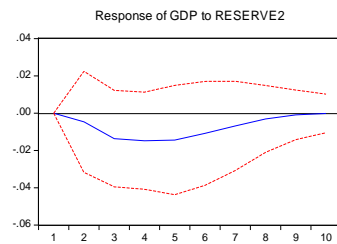
7.2: Toda and Yamamoto procedure

7.2.1: Responses to Reserves

Response to Nonfactorized One S.D. Innovations ± 2 S.E.

Response of GDP to RESERVE2

Response of P1 to RESERVE2

7.2.2: Responses to BMR

Response to Nonfactorized One S.D. Innovations ± 2 S.E.

Response of GDP to BMR

Response of GDP to RESERVE

Response of P to BMR

Response of P to RESERVE
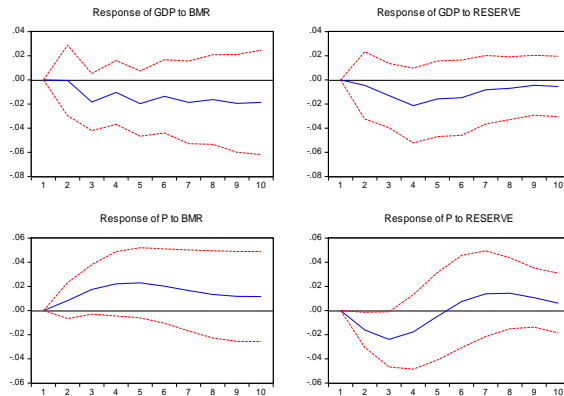
7.2.4: Responses to GL

Response to Nonfactorized One S.D. Innovations ± 2 S.E.

Response of GDP to GL
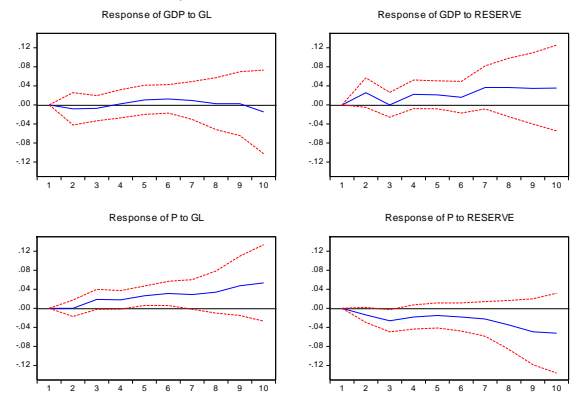
Response of GDP to RESERVE

Response of P to GL

Response of P to RESERVE

7.2.3: Responses to DC

Response to Nonfactorized One S.D. Innovations ± 2 S.E.

Response of GDP to DC

Response of GDP to RESERVE

Response of P to DC

Response of P to RESERVE
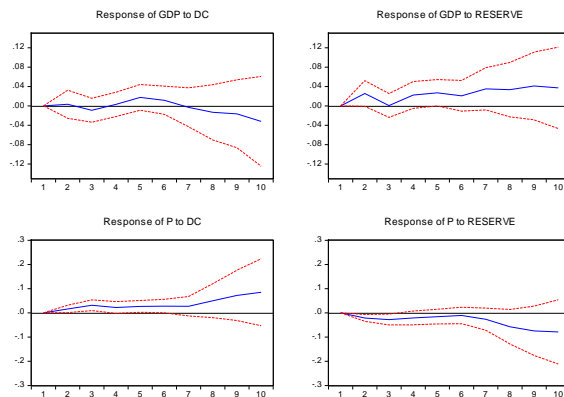
7.2.5: Responses to PL

Response to Nonfactorized One S.D. Innovations ± 2 S.E.

