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# Dollarization and Economic Growth in Zimbabwe

**BY**

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# DEDICATION

To my Father in the Lord, *Prophet Emmanuel Makandiwa*

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I am a product of many ingredients. I would like to convey my sincere gratitude to my Supervisor, Dr T. Mumvuma for his invaluable input and patience into this study; my Chairman, Dr Phineas Kadenge and the academic staff in the Economics department of the University of Zimbabwe. In addition, I also want to thank Mr Stephen Zhanje who financed my postgraduate studies; my fiancé Mavis Tatenda Siwela; Gerald Kadira and the MSc class of 2013; family and friends all in the name of my Lord and Saviour, JESUS CHRIST.

# ABSTRACT

*The study investigated the effects of dollarization on economic growth in Zimbabwe from Q1:2000 to Q4:2014. The variables included are gross domestic product per capita (GDPP), interest rates (lending), trade openness, gross domestic investment and dollarization. The study did not, however, include inflation data because it produced spurious results due to the nature of data and some missing figures during the economic crisis. The study adopted an Auto Regressive Distributive Lag (ARDL) procedure and the results showed that dollarization, interest rates, lagged GDPP and trade openness were significant at 1% level whilst gross domestic investment was found to be weakly significant. All results met apriori expectations except for lagged GDPP. Dollarisation and trade openness significantly positively influenced economic activity at 1% level and gross domestic investment was found to be positive but weakly significant at 10% level for the period under consideration. Interest rates negatively influenced economic growth at 1% level of significance. The paper recommends that the dollarization stance should be maintained due to its positive impact on economic activity. This is because dollarization resulted in economic stability and improved financial sector credibility and it is still premature to de-dollarise the economy until a sufficient level of credibility is gained by the central bank. The current liquidity constraints can be addressed by engaging respective central banks of anchor countries especially the Federal Reserve for a formal and systematic financial injection although this comes at a cost of losing national sovereignty. Zimbabwean policy makers should also establish additional complementary policies which foster economic integration with anchor countries and reduce credit risk (reflected by highly significant negative interest rates). In addition, there should be institutional and structural reforms to enhance synchronisation with business cycles and global economic trends.*

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## ACRONYMS

| | |
|---|---|
| ADF | Augmented Dickey Fuller |
| AfDB | African Development Bank |
| CDI | Comprehensive Dollarization Index |
| CFCA | Foreign Currency in Circulation |
| CSI | Currency Substitution Index |
| CZI | Confederation of Zimbabwean Industries |
| EAC | East African Countries |
| ECM | Error Correction Model |
| FCC | Foreign Currency in Circulation |
| FDI | Foreign Direct Investment |
| FOLIWARS | Foreign Exchange licensed warehouse and retail shops |
| GDI | Gross Domestic Index |
| GDP | Gross Domestic Product |
| GDPP | Gross Domestic Product per Person |
| INT | Interest Rates |
| LOLR | Lender of Last Resort |
| OCA | Optimum Currency Area |
| RBZ | Reserve Bank of Zimbabwe |
| SARB | South African Reserve Bank |
| USA | United States of America |
| USD | United States Dollar |
| VECM | Vector Error Correction Model |

| | |
|---|---|
| WB | World Bank |
| Z$ | Zimbabwe Dollars |
| ZAR | South African Rand |
| ZIMRA | Zimbabwe Revenue Authority |
| ZIMSTAT | Zimbabwe Statistics |

# CHAPTER ONE

# OVERVIEW OF THE STUDY

## 1.0. Introduction

Dollarization was defined by Havrylyshyn and Beddies (2003) as the use of any foreign currency for transactionary purposes whilst Winkler et al. (2004) added that a nation will have to forego its central bank when it dollarizes. Approximately six years after dollarization[1], the Zimbabwean economy remains fragile and characterised by liquidity constraints, high interest rates, low local demand, unsustainably high external liabilities, massive deindustrialisation and informalisation. After the economic rebound between 2009 and 2012 as a result of dollarization, growth rate has been taking a downward trend thereafter (AfDB 2014, CZI 2014). According to the African Development Bank (2014), the economic stagnation has largely been attributed to liquidity challenges as a result of dollarization. Other challenges constraining the Zimbabwean economy include out-dated technologies, infrastructure deficits, operational bottlenecks, power shortages, lack of integrated financial and administrative systems and a volatile and fragile global financial atmosphere.

AfDB (2014) asserted that the multicurrency regime has restricted the use and effectiveness of monetary policy instruments[2]. In addition, domestic revenue inflows and the upsurge in recurrent expenditures are poised to continue constraining the fiscal space resulting in a contractionary fiscal policy stance. Consumer Price Inflation has remained moderately low and has been oscillating between 0% and 5% since the inception of formal dollarization with recent figures encroaching into deflation levels (ZimStat, 2014). According to the Reserve Bank of Zimbabwe (RBZ) inflation mainly influenced by the exchange rate between the American dollar (USD) and South African rand (ZAR), international oil prices and local utility charges (RBZ, 2014). Persistent liquidity deficiencies, low effective demand and a weak South African rand continue to dampen inflationary forces in the economy (ibid).

[1] Havrylyshyn and Beddies (2003) defined dollarization as the use of any foreign currency for transactionary purposes whilst Winkler et al. (2004) added that a nation will have to forego its central bank when it dollarizes. Makochekanwa (2009) and Carchedi (2011) highlight three types of dollarization namely unofficial, semi-official (or bimonetary) and official dollarization. See section 2.1 for details

[2] Money Supply and interest rates

The move to officially adopt a multi-currency regime was aimed at achieving price stability and improving credibility in the monetary sector which would in turn boost economic activity. After officially dollarizing, the most immediate and noticeable effect of dollarization was a drastic reduction in inflation from hyperinflationary levels to creeping inflation. Most major macroeconomic indicators except for employment began to take a positive trend as a result of dollarization. This positive drift was, however, not sustained since it lasted only up to 2012, which was approximately three years after official dollarization. Thereafter, macroeconomic variables either stagnated or declined and analysts have attributed the economic stagnation to dollarization.

Firstly, dollarization negatively affected liquidity availability leading to key challenges of low local demand and working capital constraints which are vital growth elements. Suppressed local demand and working capital constraints have led to declines in both local and foreign investment. According to CZI (2014) a reduction in capacity utilisation and GDP growth has been mainly caused by two main elements namely low local demand and working capital constraints contributing 28.8% and 26.5% respectively. CZI (2014:Q4) reports suggested that owing to liquidity constraints, approximately 15 to 30 companies are shutting down operations on a monthly basis which is an unsustainable rate. GDP growth rate which was averaging 7.5% in the period 2009-12 (economic rebound) started moderating to between 3.5% and 4% (AfDB 2013). Both suppressed domestic demand and working capital constraints in the economy's key areas have largely been attributed to liquidity challenges as a result of dollarization.

Secondly, dollarization coupled with a depreciating rand has made Zimbabwe's position uncompetitive since South Africa is Zimbabwe's largest trading partner (CZI 2014). Since dollarization in 2009, the South African rand has been depreciating leading to an increase in import volumes over the past five years. This has led to slow growth of local industries of which most of them had already been incapacitated during the hyperinflation era. Some huge employers have relocated to South Africa because of cheaper costs of production thereby reducing the rate of formal employment and gross domestic product (GDP) in Zimbabwe (CZI 2014; RBZ 2013). In addition, there are mixed reactions in terms of investment levels since dollarization. Whilst there has been an increase in foreign direct investment (FDI) due to increased confidence and credibility in the financial system as a result of dollarization, the effect of this investment

increase due to FDI was counteracted by high lending rates which are a disincentive to economic agents especially local investors to borrow and invest.

Thirdly, dollarization has resulted in limiting the roles of the central bank to that of only a supervisory authority. The Reserve Bank of Zimbabwe (RBZ) no longer has direct influence on either money supply or interest rates and as such can no longer benefit from seignorage revenues. Liquidity challenges have resulted in lending rates as high as 20% and larger interest rate spreads as high as 17% due to lack of lender of last resort (AfDB 2014). Bankers are citing, among other factors, higher credit risk in the economy as a justification to the high interest rates. In addition, dollarization has not been effective (except for combating inflation) in fostering growth since there currently exists poor financial integration (and political integration due to economic sanctions) between Zimbabwe and its anchor countries and as such the country cannot get any assistance from the Federal Reserve Bank (Ministry of Finance 2013, 2014; RBZ 2014).

**Overview of the Zimbabwean Economy (2000-2014)**

In retrospect, the Zimbabwean economy has been characterised by hyperinflation for almost a decade (1998-2008). During this era inflation figures exponentially rose from 48% in 1998 to 585.84% in 2005 and 66 212% in 2007 (Hanke et al. 2009). The inflation rate reached its peak between August and November 2008 with approximate figures reaching around 79, 600, 000, 000% annually and daily equivalent inflation being around 98%. Zimbabwe's inflation rate did not, however, surpass Hungary's daily inflation rate of 195% in July 1946 (Hanke et al 2009). Net exports fell by a margin of 17.6 % within the ten year era and the international trade structure shifted from Europe being Zimbabwe's significant trade partners to South Africa and some Asian countries due to souring international relations in this era (RBZ 2012; CZI 2012).

As a result of several economic challenges, the central bank Governor Dr Gideon Gono resorted to introducing the 'cheap to produce' bearer cheques[3] to benefit from seignorage revenue. This further fuelled the rate of growth of inflation. Inflation was increasing at an increasing rate leading to the highest hyperinflation levels in the 21st century. The exchange rate remained suppressed by the central bank and consequently the black market emerged. Economic stakeholders started substituting local currency with foreign currency in transactions to hedge

[3] Bearer cheques were used as legal tender in Zimbabwe during the economic crisis

themselves against hyperinflation. The continued crisis increased the impetus of foreign currency use in the black market up to a point where bearer cheques became virtually useless.