Response of GDP to PL

Response of GDP to RESERVE

Response of P to PL

Response of P to RESERVE

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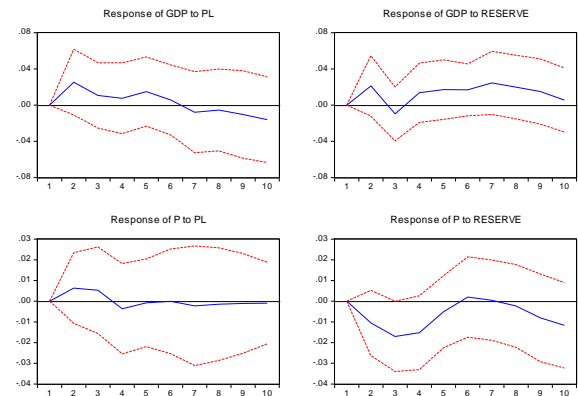
7.3: Responses to Dollarization

7.3.1: VAR

Response to Cholesky One S.D. Innovations ± 2 S.E.

Response of GDP to DI

Response of P to DI
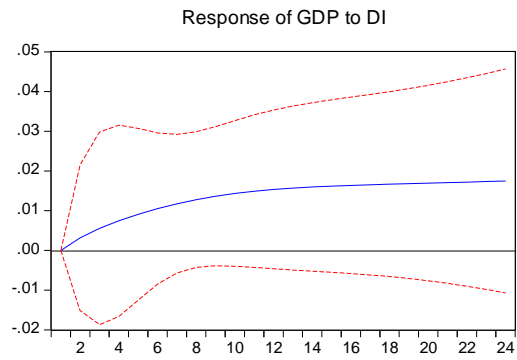
7.3.2: T and Y Procedure
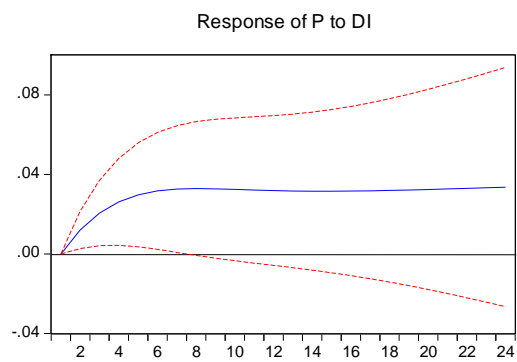
Response to Nonfactorized One S.D. Innovations ± 2 S.E.

Response of GDP to DI

Response of P to DI
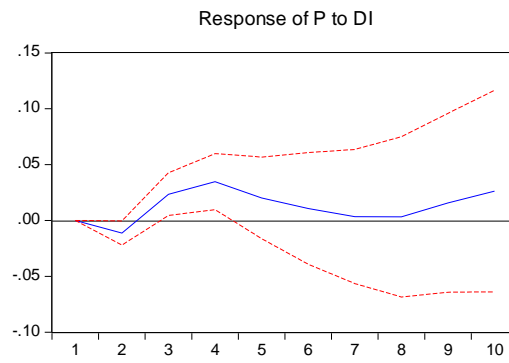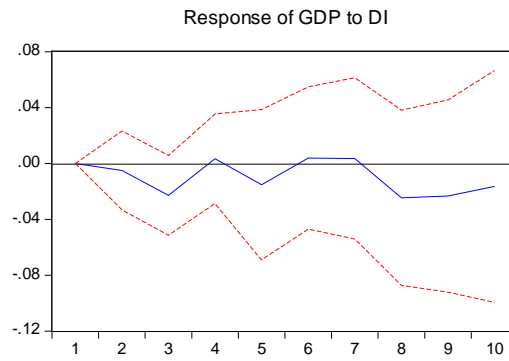
Chapter 8- Conclusion and Policy Implication

8.1. Conclusion

The reliance on hard currency or the dollarization of an economy, as widely used terminology, has broadly been debated and discussed in the research field of monetary economics, international finance and macroeconomics. Despite an immense coverage of the subject matter, there are still some remaining gaps that need to be filled. The majority of the studies are concentrated on the dollarization of Latin American and Asian economies, while very few have given attention to the dollarization of African economies.

This might be due to high level of dollarization in the former economies, not to mention the full dollarization of some Latin American economies, which draws many scholars' attention for broad investigation. According to the study by Luca and Petrova (2008a), loan dollarization averaged 38 percent and 39 percent of total loans in transition economies and Latin American economies respectively during the period 1990-2001. The study by Bass et.al., (2007) has also shown that deposit dollarization averaged 40 percent of the total deposits in transition economies during the period 1993-2006. In line with this study, Honohan and Shi (2002) find that deposit dollarization in 25 emerging economies rose from 37.1 to 44.2 percent of total deposits over the period 1995-1999.

Among others, the reviewed literature has covered how dollarization can be measured, what drives dollarization, what consequences dollarization has, why dollarization persists and how dollarization can be reduced. On the measurement side of the study, the studies by Akacay et al., (1997), Zoryan (2005), Clements and Schwartz (1992) and Balino et al., (1999) have shown that the most standard

measurement of the extent of dollarization is the ratio of foreign currency deposits to broad money in the economy. Other studies, including the studies by Yeyati (2006), Rennhack and Nozaki (2006) and Nicolo et al., (2005), have used the ratio of foreign currency deposits to total bank deposits instead of the broad money. Hausmann et al., (2001) and Reinhart et al., (2003), however, have developed the original sin index (based on the extent of liabilities contracted in foreign currencies) and composite index (based on the sum total of the ratios of foreign currency deposits to broad money, total external debt to GDP and domestic government debt denominated in dollars to total domestic government debt).

In addressing what drives dollarization, the original sin (the inability to borrow in their own currency when loans are issued to developing countries), the existence of high inflation (as in the case of most Latin American, Asian and some African economies), exchange rate volatility in the economy, domestic monetary instability, openness of the economy, close economic and financial links with the hard currency generating country such as the U.S.A. and the existence of weak institutional factors have all been found as influential factors (see Uribe, 1997; Kamin & Ericsson, 2003; Ize & Yeyati, 2003; Berg & Borensztein, 2000; Yinusa, 2008; Arteta, 2002; Wessels, 2004; Zoryan, 2005; Alvarez-Plata & Garcia-Herrero, 2008; Minda, 2005; Edwards & Magendzo, 2006; Honig, 2009; Bahmani-Oskooee & Domac, 2003; Edwards & Magendzo, 2003; Galindo et al., 2003, among others).

On the other aspect of dollarization, the studies that examine the consequences of dollarization find that dollarization tends to bring benefits as well as costs to an economy regardless of whether the economy is fully or partially

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dollarized. The economies of Panama, Ecuador, El Salvador and others, for example, have gained economic stability and enhanced trade (see Soto, 2008; Quispe-Agnoli & Whisler, 2006; Rose & Engel, 2002; Rose et al., 2000; and Hinds, 2004). Dollarization, however, incapacitated some of these economies from conducting an independent monetary policy. Dollarization in some of these countries has also resulted in an increase inequality and unemployment rate as the studies by Soto (2008) and Towers and Borzutzky (2004) show. Some other benefits and costs have been discussed by several researchers based on the micro- and macro-level effects of dollarization.

At macro level, some studies have looked at the effects of dollarization on the inflation rate, the effectiveness of monetary policy, exchange rate volatility and output volatility. The studies on the impact of dollarization on inflation suggest that dollarization might reduce or enhance inflation depending on the form it takes in the economy. If dollarization is full then it reduces inflation. However, if it is adopted in partial form it might or might not reduce inflation depending on the original and recurring economic status of the partially dollarized economy. Similarly, the impact of dollarization on the exchange rate volatility depends on the form of dollarization that exists in the economy. While full dollarization enhances exchange rate stability, partial dollarization might reduce or produce more exchange rate volatility depending on the intervention of the central bank as well as the existence of the black market in the economy.

Another group of studies, at macro level, have covered the effectiveness of monetary policy as a result of dollarization. The studies, however, have demonstrated divisive research findings. On one hand, Eichengreen et al., (2002),

Rennhack and Nozaki (2006), Gruben and McLeod (2004) and Wessels (2004) explain that dollarization hinders an economy from conducting independent monetary policy and therefore it makes monetary policy more complex and less effective. On the other hand, Reinhart et al., (2003), Billmere and Banoto (2004), Armas and Grippa (2005) and Leiderman et al., (2006) argue that monetary policy is effective even though economies are dollarized.