In December 2008, the central bank licensed 1000 retailers and wholesalers to trade using foreign currency. This was aimed at siphoning the foreign currency from the unofficial market into the official market and at the same time check the response of stakeholders on the use of foreign currency in economic transactions. The pilot project resulted in a significant increase in availability of goods as traders were now hedged against hyperinflation. In February 2009, the government officially adopted several foreign currencies as legal tender in Zimbabwe (Government Budget 2009). These were the United States dollar, the Botswana pula, the South African rand and the Euro among others.

The stance to adopt a multi-currency regime was aimed at achieving price stability and improving credibility in the monetary sector. After officially dollarizing, the economy began to take a positive drift. This positive trend was, however, not sustained since it lasted only up to approximately three years after official dollarization. Economists argue that dollarization has resulted in liquidity constraints which have negatively impacted economic activity supporting Edwards et al (2001) who hypothesised that dollarized economies have slower economic growth compared to non-dollarized countries. CZI (2014) highlights as reflected in Table 1 above how liquidity challenges as a result of dollarization have suppressed demand and funds to cater for operational costs known as working capital.

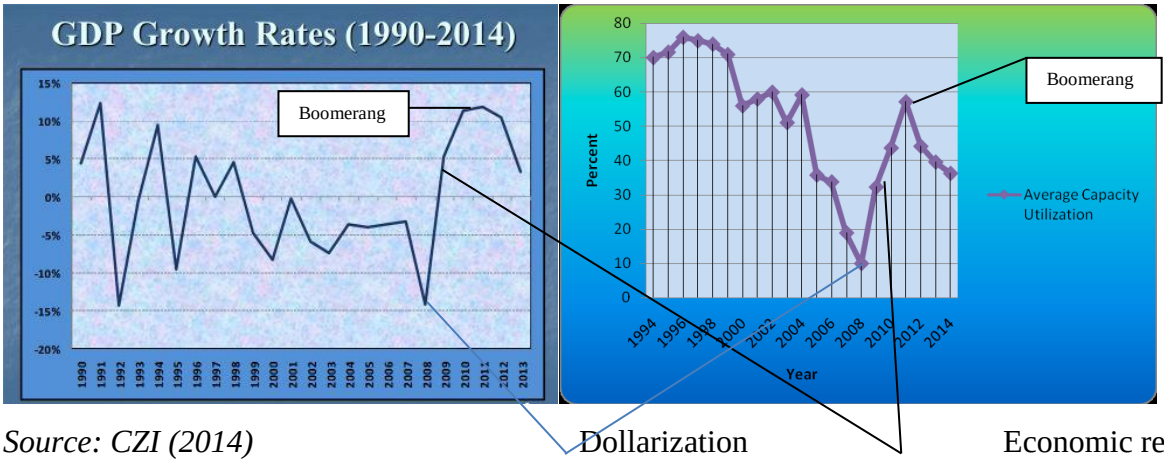
**Table 1: Major Contributors to Capacity Constraints**

| **Capacity constraints** | **% 2012** | **% 2013** | **% 2014** |
|---|---|---|---|
| Low local demand | 17.6 | 13.3 | 28.8 |
| Working capital constraints | 40.2 | 32.3 | 26.5 |
| Antiquated machinery and machine breakdown | 12.5 | 9.5 | 14.2 |
| Power and water shortages | 8.8 | 9.9 | 3.8 |
| Shortage of raw materials | 5.9 | 5.3 | 6.2 |
| High cost of doing business | 5.2 | 8.0 | 6.2 |

*Source: CZI 2014*

Table 1 above shows that suppressed domestic demand and working capital constraints are the major contributors to capacity utilization resulting in low economic activity. These have been largely attributed to dollarization since the central bank can no longer inject liquidity to stimulate demand.

**Figure 1: Trends in GDP Growth rates and Capacity utilisation**




*Source: CZI (2014)*

Figure 1 above reflects the trends in GDP growth rates and capacity utilisation. The diagrams clearly indicate the negative decline in economic activity during the crisis period of 2000 to 2008 and the upsurge after dollarization in 2009. This was followed by a period of economic recovery between 2008:Q1[4] up to early 2012. The recovery could be clearly attributed to dollarization. However, after 2012 the trends clearly show that the economy boomeranged and the general trends started subsiding. This has been attributed to liquidity constraints which have dampened key growth elements of both local demand (consumption) and working capital (investment).

### 1.2. Problem Statement

The management of exchange rate was problematic for Zimbabwe between 2000 and 2008 leading to dollarization. However, economic analysts view dollarization as depriving the country of its sovereignty and that it should be abandoned because the nation will be disadvantaged of its monetary policy mediations and monetisation of domestic credit. The problem is that the economy has stagnated due to liquidity constraints as a result of dollarization and no study has

[4] Economic recovery is believed to have started when the central bank issued licences to 1000 retailers in the last quarter of 2008. The recovery, however, became very significant after official dollarization in February 2009

investigated this effect. Liquidity is important because it provides the necessary stimuli to boost both consumption and investment which are significant for economic growth. Initially, there seemed to be a positive effect on economic growth due to stability and credibility gains because of dollarization but the economy seemed to have reached its upper limit and in 2012 the economy started taking a downward trend. Analysts have attributed this to insufficient liquidity to stimulate the economy.

There is scanty literature on the effects of dollarization in Zimbabwe hence this study will attempt to identify the effects of hard pegs such as dollarization on economic growth. No existing literature has addressed the economic effects of dollarization in Zimbabwe at a macroeconomic level. Existing literature by Sikwila (2013) and Chagonda (2010) tried to establish the effects of dollarization on tourism and education and banking sectors, respectively. Nkomazana and Niyimbanira (2014) focused on the causes and effects of dollarization on the banking sector only. These studies were analysed at a microeconomic level and the paper by Sikwila (2013) used a qualitative approach in its analysis and they were not analysed within a liquidity constrained environment. This study, therefore, seeks to fill this literature gap by analysing the macroeconomic effects of dollarization in Zimbabwe and applying econometric techniques for data analysis.

### 1.3. Objectives

The study's general objective is to analyse the economic effects of dollarization on the Zimbabwean economic activity from Q1:2000 to Q4:2014. Its specific objectives are as follows:

- To establish the effects of dollarization on economic growth
- To establish the effects of interest rate on economic growth
- To establish the effects of imports on economic growth

### 1.4. Research Questions

The main research question is: Does dollarization have any significant effects on economic growth?

The study seeks to answer to the following specific questions:

- Does dollarization have a positive effect on economic growth in Zimbabwe?

- Are interest rates affecting economic growth in Zimbabwe?
- What sort of effect does trade openness have on economic growth in Zimbabwe?

### 1.5. Hypotheses

- Dollarization positively impacted economic growth
- Interest rates negatively affects economic growth in Zimbabwe
- Trade openness positively impacts the Zimbabwean economy

### 1.6. Justification of the study

The study is significant for policy makers because it can shed light on the strengths, weaknesses and challenges of dollarization. These challenges range from reduced domestic demand as a result of liquidity constraints, increased in-formalisation of the economy, falling industrial capacity to reduced competitiveness of local products on the international market. The study will also assist policy makers with identifying key target variables for policy formulation. The study has important implications for economic policy as it enables development of sound policies for the correct target variables. In addition, the study will contribute to literature on dollarization in Africa since there is scanty literature on the subject of dollarization of which most of the studies were conducted outside Africa.

### 1.7. Scope of the Study

The study will focus on Zimbabwe from the first quarter of 2000 to the final quarter of 2014. This is because the Zimbabwean economy started experiencing perennial inflationary challenges in 2000 which ultimately led to dollarization almost a decade later. The paper will concentrate on Zimbabwe because of its unique situation regarding its monetary sector and the nature of dollarization. Dollarization and economic growth are the main variables in this study.

### 1.8. Organisation of the study

The study comprises five chapters. The next chapter provides the theoretical and empirical literature of the study. Methodological estimation procedures follow in chapter three, while chapter four presents the empirical results discussion and economic interpretation. Finally the last chapter, chapter five concludes with policy recommendations as well as suggestions for future research.

# CHAPTER TWO

# LITERATURE REVIEW

## 2.0. Introduction

In the existing literature, the effects of dollarization on economic growth in Zimbabwe remain controversial. Before we embark on the empirical investigation, it is imperative to review some definitions and theoretical postulations on which the dollarization debate is anchored. The study will consider the applicability and significance of the theoretical and empirical literature, that is, their strengths and weaknesses in the Zimbabwean context.

## 2.1. Types and Measures of Dollarization

### 2.1.1. Types of Dollarization

The subject of dollarization has been surrounded by varying opinions and controversies for some decades now with the debating reaching its peak in the late 1990s and early 2000 due to the increased incidence of currency crisis countries like Argentina, Turkey, Mexico and Croatia (Edwards et.al 2001; Bahmani-Oskee and Domac 2003 and Kraft 2003). Such debates could be as a result of several forms and measures of dollarization resulting in different and sometimes contrasting analysis and policy recommendations. It is therefore imperative to highlight some of the definitions used in existing literature. Dollarization has been defined by Winkler et al. (2004) as the adoption of foreign currency by authorities of a domestic country as legal tender and official currency, implying that the country chooses to abandon its own currency and central bank to forego the monetary policy instrument. Havrylyshyn and Beddies (2003) used a broader definition and defined dollarization as the use of any foreign currency. Hence, the multicurrency regime in Zimbabwe is also a dollarized system.[5]

Makochekanwa (2007) and Carchedi (2011) highlighted that there are three types of dollarization: unofficial, semi-official and official or full dollarization. Under unofficial dollarization, economic stakeholders hold their financial assets in foreign currency even if the

[5] Institutional specifications of dollarization regimes may differ in detail; for instance, some countries have maintained their central bank after dollarizing, while others have abolished it. Moreover, some dollarized countries still issue domestic coins like the recently introduced Zimbabwean 'bond coins' and this merely has a subsidiary or symbolic role.

foreign currency is not legal tender. This is mainly due to the need to hedge against hyperinflation, credit risk or some form of financial system instability. Unofficial dollarization is the rationale behind the theory of currency substitution. The phase of unofficial dollarization was mainly experienced in Zimbabwe between 2000 and 2008 when the black market emerged and foreign currencies were used to peg almost all prices in the informal market since the official exchange rate was not adjusted to inflation rates. Local currencies (and later bearer cheques) were still being used as legal tender but the majority of stakeholders were hedged against hyperinflation by holding their liquidity in foreign currency form, only converting it to local currency for transactionary purposes. De Nicolo et al. (2005) argued that many countries like Tanzania fall into the category of unofficial dollarization. De Nicolo et al. (2005) further defines unofficial dollarization based on functions of money namely transaction dollarization (or currency substitution), financial dollarization (or asset substitution) and real dollarization which is the indexing of local prices and wages to foreign currency.