At micro level, different scholars have studied the impact of dollarization on financial and non-financial firms. While some of the literature on non-financial firms (see the studies by Krugman, 1999; Galindo et al., 2003; Aguiar, 2005; Fuentes, 2009; Echeverry et al., 2003) have discussed the negative balance sheet effect of exchange rate depreciation on firms with dollar debt, the studies by Bleakley and Cowan (2002) and Luengnaruemitchai (2003) find positive impact of devaluation on investment levels of firms with high foreign debt in Latin America and East Asian firms. The literature on the impact of dollarization on financial firms commonly pointed out the vulnerability of the banking industry to external shock and also to the financial fragility (see Burnside et al., 2001; Aghion et al., 2000, 2001; Chue & Cook, 2004; De Nicolo et al., 2003; Domaç & Martinez Peria, 2003).

Having summarized the studies of dollarization and its measurement, its effects and its driving factors, some questions arise here as to how and in what way this study fits into the existing literature. In other words, what special contributions has this study made which might make it different from the existing literature? This leads to the discussion of the gap in the literature and how this gap has been minimized by this study.

8.2. Contribution

The contribution of this study reflects the gap that has been filled in the study of dollarization. This study has contributed in three different areas: first, the measurement of dollarization; second, the determinants of dollarization; and third, the effects of dollarization on exchange rate volatilities, inflation, and monetary policy transmission mechanisms.

The first contribution of this study is related to the measurement of the extent of dollarization. Of the measurement aspect discussed above, it has been identified that the fundamental drawbacks of using the ratio of dollar deposit to broad money or to total deposits is that the measurement does not include offshore dollar deposits. Moreover, although the measurement attempts to capture the financial dollarization, it fails to include loan dollarization which is quite common in economies whereby deposit dollarization is high.

Although the original sin index is useful for measuring the liability dollarization, the remaining forms of dollarization that might exist in an economy are not captured by the index. Similarly, while the composite index attempts to present a holistic approach towards measuring the degree of dollarization, it overlooks the dollar loans issued to the private sector, offshore dollar deposits and the underground dollarization. Given these shortcomings in the literature, this study has constructed a new index to capture the overall forms of dollarization that exist in the Eritrean economy. In particular, it has applied a mathematical method of capturing the amount of hard currency supplied by the black market and thereby captures the underground dollarization.

Another contribution of this study is on the determination of the dollarization. It has been noted that the existing literature concentrates on the internal factors, such as the lack of confidence in domestic currency driven by high inflation, unstable monetary situation, exchange rate fluctuation and weak institutions. Less emphasis has been given on the external factors. This study identifies an external factor; that is the dollarization of the developing countries themselves, which enhances the dollarization process of the developing world. If developing countries are settling their transactions of imports and exports in dollars instead of their local currency when they trade not only with the U.S. but also with each other, it is likely to see the dominance of dollarization in their economy. The inability to conduct trade with each other in their own currencies is, therefore, another determinant external factor of dollarization.

In addition, this study contributes to the scant literature of the determinants of dollarization on the banking side by analysing the impact of Eritrean banking practices and monetary system on dollarization. It finds that the structure of the interest rate that distorted the economy, the fewer loans issued to the private sector compared to the government sector, the issuance of the new currency that ultimately damaged the economy and led to greater dependence of the economy on imported goods, the selling of houses and lands in exchange for hard currency by the Housing and Commerce Bank of Eritrea and the introduction of strict regulation on the foreign currency exchange have contributed to the reliance of the Eritrean economy on hard currency.

It should be noted here that the originality of this study on the dollarization of Eritrea at macro level is another important contribution. Of the reviewed

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literature, neither the effect nor the determinants of dollarization in the Eritrean economy has been covered which makes this study the first of its kind. In examining the impact of dollarization on exchange rate volatility, both real and nominal exchange rates of the black market as well as real exchange rate of the official market have been examined. In the analysis, GARCH methodology is implemented by including the dollarization variable. The results suggest that partial dollarization of the Eritrean economy has a positive effect on the black market exchange rate volatility.