Semi-official (or bimonetary systems) dollarization is a scenario when a country allows foreign currency as an alternative official legal tender in everyday transactions. Foreign currency will be playing a secondary role relative to national currency. The Zimbabwean economy can be said to have experienced semi-official dollarization when the Reserve Bank of Zimbabwe issued foreign currency licences to 1000 traders[6] in September 2008 until the country officially dollarized the whole economy in February 2009.

Finally, official or full dollarization is when a country replaces its domestic currency with foreign currency and national currency can exist at most in form of coins. The country becomes part of the anchor country's monetary system. Zimbabwe adopted full dollarisation in February 2009 and prices, taxes and the national budget were pegged in USD whilst other currencies were used for convenience purposes.

### 2.1.2. Measures of dollarization

Ideally, when dollarization is officialised the initial country's monetary supply is determined by its monetary base and by the conversion rate of the local currency into dollars. The monetary

[6] Reserve Bank of Zimbabwe issued foreign currency licences known as foreign exchange licensed warehouses and retail shops (FOLIWARS) through quasi-fiscal policies.

base will grow if net exports and net capital inflows are positive. In the case of Zimbabwe the initial money supply was not determined by the monetary base and there was no conversion rate of the domestic currency into foreign currency since there was no formal agreement between RBZ and the Federal Reserve. Rather, the initial money supply was mainly influenced by the amount of foreign currency which was already floating in the informal economy. The monetary base of Zimbabwe when it officially adopted other currencies was estimated at USD 269 million in January 2009 to USD 991.6 million in October 2009 (RBZ 2009). The current money supply in Zimbabwe continues to be mainly influenced by exports revenue, tax revenue, foreign direct investments and diaspora remittances (ZimStat 2013; RBZ 2014). It is estimated that USD3.8 million flow into the country monthly.

## 2.2. Theoretical Literature Review

### 2.2.1. The Currency Substitution Theory

The dollarization debate has its rationale anchored in the theory of currency substitution. Currency substitution refers to the degree that currencies substitute in the portfolios of ultimate wealth holders (Girton and Roper 1976). Currency in this context refers to money as opposed to interest bearing assets that are considered in the capital accounts. Friedman (1953) and Johnson (1972) advocated against hard pegs[7] such as dollarization because currency substitution (or dollarization) would incapacitate domestic monetary policy as with the current experience of Zimbabwe where the central bank have limited or no influence over monetary instruments. However, proponents of currency substitution who include Miles (1978) and McKinnon (1982) argued that economic agents hold both domestic and foreign currencies and variations in interest rates or expected future exchange rates will make the domestic exchange rate unstable because economic agents will be switching resources to maximize returns on their money holdings. Consequently, flexible exchange rates[8] will not secure monetary autonomy leaving hard pegs such as dollarization an optimal policy option. The currency substitution theory is relevant in Zimbabwe because it explains the logic behind economic agents' preference to hold foreign currency in their portfolios during the crisis period. Zimbabweans were holding both

[7] I adopt Friedman (1953) and Mundell (1961) definitions in using the term 'hard pegs' to denote rigid exchange rates where no exchange rate controls exist and no sterilisation occurs. Sterilisation (also known as sterilised intervention or neutralisation) is action by monetary authority to offset the effect of changes in demand for foreign currency on the supply of domestic monetary base, or vice versa.

Zimbabwean dollars and foreign currency especially USD as a hedging mechanism from asymmetric shocks. The currency substitution theory also explains the rationale behind the emergence of the black market in Zimbabwe. This is because the exchange rate was suppressed by the central bank and economic agents started substituting domestic currency with foreign currency in their portfolio balances to hedge themselves against hyperinflation, changes in interest rates and expected changes in exchange rates. Currency substitution can be linked to unofficial dollarization and semi-official or bimonetary dollarization.

### 2.2.2. The Bipolar View

This study will also consider the bipolar view of sustainable exchange rates in relation to dollarization. This view attaches much weight on the benefits a country would gain by regaining monetary credibility. The bipolar view argues that dollarization is a much faster and cheaper way of regaining credibility compared to more orthodox measures (Winkler et.al 2004). Consensus among economists seemingly emerged that assuming open capital accounts, hard pegs are regarded as sustainable in most emerging markets (Frankel 1999; Fischer 2001a). Hence, countries with open capital accounts or plan to liberalise capital flows should choose in favour of dollarization. Zimbabwe gained credibility in the financial sector as a result of dollarization. This resulted in an increase in economic activity since investor confidence improved. When inflation decreased to mild levels in 2009, the economy became more stable and planning became possible and this improved credibility in the country. Therefore, the bipolar view is relevant to the Zimbabwean situation because it articulates the gains associated with improved monetary credibility as a result of dollarization.

Credibility of domestic monetary policy is considered the most significant factor in choosing a proper exchange rate regime. According to Summers (2000) and Calvo and Reinhart (2001), countries with a low degree of monetary policy credibility are severely limited in their capacity to use monetary policy to reduce output fluctuations and cannot act as an effective lender of last resort (LOLR). It is difficult for Zimbabwe's central bank to fully 'commit' since Zimbabwe dollarized without a formal agreement with the Federal Bank or any other central bank in the basket of currencies. This has led to liquidity challenges which are currently negatively affecting the credibility of the central bank and the monetary sector. This is to a certain extent stifling the rate of financial development and stabilisation of monetary and economic conditions of the

country. As a result, Zimbabwe is not fully reaping the benefits of improved credibility that have been propounded by the bipolar view as a result of dollarization. Despite some shortfalls, dollarization is still regarded as a key policy tool that can put emerging markets on the road to monetary and financial stability (Calvo 2001). Dollarization is not, however, a tool for stabilising business cycle fluctuations. On the contrary, it ensures that countries cannot pursue classical stabilisation policies they would be incapable of implementing effectively owing to credibility problems.

The bipolar view does not sufficiently explain the experiences in Zimbabwe. For instance, the bipolar view suggests that credibility would improve since both inflation and interest rates will converge and decrease as a result of dollarization. Zimbabwe had rather mixed results regarding the two variables. On one hand, there was a sharp decline in inflation whilst on the other hand; both lending rates and interest rates spread have remained very high in the dollarized era. These contrasting results reflect some weaknesses in the theory and we intent to investigate the factors that could be leading to such results in Zimbabwe which the bipolar view might not have taken into account. For example, high interest rates could be as a result of either the liquidity crisis or high credit risk prevailing in the country and both these factors minimise credibility as advocated by the bipolar view.

### 2.2.3. Theory of Optimum Currency Areas (OCAs)

The third arm of the dollarization debate is anchored on the theory of optimum currency areas (OCAs). An optimum currency area is a geographical region in which it would maximise efficiency to have the entire region share a single currency and is often larger than a single country (Cohen 2002). The theory of OCA is part of the rationale behind the creation of the Euro. The theory was pioneered by the Nobel laureate Robert Mundell in 1961 and he further developed it in 1973. He came up with two models; OCA with stationary expectations (the 'old' view) and OCA with international risk sharing (the 'new' view).

#### (a) The 'Old' view

The 'old' view is the OCA theory with stationary expectations. It focuses on the significance of an adjustment mechanism in the case of asymmetric shocks and a poor level of economic integration between the dollarized country and its anchor. The theory assumes that asymmetric

shocks undermine the real economy and if they cannot be controlled, a regime with flexible exchange rates is preferred since global monetary policy (interest rates) will not be adjusted for a specific situation in each constituent region (Mundell, 1961). Zimbabwe does not seem to currently have control mechanisms in the event of asymmetric shocks since the central bank has little or no influence on monetary policy instruments. Therefore, according to the 'old' view, the Zimbabwean real economy is susceptible to asymmetric shocks and cannot be controlled. The theory is relevant because it sheds light on why; despite the Zimbabwean economy being dollarized it is still affected by global economic events. This is because there are no automatic stabilisers to asymmetric shocks.

Mundell (1961) cited four key issues for a successful currency union which are labour mobility across the region, openness with capital mobility and price and wage flexibility, a risk sharing system such as an automatic fiscal transfer mechanism to redistribute money to sectors which have been adversely affected and should have synchronised business cycles. The 'old' OCA theory is significant in explaining why Zimbabwe has not derived the maximum benefits of dollarization. Using Mundell's (1961) conditions for a successful currency area we can generally conclude that Zimbabwe still falls short of the conditions and as such the benefits of dollarization are not yet being maximised. For instance, there is no free labour movement between Zimbabwe and its anchor countries as evidenced by the 'difficult to obtain' visas. Mundell (1961) highlighted that if labour markets are better integrated like low language barriers and less visa requirements, dollarization can be more effective in enhancing productivity and labour movements between the two markets. In addition, there are no automatic fiscal transfers to redistribute income to sectors which have been adversely affected and business cycles between Zimbabwe and its anchor countries are not synchronised. The 'old' OCA theory places much weight on the significance of economic integration for dollarization to be successful. Therefore, in addition to dollarization this theory also propagates that policy makers should endeavour to make sure the four cited conditions are met to maximise the gains of dollarization since Zimbabwe will be more integrated with its anchor countries.

For instance, on the issue of price and wage rigidities let us consider the following example. Let us assume a hypothetical economy with only two countries (Zimbabwe and America) and two goods only (bananas and instruments) engaging in international trade. Further, assume that

Zimbabwe exports a bunch of bananas at Z$1 per bunch to US and imports light machinery at USD$1 as well. Also assume the cost of labour is Z$5 to produce each bunch of bananas. If we assume that Zimbabwe exports 1 bunch and imports 1 set of instruments in this hypothetical economy, then the exchange rate will be Z$1/USD$1. Now, let us assume there is an asymmetric shock and the demand for bananas falls in America such that Americans are now demanding each bunch at $0.80. Assuming the volume of exports remains the same, a decline in demand of bananas will put pressure on the exchange rate to Z$1.25/$1 and therefore, Zimbabweans will need more Zimbabwean dollars to import the same amount of light machinery. Since the demand for bananas has decreased, the price of labour which produces bananas must also decrease to $4. However, since wages are more rigid downwards any attempt to lower wages from Z$5 to Z$4 a bunch will likely lead to social unrest.

Thus, dollarization was viewed as an effective way to eliminate exchange rate fluctuations between the two economies. Considering our banana example, Mundell (1961) argued that if Zimbabwe now dollarize then in the event of a decrease in demand for bananas, the country will either export more bananas or import less instruments from America but wages will remain constant. The overall effect on the economy will remain the same because either way aggregate demand will decrease but the major difference will be mostly psychological since employees' wages will not be tempered with.

**(b) The 'New' view**

Under OCA with international risk sharing, Mundell (1973) explained how exchange rate uncertainty will interfere with the economy. This view assumes that once a currency is well managed, larger currency areas are preferred to smaller ones. In contrast to the 'old' view, the new OCA theory argues that asymmetric shocks are not considered significant because of existence of a common currency since shocks are spread across the whole region and are dampened whereas in a flexible exchange rate regime, the cost will be concentrated on individual regions since devaluation will reduce its purchasing power. Thus, long run ineffectiveness of monetary policy, low credibility and an ineffective exchange rate system are enough illnesses for an economy to dollarize according the 'new' OCA theory. Winkler et al. (2004) postulates that low credibility implies low effectiveness of monetary policy and nominal exchange rate changes even in the short run and the cost of losing the monetary instrument is negligible in this view.

Whereas the 'new' OCA theory stresses on the benefits of dollarization to economic stability, the 'old' view highlights the integration prerequisites of dollarization. Therefore, the arguments of the 'new' OCA theory are similar to the bipolar view since they both perceive stability or credibility as an integral part of the debate. This is because the cost benefit analysis of the old theory does not focus on whether a country can use monetary policy effectively to cope with asymmetric shocks and unsynchronised business cycles. It actually raises a query of whether such a policy is needed. Under the old view, the pros and cons are not assessed by analysing the effectiveness of domestic monetary policy, but rather by assessing the usefulness of other adjustment mechanisms and the level of economic integration (Winkler et al. 2004).

Mongelli (2002) added to Mundell's (1961) four key properties by highlighting several key properties of the 'old' OCA view that could allow a country to forego monetary policy as an adjustment mechanism. These properties are price and wage flexibility, mobility of factors of production, diversification in production and consumption, fiscal and political integration, openness and trade integration, financial market integration as well as business cycle integration. Literature suggests that fiscal and political integration can be used as shock absorbers (Winkler et.al 2004).

In general, the level of integration that calls for a larger currency area is still poor in Africa since financial markets and business cycles in African economies do not move in a systematic fashion. For example, there is no financial market and business cycle integration between Zimbabwe and the United States or South Africa. In addition, Zimbabwe is not politically integrated due to the existence of the controversial sanctions. According to the 'new' OCA theory lack of financial and political integration will make dollarization ineffective. The economy must both be stable and have the ability to cope with asymmetric shocks for dollarization to be effective.

### 2.2.3. Stability and Integration as key issues

Stability and integration are the two main issues that can be derived from the theoretical literature in analysing the effects of dollarization on economic growth. On the one hand, dollarization is seen from a stability point of view as a tool to eliminate credibility problem and therefore enhance macroeconomic and financial stability which create the necessary environment for economic growth. The bipolar view and 'new' OCA theory are in favour of the stability

argument. The currency substitution theory also highlights why economic agents substitute domestic currency and replace it with foreign currency. This is because foreign currency is more stable. The theories are significant to the Zimbabwean situation because they highlight the benefits of credibility or stability that the economy gained when it officially dollarized. The monetary sector became more stable after official dollarization and this increased investor confidence resulting in increased economic activity although some variables like high interest rates still need to be addressed. Therefore, using the bipolar view we expect dollarization to have a positive effect on economic growth in Zimbabwe.

On the other hand, dollarization is viewed from an integration perspective where it is linked to the degree of economic and financial[9] integration with the anchor country. On the integration angle, some call for *ex ante* integration to warrant sustainability while others argue for *ex post* integration, depending on endogenous integration tendencies related to the adoption of the foreign currency (Winkler et al. 2004). The OCA theory is significant in explaining the significance of integration for dollarization to be effective. The Zimbabwean economy is not integrated with its anchor countries like USA, South Africa, India and Europe. We further argue that under the stability perspective, countries face difficulties in making efficient use of domestic monetary policy owing to lack of credibility but according to the integration point of view, Zimbabwe will still need domestic monetary policy as an adjustment tool to use in the wake of asymmetric shocks. Whichever way you look at it, stability and credibility remain key points attached to dollarization and economic growth.

### 2.3. Empirical Literature Review

The empirical relationship between dollarization and economic growth is the thrust of this section of the study. The existing literature has varying opinions on the subject of dollarization. However, Edwards et al. (2001) acknowledges that there are very few observed cases of dollarization and 'history provides very little guidance on its consequences' and it will be unscientific to consider any single country as a test case that proves something about dollarization as a whole. Eichengreen (2000), Molano (2000) and Edwards et al. (2001) all asserted that there is no sufficient evidence that countries which dollarized are more fiscally prudent and the behaviour of current account imbalances is no different either. Eichengreen

[9] and often also institutional integration

(2000) used dynamic panel data analysis, Molano (2000) both employed Auto Regressive Distributive Lag (ARDL) approach whilst Edwards et al. (2001) used the matching estimator technique. Their findings are relevant for Zimbabwe because the nation is experiencing consistent budget deficits and current account imbalances even after dollarization. The researchers conjecture that current account imbalances are a result of difficulties in accommodating external shocks, an argument raised in the 'old' OCA theory. Klein (2002) found contrasting results regarding dollarization and trade. Using an augmented gravity model to investigate on dollarization and trade on a sample of 165 countries, Klein (2002) found out that currency unions increase trade significantly and studies in Chile by Edwards et al. (2001) acknowledged that dollarized economies had lower inflation and experienced faster growth. Zimbabwe has also experienced lower inflation since dollarization but it is not yet clear whether dollarization increased growth in Zimbabwe, hence, this study intends to fill in the literature gap by investigating if dollarization had a positive effect on economic growth in Zimbabwe.

In the same period Grandes (2001) explored external solvency, dollarization and investment in Argentina. Their study used VAR analysis and showed that a significant endogenous relationship between GDP growth, fiscal debt and country risk holds. Results exhibited that reducing interest rates on foreign currency was less significant than reducing interest rates on peso[10] due to varying interest rate spreads. The study shows the significance of interest rate spreads in a dollarized Argentina. Whilst theoretical and empirical literature suggests that dollarization leads to lower interest rate spreads, Zimbabwe is still faced by high interest rates spreads which are as high as 17% which have limited the level of investment. High interest rate spreads in Zimbabwe have been attributed to liquidity constraints and high credit risk. Secondly, Grandes (2001) found out that Argentine external and fiscal vulnerability sharply worsened between 1994 and 1999 supporting the argument of the 'old' OCA theory which places weight on the need to pay attention to external shocks. The third result was that dollarization is not the best policy to improve fiscal discipline and make structural reforms a success. The same evidence is held by Edwards (2001), and Goldfajn (2000) who support that full dollarization regime did not generate fiscal discipline for Panama. Therefore, dollarization in Zimbabwe needs other complementary policies that promote fiscal discipline, for instance, focusing on capital

[10] Argentine currency

expenditure as opposed to recurrent expenditures like salaries and wages. At present, there are no significant institutional reforms in Zimbabwe to support dollarization policy.

Using a model applied by Tanzi (1983) and making minor changes to the specification of the demand for currency model to incorporate the effects of dollarization of the economy of Pakistan is Aslam (1998) who studied the underground economy and tax evasion in Pakistan and considered the impact of dollarization on the economy for the period 1960 to 1998. The Tanzi model was developed by Tanzi in 1983 to investigate the nature and size of non-measured economy.[11] The original model lacked a base year and Aslam (1998) adjusted it by including more relevant variables like tax evasion, demand for foreign currency, and interest on time deposits and also measured the underground economy for the period concerned in order to increase the accuracy of the estimates. To incorporate dollarization of the economy, the author included a new variable which consists of resident foreign currency accounts along with foreign currency in circulation (CFCA). Demand for foreign currency is measured by the CFCA to money supply (M2). The results showed among other factors, that structural reforms and introduction of foreign currency accounts increased the degree of dollarization in Pakistan.