Besides the contributions that have been discussed so far, this study has constructed an inflation model from money demand and money supply equations. Vector Error Correction modelling is then applied to the inflation model together with Dynamic Ordinary Least Squares (DOLS) so as to examine both short- and long- run effects of partial dollarization of the Eritrean economy on inflation. The results of the analysis show that dollarization has a positive effect on inflation. That is, inflation increases with the increase of dollarization. The analysis is conducted using both official and black market data and the results are similar regardless of which market is used in the analysis. The error correction terms under the inclusion of official and black market are 7.2 and 7.6 percent respectively. This indicates that about 7.2 percent and 7.6 percent of the disequilibrium is corrected in the first period when official and black market exchange rates are used respectively. Both the error correction terms are negative which signify that there is an adjustment back to the long run relationship in successive periods to remove the discrepancy in the short run.

Furthermore, this study uncovers the balance sheet effect and the purchasing power effect in explaining why some partially dollarized economies enjoy lower inflation while some others do not. Similarly, more reliance on imported goods and the balance sheet effect have also been discovered as the reasons behind high exchange rate pass through effect which is common as the degree of dollarization in an economy gets higher.

The last contribution of this study is related to the effect of dollarization on the monetary policy transmission mechanisms of the Eritrean economy. To carry out the analysis, Vector Autoregressive model in levels (VAR), Structural Autoregressive model (SVAR) as well as the Toda and Yamamoto (TY) procedure have been applied. The discoveries of the possibility to estimate VAR models in levels together with the reasons behind the technique are some interesting econometric aspect of this study. In the process of analysis, it was found that estimating a model in the first differences when co-integration exist throws away the information found in the levels and leads to model misspecification (Ericsson, 1997). Moreover, estimating a model in the first differences when co-integration exist may bias impulse responses (Ramaswamy & Sloek, 1998) and presents no information on the relationships between levels of the variables in which economic theory is most informative (Poddar et al., 2006).

The results of the analysis suggest that the exchange rate channel is effective through the black market exchange rate when using VAR and SVAR. On the other hand, an effective credit channel has been found under the VAR, SVAR and TY procedure. This finding is peculiar relative to the findings of the studies reviewed so far. The fundamental source of the effectiveness of the credit channel

is found in the credit issued to the government sector when separate analysis on government versus private sector credit is conducted. The next question that one might pose after all these contributions of the study is: so what? This question leads to the discussion of policy implications of the research and the benefits related to the study.

8.3. Policy Implication and Recommendation

For every effect of a certain case, its foundation relies on its cause. The effects of relying on hard currency in the Eritrean economy, as discussed above, have their roots on what drives the reliance of the economy on hard currency in the first place. The first policy implication of the study is, therefore, related to addressing the origins of relying on hard currency in the Eritrean economy. It has been noted that the private sector is crowded out by the government sector as the credit issued strongly favours the government sector over the private sector.

The absence of a more active and productive private sector has weakened the growing capacity of the economy which has undermined the value of the domestic currency and slipped the economy into recurring reliance on and living by foreign borrowing and imported goods. It is, therefore, vital to create conducive environment for the private sector to effectively participate in the economy. To do that, restructuring the current interest rates and offering favourable as well as business oriented terms is crucial. It is also equally important to introduce a market based structure of interest rates instead of leading the economy on interest ceiling. Speaking of the interest rate structure, it would be for the benefit of the economy in general if favourable terms were determined for the export sector. The current interest rate structure on some export activities is as high as the interest

rate charged on the import activity. Revisiting this structure and modifying in a way it would encourage the export sector to boost the economy is needed.

Other than the structure of the interest rates, the selling of houses and lands in exchange for hard currency may not be the best option for the economy. It is essential to consider the fact that the medium of transaction in the economy is the domestic currency and not that of hard currency. In spite of this, requiring households to purchase either land or houses in exchange for hard currency makes those whose income is denominated in domestic currency unaffordable to buy a house. It is plausible to assume that purchasing houses in exchange for hard currency can only be affordable by those who live in overseas. In addition to its impact on widening the inequality between those who can afford and those who cannot, creating more demand for hard currency will have a counter effect on the value of the domestic currency. Revising and reforming the existing policy in terms of land and house purchase in exchange for hard currency would by no means help the economy.