The findings of Aslam (1998) are significant to the Zimbabwean context because they relate to how the dollarization process took place in Zimbabwe. Foreign currency found its way into the Zimbabwean economy through the use of foreign currency accounts during the hyperinflation era. Stakeholders would then leak the foreign currency into the informal and illegal market to evade taxes when transacting. The study by Aslam (1998) which used the Tanzi method is significant because it highlights the significance of the need to measure and approximate the amount of foreign currency in the informal and illegal economy. The inclusion of foreign currency deposits plus the currency in circulation in the formal, informal and illegal market will assist policy makers in Zimbabwe to come up with more accurate estimates of the degree and extent of dollarization both in the formal and underground economy thus minimising speculative attacks. More accurate estimates will assist in mapping correct strategies in structural reforms to synchronise the formal and underground economy. Similar to the case of Pakistan, there is need to pay attention and consider the dynamics of the underground economy in Zimbabwe because approximately 70% of the labour force employed informally implying a significant proportion of

[11] Both informal and illegal economy

foreign currency is circulating in the underground economy in Zimbabwe and there is a high incidence of tax evasion[12] in Zimbabwe.

The significance of underground economies with regards to dollarization was also confirmed by Sosic and Faulend (2002) for Croatia. The paper used ARDL approach and used remittances and foreign currency deposits as a proxy for dollarization. The study also employed the adjusted Tanzi method to approximate the size of the underground economy for Croatia. They brought supporting evidence that foreign currency is linked with underground economies in countries where the phenomenon of dollarization is widespread. They then suggested that there should be more understanding on the extent and dynamics of dollarization as this will provide important information about the dynamics of underground economies. In other words, understanding dollarization dynamics is more efficient and effective ways of understanding underground economies since the two are closely linked. The authors, however, noted that their estimates are of an indicative nature only and maybe be subject to criticism. Thus, their objective was to draw more consideration to the importance of dollarization for underground economies exploration than to provide final estimates.

The dynamics of currency substitution, asset substitution and dollarization was investigated by Feige (2003). The study included 25 transition countries. He used foreign currency in circulation (FCC) to develop comprehensive dollarization index (CDI) and indices for currency substitution (CSI) and asset substitution. The author then compared CDI to the traditional dollarization index that relies solely on foreign currency deposits as a proxy for dollarization and found out that comprehensive dollarization measure gave a more complete picture by clearly reflecting separate influences of currency substitution and asset substitution. These new dollarization indicators can enable Zimbabwean policy makers to examine the causes of the dollarization process and its tendency to lead to irreversibility (hysteresis). Understanding of the hysteresis effect will help Zimbabwean policy makers to grasp the reality that de-dollarization is not easily acceptable even after economic stability and credibility has been regained. Havrylyshyn and Beddies (2003) also found high evidence of dollarization known as the hysteresis effect in his study on dollarization in the former Soviet Union. Havrylyshin and Beddies (2003) also confirmed the currency substitution theory when they highlighted that foreign currency use as an alternative instrument

[12] See Zimbabwe Revenue Authority (ZIMRA 2014): Annual Report

for portfolio diversification is an 'embryonic financial market.' However, they concluded contrary to popular reasoning that dollarization does not impede effective conduct of monetary policy but actually has a beneficial dimension in promoting financial development.

Further research was later done by Winkler et al (2004) who investigated the motives, features and policy implications of dollarization for several countries across the globe. The authors used qualitative analysis in their study. They recommended that policies should foster integration with the anchor country particularly in fiscal transfers, tourism and offshore finance which are critical in supporting the exchange rate regime of dollarization. In other words, their findings support the 'old' OCA theory. Zimbabwe is currently not highly integrated with its anchor countries thus placing a limit on the benefits of dollarization. Integration can be improved by lessening visa requirements thus promoting free labour movement, reducing language and cultural barriers, removing economic sanctions and engaging in trade agreements.

In 2006, Cohen analysed United States policy on dollarization and focused on the potential costs and benefits of dollarization. The pros and cons are both economic and political. Cohen suggested that there exists no clear presumption regarding U.S interest leaving wide latitude for policy direction and he expects continued passive neutrality from the Federal Reserve with only the possibility of the Euro posing a serious contest to the dollar's global supremacy and this might stimulate a competitive response from Washington. Despite highlighting several pros and cons of dollarization of which most of them exist in other literature[13], the paper will not contribute much to our investigation because it placed its attention on the American economy and the European area. Its analysis was mainly focused on the potential threat to the USD that could be brought by the Euro since the Euro was now replacing the USD in Europe, which is a new 'currency area.' The other weakness of the paper is that Cohen (2006) used qualitative analysis in his paper making his arguments subjective.

Reflecting on Argentina's currency boards and the choice of whether to dollarize or not, Aschinger (2004) empirical results showed that even with a currency board, it is difficult to restore stakeholders confidence or monetary credibility considering a crisis has been developing for years. This crisis could be characterised by economic disparities such as high unemployment,

[13] For a summary of arguments for and against dollarization, see table 2 below

buoyant inflation or staggering economic growth. These findings are also significant because they explain why Zimbabwean policy makers are still battling to restore stakeholders' confidence in the financial sector several years after the 2008 crisis. This has resulted in several challenges like reduced bank deposits and low investment levels even years after the economy has stabilised since both depositors and investors are still sceptical about future policies in Zimbabwe. For instance, even though the majority of economic stakeholders were aware that the central bank was trying to address the current liquidity crisis, the recent introduction of the 'bond coins' by the central bank was not initially well accepted by economic stakeholders although the bond coins were pegged at an exchange rate of 1:1 with the USD. Aschinger (2004) further asserted that after economic stabilisation in Argentina, statistical analysis showed that overheating effects showed up in several countries which would manifest in difficulties in the banking or real estate sector. The study concludes by reflecting that it is generally difficult to judge future implications of policy measures such as currency boards given the chaotic situation of the country. The crisis can only be subjugated by changing internal structures, improving institutions and reducing corruption coupled with international assistance.

In the study of Peru, Moron and Castro (2003) used a portfolio approach to explore de-dollarizing the economy. Upon indicating that countries with high dollarization have not done anything to reduce it, the study highlighted that financial dollarization creates design problems for economic policy since it increases the level of financial vulnerability. The study performed Cointergration analysis and panel estimation of 14 Latin American countries. A Vector Error Correction Model (VECM) was also specified and econometric tests were performed. Two policy alternatives which emphasize on the portfolio approach were proposed, that is, increasing the risk of dollar deposits and increasing the relative volatility of inflation via real depreciation. The results suggested that the former has the potential risk of lowering the level of financial intermediation whilst the latter is more effective to de-dollarize the economy. The portfolio approach could be taken into account in the event that Zimbabwean policy makers are seriously considering de-dollarizing but currently there are no serious signals of de-dollarizing in Zimbabwe.

However, a study was conducted by Makoto (2012) with regards to de-dollarizing in Zimbabwe. In his exploration on the macroeconomic effects of full dollarization and the viability of de-

dollarization in Zimbabwe, Makoto (2012) concluded that the economy stabilised as a result of full dollarization. He, however, reiterated that stability came at the expense of the loss of economic policy independence. He further highlights that the Zimbabwean economy does not currently possess conditions of successful de-dollarization namely a sustainable current account balance, improved capacity utilisation and central bank reform. They recommended that Zimbabwe can adopt market driven de-dollarization by first introducing coins less than $1 backed by gold and diamonds with a one-to-one exchange rate. This will facilitate smaller transactions in the economy making them acceptable to the general public. Makoto's (2012) recommendation has since been adopted by the central bank in 2015 with the introduction of 'bond coins' which are backed by the AfDB. The author further highlighted that following the consolidation of gains in economic performance, authorities can broaden the use of Zimbabwean dollars (ZW$) together with the USD. Makoto (2012) preferred gradual de-dollarization to randisation[14] as this will lead to persistent loss of policy independence.

Misaico (2004) researched on transmission mechanisms of monetary policy in the partially dollarized Peruvian economy. Dollarization in Peru was mainly as a result of asset substitution since domestic currency is mostly used for transactionary purposes. The author used a model based on Quispe (2000) and Bernanke and Mihov (1998) and applied a VAR analysis where the independent variables were monetary policy variables and dependent variables were non-policy macroeconomic variables. One represented policy maker's reaction functions and the other represented structural relationships that describe the transmission mechanism. Results indicated that inflation in Peru is driven by demand shocks and monetary shocks are significant and account for 30% to 40% of the variance in inflation rate. Zimbabwe is also a small economy and the results of Peru signalled the need to monitor demand and monetary shocks. These asymmetric shocks were considered significant by the 'old' view of the OCA theory.

Ize and Parrado's (2006) study explored the dynamic interaction between real dollarization (dollar indexing of wages) financial dollarization (dollar denomination of financial contracts) and monetary policy. The authors used a general equilibrium model with real shocks. They found out that local welfare is maximised if real dollarization is avoided as long as the domestic monetary authorities perform optimally. Their findings are a fusion of the bipolar view and the

[14] Simply adopting the South African rand as legal currency.

'old' OCA theory. They highlighted that dollarization occurs when central bank performs poorly[15] and is accelerated when the correlation between domestic and external shocks is high.[16] They further highlighted that although real dollarization significantly contributes to financial dollarization, significant asymmetries between the two exist. They used a model similar to the ones developed by Corsetti and Persenti (2001, 2005), Devereux and Engel (2002, 2003) and Parado and Velasco (2002) where the money demand equation is a function of the inverse of gross national interest rate and the model was blended in a new-Keynesian fashion

In his study on the implications of dollarization for Belize, Ford (2001) highlighted two clear immediate benefits of dollarization namely the elimination of currency risk and lower transaction costs. The elimination of currency risk was the major benefit for Zimbabwe when it dollarized since inflation sharply declined in February 2009. The need to hedge against hyperinflation was immediately eliminated. In addition, transaction costs were also minimised in Zimbabwe as asserted by Cohen (2002), Makochekanwa (2009) and Sikwila (2013). Transaction costs are in the form of currency conversion and hedging. Ford (2001) further highlighted that operations in the parallel market do not cease as in the case of Liberia because of inadequate US dollars, solvency challenges and civil unrest. The findings partially explain why the parallel market still exists in Zimbabwe even after official dollarization. The continued existence of parallel market could be fuelled by liquidity shortages which currently exist as a result of dollarization. However, the paper by Ford (2001) found it difficult to statistically ascertain the dollarization benefits domestic and international business rates differentials. This is because where interest rates are concerned dollarization was accompanied by additional legislative measures to ensure that any cost savings derived from lower reserve requirements are passed through to the general public. For instance, Ecuador and El Salvador passed legislature to enforce banks to lower lending rates as part of their dollarization program. In other words, interest rates were not left to the invisible hand of market forces and as such we cannot conclusively say dollarization lowers interest rate differentials. Their observation possibly explains why interest rate differentials have not reduced in Zimbabwe since 2009 because there has not been any legislative intervention to force interest rates down as with the case of Ecuador and El Salvador.

[15] Bipolar view stresses on poor performance of the central bank and the need to restore credibility by dollarizing.
[16] The 'old' OCA theory places weight on asymmetric shocks and the need for adjustment mechanisms.

Bahmani-Oskooee and Domac (2003) investigated the role of dollarization in the dynamics of inflation in Turkey. Descriptive analysis suggests that despite high inflation and economic instability, institutional factors played a significant role in the evolution of dollarization in Turkey. Results indicated that shocks on dollarization led to a decrease in the monetary base since the public switched from domestic to foreign money balances. The findings complement the 'old' OCA theory which asserts that a dollarized economy loses adjustment mechanisms in the event of external shocks and the monetary base of Zimbabwe will be heavily affected by such asymmetric shocks. Institutions have also played a significant role in influencing the evolution of dollarization and economic growth in Zimbabwe. Dollarization process started in the informal and illegal market until it came to a point where the Government had no option but to dollarize, thus, institutions were very significant in evolution process of dollarization. After official dollarization, institutions have dampened rather than amplifying economic growth in Zimbabwe. For instance, approximately 80% of Zimbabwe's government revenue is channelled towards recurrent expenditures salaries (Government Budget, 2014) leaving only a small proportion for gross domestic investment.

Berg and Boreinsztein (1999) and Calvo (2000) argued that dollarization support development of a country's financial sector and that a stable currency is a precondition for financial development.[17] They further argued that dollarized economies enjoy higher level of confidence among investors and lower interest rate spreads on their international borrowing. This fosters international trade, reduces fiscal costs and boosts investment growth. However, Makochekanwa (2009), Chigome (2011), Sikwila (2013) and Nkomazana and Niyimbanira (2014) are of the view that the Reserve Bank of Zimbabwe can no longer gain from seignorage revenue. This includes both once-off 'stock' arising from replacing the national currency in circulation with foreign bank notes; and the 'flow' costs arising from loss of future earnings curtailing from the flow of new currency printed each year. The loss in seignorage revenue results in lack of the financial stimulus need to boost economic activity. The inability of the central bank to print money explains the current liquidity constraint in Zimbabwe.

Frankel and Rose (1998), Rose and Engel (2000) and Dallas and Tavlas (2001) support the idea that dollarization might lead to real convergence in terms of GDP levels and convergence of

[17] Well known stylized fact

business cycles with the issuing country and that shocks also become more synchronised further promoting integration. This is in support of the OCA theory. Contrary to this view Goldfajn and Olivares (2000) argued that dollarization could increase a country's default risk thus contributing to higher risk premia if the loss of exchange rate instrument reduces a country's adjustment capacity to asymmetric shocks. Higher default risk is reflected by high lending rates to investors. Bankers in Zimbabwe have cited high credit risk as a justification for high interest rates in the dollarized era. In addition, Goldfajn and Olivares (2000) purport that dollarization does not preclude the sovereign defaults of an economy emanating from an unsustainable fiscal position, unsound financial systems or political turmoil which will further lead in divergence rather than convergence as earlier argued. Zimbabwe did not restructure its financial and political systems even after dollarization and this could explain why interest rates have been diverging from those of the anchor country. Therefore, according to this argument interest rates will remain significantly high and deterring growth in Zimbabwe until financial and political systems have been restructured to complement a dollarized regime.

In Africa a study was conducted in 2011 by Panteleo (2011) who researched on dollarization in Tanzania using empirical evidence and cross-country experience. The study investigated on the stylised facts of dollarization in Tanzania and the East African Countries (EAC) region since the use of the USD as a unit of account, store of value and medium of exchange was raising concerns amongst economic policy makers. The study showed that financial dollarization is very high in Tanzania compared to other EAC countries. The study used primary data gathered using questionnaires which included 20 firms located in Dar es Salaam to determine the extent and driving force behind the use of USD as a unit of account for prices, salaries and financial reporting. Although their methodology was sound in the sense of obtaining primary data, their coverage was very limited and the region may not be representative enough for the whole country. This study is going to use secondary data because it is more relevant and effective to our analysis and will consider time series data rather cross sectional data. Time series data has the advantage of time heterogeneity whilst cross sectional data has the advantage of individual heterogeneity. Moreover, there will be national coverage in the statistics which will give us a much better representation.

Edwards and Magendzo (2001) investigated on whether dollarization is associated with lower inflation and faster economic growth. The analysis was done using a matching estimator technique which was developed in the training evaluation literature. The results suggested that inflation has been significantly lower in dollarized economies compared to non-dollarized ones. In addition, the results also indicated that dollarized nations had lower economic growth than non-dollarized ones and that macroeconomic volatility is not significantly different across countries. The authors conjecture that lower economic growth in dollarized countries is partly because of the difficulties in accommodating external shocks as explained by the OCA theory, for instance, major terms of trade and capital flows shocks. In their coverage, they did not include Zimbabwe and this study intends to investigate also on the relationship between dollarization and economic growth in Zimbabwe, that is, whether the results for Zimbabwe will still be consistent with the findings of Edwards and Magendzo (2001).

Nkomazana and Niyimbanira (2014) investigated on the overview of the economic causes and effects of dollarization in Zimbabwe. They examined the failure of the banking system in providing currency to economic stakeholders, that is, firms and individuals. The paper concluded that dollarization eliminated inflation instantly and reduced capital flight. Although the paper considered not only the causes but also the effects of dollarization in Zimbabwe, the authors did not use econometric techniques in their analysis which leaves some gaps in the study since the conclusions are based on subjective rather than objective arguments. In this study, we are going to apply econometric methods to come up with more robust conclusions for our policy makers and other economic agents.

In addition to the above literature, Table 2 below shows a summary of some of the studies which advocated for and against dollarization.

**Table 2: Arguments for and against dollarization**

| Author and Year | Argument(s) for Dollarization |
|---|---|
| Cohen (2002) | Reduces transaction costs by eliminating expenses in currency conversion or transactions in hedging.<br>Brings greater stability to economies which create a conducive environment for trade and investment |
| Fischer (2001); Barro and Gordon (1983); Goldfajn and Olivares (2000) | Fosters macroeconomic stability since it solves the credibility issue that arise when central bank is unable to pre-commit itself to a low rate of inflation.<br>Interest rates are assumed to converge towards the level of the anchor country. |

| | |
|---|---|
| Eichengreen (2000) | Promote fiscal discipline by eliminating the possibility of printing money to finance debts. |
| Goldfajn and Olivares (2000) | Leads to lower risk premium because a sharp and sudden devaluation is ruled out by definition. |
| Berg and Borenstein (2000); Calvo (1999) | Improves a country's access to international capital markets as a result of lower currency risk, higher financial sector stability, lower risk of sudden introduction of capital controls and lower information costs |
| Hausmann et al. (1999); Berg and Boreinsztein (2000) | Support development of country's financial sector. It is a well-known stylised fact that a stable currency is a precondition for financial development.<br>Dollarized economies enjoy higher levels of investor confidence, lower interest rate spreads on their international borrowing, reduced financial costs and more investment growth |
| Frankel and Rose (1998); Rose and Angel (2000a); Dallas and Tavlas (2001) | Fosters a country's economic integration with the economy of the issuing country.<br>Dollarization might lead to real convergence in terms of GDP levels and convergence of business cycles with the issuing country.<br>Shocks might become more synchronised further fostering integration. |
| Winkler et al. (2004) | Dollarization is seen as one way of accepting the impossible trinity. |
| | |
| | **Argument(s) against dollarization** |
| Cohen (2002) | Dollarization has no direct impact on other critical deficiencies such as fiscal indiscipline, poor banking supervision and labour market rigidities. |
| Goldfajn and Olivares (2000) | Dollarization could increase a country's default risk thus contributing to higher risk premia if the loss of exchange rate instrument reduces a country's adjustment capacity to asymmetric shocks.<br>Dollarization does not preclude sovereign defaults resulting in unsound financial systems or political turmoil. |
| Winkler et al. (2004) | Countries lose use of monetary policy instruments as an adjustment mechanism in the wake of asymmetric shocks. Central banks can no longer react to fluctuations in the business cycle that are not related the anchor country, for example, sudden bank runs. |
| Berg and Boreinsztein (2000); Makoto (2012) | No lender of last resort (LOLR)<br>Loss of policy independence |
| Sikwila (2013); Chogome (2011); Makochekanwa (2009); Nkomazana and Niyimbanira (2014) | Central banks cannot gain from seignorage revenues. This includes 'once-off' stock arising from replacing the national currency in circulation with foreign bank notes and the 'flow' costs arising from loss of new currency printed each year. |

*Source: Author's compilation*

## 2.4. Conclusion

Existing literature gives us contrasting evidence on the behaviour of certain key variables such as interest rates, economic integration and economic growth. Some literature suggest that dollarization lead to convergence between interest rates and inflation with those of the anchor

country while some literature argues that there is no evidence of such a convergence. Moreover, dollarization calls for both ex ante and ex post integration resulting in improved international trade conditions but some empirical studies do not have such evidence. Studies have also presented contrasting evidence regarding dollarization and economic growth; some advocating for a positive relationship while others reason that dollarization slows growth due to lack of lender of last resort and lack of adjustment mechanism to deal with asymmetric shocks.