One of the fundamental enhancing factors for the reliance of the Eritrean economy on hard currency is the issuance of the new currency. Although this might politically seem the right option at the time of issuance, it has economically cost more than what originally was thought or expected. It is politically sensitive area and quite unfavourable to conclude that the economy should abandon its currency despite all the effects caused by its new currency. It is, however, safe to say that it might help to adopt a currency whereby the economic and financial condition of the country could be rescued.

In saying that, economic cooperation and integration with the neighbouring countries is one of the keys to alleviate the economic problems of Eritrea. The prerequisite for this to happen would be the improvement of diplomatic relationships and political reconciliation with the neighbouring countries. Designing a monetary system, whereby each country can use its own currency yet the policy lives the currency as strong enough as the currency of the neighbouring country, would be part of the cooperation. Reaching an agreement on the terms of the exchange rate that favours each cooperating country and also redeems the country that has weak economic and financial system would alleviate their respective burdens if not completely eradicate them.

Constituting trade policy that favours the goods and services of the neighbouring countries would save each trading neighbouring country from requiring more hard currency to settle transactions. Creating a conducive environment for the flow of goods and services by each of the cooperating country, including forming an agreement on using domestic currency in the exchange of goods between each other, would benefit each country. The formation of an agreement on the transaction affairs would address the issue of the external factors that make most developing countries rely on hard currency. It has been identified that the dollarization of trade is one of the external factors that enhance the process of dollarization in developing countries. Although it is beyond the control of the Eritrean economy to make all trading countries use their local currencies to settle trade transactions, the agreement by the neighbouring countries on this matter would ease the tension of dollarization.

Another policy implication of the study is to do with the growth of the black market exchange rate and the demand to feed the economy's need for hard currency through this market. It should be noted that the more restricted the foreign exchange rate policy is, the harder to get rid of the black market from the economy would be. There are certain areas through which the Bank of Eritrea can address the issue of the black market so as to run a healthy economy. The first area is to work on the official exchange rate which is currently fixed by the Bank of Eritrea. Allowing the market to operate effectively in the determination of the official exchange rate by, perhaps, employing slight management would open the competitiveness and bring down the currently high rate of foreign exchange in the black market.

The second area is on the permission of the black market dealers of foreign exchange to find legitimate licences to be able to legally engage in the foreign exchange services. Lifting the restriction on the right to participate in the foreign exchange services would stop the illegality of the market on one hand. On the other hand, it would open a room for legal competition with the official market which would ultimately reduce the high rate that is operating within the black market. The ability to freely and legally obtain a licence by either a domestic citizen or a foreign citizen might bring the black market to an end. It would also benefit the economy in general in terms of having guaranteed foreign exchange supply and maintaining proper growth. At the moment, the foreign exchange supply is very restricted and hard for the household and the business sector to purchase any foreign currency in any form in times of urgent need.

The findings on the inflation section indicate that inflation increases with the increase of dollarization both in the short run and long run. This implies that the Bank of Eritrea needs to consider dollarization in fighting and targeting inflation. It is equally important for the Bank of Eritrea to bear in mind that although there are some other factors that affect the Eritrean inflation, dollarization has played its role as well. Therefore, tackling the economy in its dollarization process would require the Bank of Eritrea to employ different instruments. One of the instruments would be reducing the liability dollarization that comes from the growth of external debt. Using broad money instead of base money growth would also be essential for targeting inflation.

The analysis on the dollarization and monetary policy transmission mechanisms of Eritrea indicates an effective and significant response of inflation to the changes in the reserves. This implies that there is a room for the Bank of Eritrea to use the reserve requirement ratio monetary policy instrument to manipulate inflation in the economy. The effectiveness of the credit channel through the credit issued to the government sector indicates that the Bank of Eritrea can somehow control inflation by controlling the credit issued to the government sector. It also implies that there is a need for cutting the government expenditure and minimizing the government sector. Moreover, the Bank of Eritrea needs to be independent from being a financer to the government sector.