The reviewed literature elucidates why, despite broad agreement on potential costs and benefits of dollarization, it is far from conclusive (Winkler et al. 2004). Literature reviewed has clearly shown that little to none has been done in seeking to understand the effects of dollarization on the economic activities of the Zimbabwean economy. Thus this study will consider attainment of that objective by applying an Auto Regressive Distributed Lag (ARDL) approach although several papers in the reviewed literature have applied the VAR and VECM models. The model specification in our study cannot be attributed to a particular theory due to the inconclusiveness of the theories but is based on key variables that have been highlighted in theoretical and empirical literature as significant. The next chapter provide an econometric methodology of the ARDL in greater detail.

# CHAPTER THREE

# METHODOLOGY

## 3.0. Introduction

This chapter seeks to outline the methodology and specify the model that will be used to analyse the economic effects of dollarization on the Zimbabwean economy using quarterly time series data from 2000 Q:1to 2014 Q:4. In addition, all the necessary estimation procedures and tests necessary in the Auto Regressive Distributive Lag (ARDL) procedure will be reviewed in this section.

## 3.1 Model Specification

To examine the economic effects of dollarization on the Zimbabwean economy this study follows the following generic equation in log form:

$$lnY_t = \beta_0 + \lambda lnI_t + \gamma lnT + \theta D + \omega G + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

where Y is economic growth, I represent domestic interest rates,T being Trade Openness, D being a dummy measuring Dollarization, G is the Gross Domestic Investment and ε is the white noise disturbance term assumed to be normally distributed with mean zero and constant variance. β is the constant and λ, γ and ω are coefficients of the respective variables. λ is expected to have a negative sign and a positive sign for γ and ω based on the view that trade openness and gross domestic investment should contributes a positive net financial inflow.

## 3.2. Econometric Methodology

There are several time series methodologies that could be employed in our analysis to estimate equation (1). Existing literature by Molano (2000) and Sosic and Faulend (2002) employed ARDL procedure while a VAR analysis was used by Grandes (2001) for a similar study. VAR analysis has a weakness of running into scarce degrees of freedom but is generally sound for time series analysis.

In this study we will employ the ARDL approach to our quarterly time series data because of its ability to accommodate a huge array of functional forms (Perasan and Shin 1998; Sosic and

Faulend 2002). ARDL bound tests also yield consistent and asymptotically normal estimates of long run coefficients. The ARDL bounds test does not restrict the regressors to be I(1). The test can be applied irrespective of whether the regressors are I(0), I(1) or mutually cointegrated (Perasan and Perasan 1997). The test is also considered to be more efficient in small sample data sizes which are characteristic of developing countries. Moreover, Perasan and Shin (1998) argued that the ARDL bounds test yields consistent and asymptotically normal estimates of long run coefficients. In view of the stated advantages and the short series used in this study, the ARDL is likely to produce optimal results for our investigation. ARDL involves an estimation of a conditional Error Correction Model (ECM) and then determining the optimal structure for the ARDL specification of the short run dynamics by using model selection (Abott & De Vita, 2003).

Assuming existence of a long-term relationship between variables is borne out, the second stage in the analysis comprises of estimating the short and long term parameters applying the ARDL approach. Once the long term relationship is established, then the estimates of the long-term ARDL can be outlined. If a long-term relationship between the variables exists, then there also exists an error-correction representation. As a result, the error correction model is estimated in the third step. This indicates the speed of adjustment to long-term equilibrium after a short term shock.

The general error-correction model in equation (1) is formulated as follows:

$$\Delta \ln(Y) = \beta_0 + \sum_{i=1}^{p} \beta_i \Delta \ln(Y)_{t-i} + \sum_{i=0}^{p} \mu_i \Delta \ln(I)_{t-i} + \sum_{i=0}^{p} \emptyset_i \Delta \ln(T) + \sum_{i=0}^{p} \omega_i G_i + \sum_{i=0}^{p} \vartheta_i D_t + \delta EC_{t-1} + \mu_t \ldots\ldots (2)$$

where, $\delta$ is the speed of adjustment parameter and *EC* are residuals derived from the estimation of the Cointegration model given in equation (1). To determine the adequacy of performance of the ARDL model, we perform diagnostic tests. The minimum Akaike's information criterion (AIC) is used to determine optimal structural lags. To test for the long run equilibrium relationship the estimated coefficients of lagged level variables $\eta$, $\varphi$ are restricted equal to zero, thus:

$$H_0 : \eta_1 = \eta_2 = 0 \ldots\ldots (3)$$

$$H_0 : \psi_1 = \psi_2 = 0 \ldots\ldots (4)$$

### 3.3 Estimation Techniques

#### 3.3.1. Pre estimation Test

We test for stationarity of the variables in study prior to carrying out the ARDL bounds test so as to determine their order of integration, thus, ensuring that the variables are not integrate dof order two, that is, I (2) as this may bring forth spurious results (Fosu and Magnus, 2006). This test will be carried out using the Augmented Dickey Fuller test (ADF). The variables I(0) are said to be stationary while those non stationary variables will be differenced $n$-times until they become stationary. We can efficiently apply the ARDL if variables are I(0) or I(1). This is then followed by investigating the possibility of Cointegration between the variables. Properties of the data are then analysed and the unit root procedure is conducted. The appropriate model to use on your data is found after a unit root test is performed.

#### Cointegration Analysis

The bounds test for a long run relationship can be analysed using either the F-test or Wald-test. ARDL uses F-test to determine the presence of a cointegrating relationship between economic variables although the asymptotic distribution of the F-statistic in this context is not standardised with considering whether the variables are I(0) or I(1). Perasan and Perasan (1997) and Perasan et al. (2001) give us the critical values of the distribution. We present the two sets in Table 5 in the next chapter assuming all variables are I(1) and the second set assumes values to be I(0). This will allow stationarity of variables. The null is rejected if the calculated F-Statistic is higher than the highest value in the region and this indicates the presence of cointegration between variables without considering whether they are I(0) or I(1). If the value of the F-statistic falls below this region, we cannot reject the null hypothesis of no cointegration. An F-value that is lying within the region implies that the results are indeterminate. If there is evidence of a long run relationship between dependent and independent variable we estimate the error correction model version of equation (1) represented by equation (2).

### 3.3.2. Post estimation Model Test

The confidence interval and hypothesis testing usually follow a student t-distribution which assumes the normality assumption to be true. We will consider the Jacque-Bera (JB) as formal test for the normality assumption. However, normality is often viewed as an unnecessary and possibly inappropriate addition to the regression model and is not necessary in obtaining the robust results we use in multiple regression analysis (Greene, 2003).

We will test for heteroskedasticity using the Breusch-Pagan-Godfrey test. The consequences of heteroskedasticity, that is, unequal variance of the OLS is that the estimator will no-longer be efficient.[18] This will inflate the standard errors thereby providing incorrect confidence interval and insignificant test results. In the case that the variances are not equal, Greene (2002,69) argued that if the regressors are well behaved and observations are independent as well as greater than 25 then heteroskedasticity is not a problem because of the Central Limit Theorem. The consequences of autocorrelation are essentially the same as those of heteroskedasticity. This study will employ the Durbin–Watson to test for autocorrelation. Autocorrelation can be corrected by substituting with an alternative proxy[19] or eliminating the variable completely to come up with a parsimonious model.

After estimation of coefficients we will have validity tests like F- test and R-squared. R-squared is used to check the goodness of fit of the model and the higher the value of R-squared the better the model. It measures the proportion of the variations in the dependent variable explained by independent variables in the regression model. However, R-squared has tendencies of increasing as the number of variables increases although some variables might not have any economic meaning. Adjusted R-squared is merely a quality checker. This is followed by diagnostic tests for model misspecification. The Ramsey RESET will be considered for model misspecification. Probability coefficients[20] are used for significance test of each independent variable. P-value is the least probability value at which the null hypothesis can be rejected.

[18] No longer BLUE (Best Linear Unbiased Estimator)
[19] The proxy will be derived from theoretical or empirical literature
[20] Sometimes referred to as P-values

### 3.4. Definition and justification of variables

**Economic growth**

Economic growth refers to the ability of an economy to produce more in terms of goods and services over a given period of time and it is usually a rate of change or growth rate. In this paper rate of change in Gross Domestic Product per capita (GDPP) will be sued as a proxy for economic growth. The variable is preferred to some other measures of growth as it is seen to be an important factor that influences the level of income. It is a well-known stylized fact that an increase in per capita GDP is associated with marked improvement in the well-being of society, hence the wide use of GDPP to capture economic growth. The variable was also used by Nkomazana and Niyimbanira (2014) and Edwards et al. (2001)

**Dollarization**

Havrylyshyn and Beddies (2003) defined dollarization as the use of any foreign currency, thus, considering this broad definition the multicurrency regime in Zimbabwe is also a dollarized system. We propose to use the term dollarization even though the nation has officially adopted a multi-currency regime. This is because according to ZimStat (2012), the economy is using approximately more than 70% of USD in transactions, pricing and tax purposes. This variable is considered a dummy variable of 0 from the 2000:Q1 and zero otherwise. This is because it was dollarization was officialised in February 2009 although the Reserve Bank of Zimbabwe had started issuing out official licenses to retail operators to trade in foreign currency during the last quarter of 2009. Dollarization is expected to have a positive coefficient for the period under study.