8.4. Limitation

The main limitation of this study is the availability of the data required for the analysis. It was very hard to get information directly from the institutes that store the essential data for this study. This was mainly due to political fragility and sensitivity of the country to release information which makes inconvenient to work through the research. Easy access to the information and ability to obtain as much data as possible would have enriched the analysis and benefited the economy.

Since the economic history of Eritrea is fairly new, the data used in the analysis starts from 1996. There was a problem in obtaining quarterly data on inflation beyond 2002 which made it necessary for this study to employ an interpolation method using autoregression and also INTER procedure to disaggregate the annual data. Similarly, some of the data were only available in annual frequency right through the entire study period to which INTER procedure was also applied to disaggregate in order to match the frequency with the other quarterly data. The study that focuses especially on the role of Eritrean banks in the determination of dollarization in Eritrea was narrowed down due to lack of data availability.

Econometric analysis could have been employed on the determination of dollarization in the Eritrean economy if enough data were available. This study has also been restricted from conducting the analysis of pre- and post-dollarization performance of exchange rate volatility, inflation and monetary policy transmission mechanisms as a result of data limitation. A dummy variable could have been included in the equation of EGARCH-M (1, 1) analysis of the exchange rate volatility to capture the differences, if adequate information were obtained. It

should, however, be noted that the official exchange rate was fixed during the Derg regime from 1974 right through to 1991. The rate was also made fixed starting almost from 2003 onwards. Moreover, data on the black market exchange rate is not easily obtainable which made the application of a dummy variable unfeasible.

8.5. Further Study

The study opens the gates of several avenues for future investigation in the field of dollarization. Most of the avenues are related to the limitations of the study, as mentioned above. If data permits, it is useful to explore the determinants of dollarization in the Eritrean economy by applying econometric techniques. Specifically, there should be some techniques of how the issuance of the new currency in 1997 enhanced the dollarization process of the Eritrean economy. Whether it is mainly due to the introduction of new and independent currency that the level of dollarization grew fast or due to other factors should be determined econometrically.

In addition to this, if data permits, it is essential to see how the exchange rate volatility varies by using data on pre- and post-dollarization of an economy. Likewise, analysing the performance of the monetary policy transmission mechanisms by using pre- and post-dollarization is important. In the case of exchange rate volatility, for instance, it might be practical for some other economies to use a dummy variable of pre- and post-dollarization in the equation of EGARCH-M (1, 1) to see the difference. It is also equally sensible to employ the pre- and post-dollarization analysis of the monetary policy transmission mechanisms in some other countries. However, applying a dummy variable to see

the differences as a result of dollarization might not be plausible in the case of Eritrean economy as most of the data required for measuring the degree of dollarization are not available in full range. Moreover, as mentioned earlier, the official exchange rate was fixed prior to the independence of Eritrea and it is also not easy to find the black market exchange rate data.

Moreover, in the future, there is a need to explore an econometric technique to help determine by how much the exchange rate volatility has changed as a result of dollarization. The techniques that have been searched so far only enable us to see whether the exchange rate has been positively or negatively affected by the presence of dollarization in an economy. It may be helpful to investigate in the future and focus on what type of foreign exchange system is most appropriate for a partially dollarized economy.

The policy implications of this study indicate that there is a need for economic cooperation between the Eritrean economy and the neighbouring countries in order to alleviate the effects of dollarization. This needs further investigation as to how and in what ways should integration procedures be done. In particular, an assessment on the performance of economic and financial activities of each pledged economy for cooperation might be essential. A specific study is also required to work out how the exchange rate system of the cooperating countries should be designed.

Finally, since this study mainly deals with the macro-economic aspect of dollarization, it would be useful to address the micro-economic aspects of the impact of dollarization. Studies on micro-economic aspects such as: how the activities of the financial institutions; small to medium size private firms; the

agricultural sector and the housing industry might have been affected by the level of partial dollarization would be beneficial. It should be noted that due to data limitation this research has not been able to cover the impact of partial dollarization on social and political policy. Examining the impact of partial dollarization on migration and unemployment would be essential. Moreover, if data is available, how dollarization affects the level of poverty in Eritrea would be a very important aspect to cover in the future.

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