**Trade openess**

Trade openness is a ratio of the sum of exports and imports expressed as a share of gross domestic product. It gives us a clearer picture of the general international comeptitiveness of local products versus foreign products. This is expected to have a positive impact on economic growth for the period under study. Trade openness variable is borrowed from the OCA theory as it was highlighted by Mundell (1961) and Mongelli (2002) as a key component because it reflects the level of economic integration between Zimbabwe and its trading or anchor countries.

**Gross domestic investment**

Gross Domestic Investment captures government and domestic investment behaviour implying it is a purely exogenous variable. It measures the physical investment used and is significant because it provides an indicator of the economy's future productive capacity and will be considered as a percentage of GDP. A positive coefficient is expected for this variable. Persenti (2001, 2005), Devereux and Engel (2002, 2003) and Parado and Velasco (2002) also used the variable.

**Interest rate**

Interest rates are defined as the cost of borrowing since we are using lending rates as our proxy. Interest rates are considered significant in our model because literature reviewed by Grandes (2001) and Aschinger (2004) asserts that high interest rates reflect high credit risk in the country while Goldfajn and Olivares (2000) highlighted that high interest rates reflect liquidity constraints. We can also use interest rates as a proxy for in investment since there an inverse relationship between investment levels and interest rates.[21] In addition, the bipolar view highlights that the central bank loses control over interest rates after dollarization therefore the study intends to check the behaviour of interest rates as a result of dollarisation.

### 3.5. Data Sources, Type and Period of the Study

Secondary time series data was used to estimate the effects of dollarization on the Zimbabwean economic activity using quarterly time series data from 2000 to 2014. All the data used were obtained from the World Bank (2015). However, World Bank (2015) data was annual and then we computed quarterly data from the annual data using Linsman and Sandee (1964) technique.[22]

### 3.6. Conclusion

This section has specified and elaborated on the ARDL model to be used in empirical analysis of the effects of dolllarisation on economic activities in Zimbabwe. Also all important estimation techniques, the variables and the data source for these variables were discussed. The next chapter will look at the estimation, presentation and interpretation of results.

[21] Loanable funds theory (Keynes, 1936)

[22] Lisman and Sandee (1964) developed a technique to generate quarterly data from annual data. The technique takes into account some fluctuations that may be occurring within the year and generates quarterly data using a formula in their short paper.

# CHAPTER FOUR

## ESTIMATION, PRESENTATION AND INTEPRETATION OF RESULTS

### 4.0. Introduction

This chapter presents the estimation results on the impact of dollarization on economic activity from the empirical models specified in the previous chapter. The first section discusses the descriptive statistics of the data to show statistical distributions of the variables used. Section 4.3 presents the unit root test results of the variables to establish their order of integration. This is followed by a discussion of the diagnostic tests and discussion of the estimation results.

### 4.1 Descriptive statistics

A preliminary examination of the data used was conducted so as to provide a brief description of the basic properties and features of the variables under study. The summary of the descriptive statistics is presented in Table 1.

**Table 3 Descriptive Statistics**

| | GDI | DOLL | GDPP_1 | INT | OPEN | GDPP |
|---|---|---|---|---|---|---|
| Mean | 2.498859 | 0.433333 | 119.0281 | 51.95528 | 20.87541 | 119.0281 |
| Median | 2.772054 | 0.000000 | 110.8455 | 16.40584 | 20.00518 | 110.8455 |
| Maximum | 5.811639 | 1.000000 | 172.8769 | 252.0161 | 31.49139 | 172.8769 |
| Minimum | -0.174069 | 0.000000 | 78.68158 | -32.25868 | 14.21971 | 78.68158 |
| Std. Dev. | 1.515445 | 0.499717 | 25.58854 | 65.82314 | 4.082497 | 25.58854 |
| Skewness | 0.220242 | 0.269069 | 0.844586 | 1.317829 | 0.886384 | 0.844586 |
| Kurtosis | 2.211470 | 1.072398 | 2.764933 | 3.857919 | 3.044214 | 2.764933 |
| | | | | | | |
| Jarque-Bera | 2.039511 | 10.01310 | 7.271399 | 19.20679 | 7.861654 | 7.271399 |
| Probability | 0.360683 | 0.006694 | 0.026365 | 0.000067 | 0.019627 | 0.026365 |
| | | | | | | |
| Observations | 60 | 60 | 60 | 60 | 60 | 60 |

As shown in Table 1, the standard deviations are relatively small for all other variables except for GDPP and INT. This means the all the variables have small deviations from the mean as compared to GDPP and INT. All variables have positive coefficients of skewness, indicating that all are positively skewed.

### 4.2. Correlation matrix

**Table 4 Correlation Results**

| | GDI | GDPP_1 | INT | OPEN |
|---|---|---|---|---|
| **GDI** | 1 | | | |
| **GDPP** | 0.0516 | 1 | | |
| **INT** | -0.688 | -0.4219 | 1 | |
| **OPEN** | 0.2492 | -0.4635 | 0.26017 | 1 |

As shown in Table 3 above, all the absolute partial correlation coefficients are less than 0.8 and this implies that there is no multicollinearity among variables. The highest pair wise coefficient is that between GDI and INT which is 0.688 and it is acceptable. In simple terms, exogenous variables do not move together in systematic ways.

### 4.3. Unit root results

Stationarity of variables is tested using the Augmented Dickey Fuller Tests (ADF) which tests the existence of a unit root. The null hypothesis that a unit root exists was tested against the alternative hypothesis that there is no unit root, of which the presence of unit root implies that the variables are non-stationary. The tests were first performed on variable in their levels and results are presented in Table 5 below. Only probability values have been considered for uniformity. All the probability value of ADF statistic was compared to 0.01, 0.05 and 0.1.

**Table 5 Unit Root Results**

| Variable | Probability | Variable | Probability | Order of integration |
|---|---|---|---|---|
| **GDPP** | 0.526 | DGDPP | 0.0883* | One |
| **GDPP_1** | 0.2941 | DGDPP_1 | 4.166e-006*** | One |
| **OPEN** | 0.0001*** | | | Zero |
| **GDI** | 0.4931 | DGDI | 0.0000*** | One |
| **INT** | 0.8676 | DINT | 1.447e-008*** | One |

*** implies stationarity at 5%, and *** implies stationarity at 1%. D means First Difference*

As shown in Table 3, Trade openness (OPEN) is the only variable that is stationary in levels at 1% level of significance. Interest rates (INT), gross domestic investment (GDI) and lagged Gross domestic product per capita (GDPP_1) are stationary after being differenced once and the probability values are significant at 1% level. Gross domestic product per capita (GDPP) is also stationary after being differenced once but is weakly significant at 10% level. Since all variables are either I(0) or I(1), it is possible to apply the ARDL procedure.

### 4.4. Estimated Results

**Table 6 Model results**

| | *Coefficient* | *Std. Error* | *t-ratio* | *p-value* | |
|---|---|---|---|---|---|
| **C** | −24.3369 | 6.79434 | −3.5819 | 0.0008 | *** |
| **DOLL** | 7.140458 | 2.216102 | 3.222079 | 0.0038 | *** |
| **d_INT** | −0.110827 | 0.0384626 | −2.8814 | 0.0058 | *** |
| **OPEN** | 1.13364 | 0.326822 | 3.4687 | 0.0011 | *** |
| **d_GDI** | 2.03927 | 1.12569 | 1.8116 | 0.0761 | * |
| **d_GDPP_1** | -0.048246 | 0.017224 | -2.801088 | 0.0101 | *** |

| | | | |
|---|---|---|---|
| **R-squared** | 0.849001 | Durbin-Watson stat | 2.080841 |
| **Adjusted R-squared** | 0.784361 | Prob(F-statistic) | 0.000023 |

*Results extracted from Gretl*

Before we interpret the results from Table 6, our model must first pass diagnostic tests. These include normality, heteroskedasticity and autocorrelation and Ramsey RESET test of misspecification.

As shown in Table 6, all variables are significant. In addition, all variables have expected signs except for lagged GDPP. The R-squared is 0.849001 while the adjusted R-squared is 0.784361. This R-squared shows that approximately 85% of the variations in economic growth[23] are explained by combined variations in the regressors. This shows that the model is of good fit since more than half of the variations are explained within the model. Furthermore, the F-test probability value is 0.00023 implying that the whole model is valid at 1 % level of significance.

The calculated Jacque-Bera statistic was found to be 2.602616 while the probability value was 0.272176. This value is greater than 0.05 hence we conclude that the errors are normally distributed at 5 % level of significance. Having passed the normality assumption, we can conclude that OLS estimators are not only BLUE but also follow well-known probability distributions. The OLS estimators of the intercept and slope are themselves normally distributed and the OLS estimator of the variance of errors is related to the chi-squared distribution (Gujarati, 2004). The Durbin-Watson (D-W) calculated value is 2.080841 and the region of no autocorrelation as [1.707; 1.9876] at 1% level. The inconclusive region is [1.9876; 2.293] therefore we can conclude that there is no evidence regarding the absence of positive first-order serial correlation (Gujarati, 2004).

**Table 7: Heteroskedasticity Test: Breusch-Pagan-Godfrey**

| | | | |
|---|---|---|---|
| F-statistic | 0.543624 | Prob. F(6,25) | 0.7700 |
| Obs*R-squared | 3.693186 | Prob. Chi-Square(6) | 0.7181 |
| Scaled explained SS | 1.477260 | Prob. Chi-Square(6) | 0.9610 |

Using the Breusch-Pagan-Godfrey test, the results obtained in Table 7 above strongly supported the null hypothesis that the errors are homoscedastic. The probability value was 0.7181 is less

[23] Proxy is GDPP

than the models probability of 0.961 and this implies that we accept the null hypothesis and conclude that errors are homoscedastic.

**Table 8: Ramsey RESET Test**

| | Value | Df | Probability |
|---|---|---|---|
| **t-statistic** | 0.934991 | 22 | 0.3599 |
| **F-statistic** | 0.874209 | (1, 22) | 0.3599 |
| **Likelihood ratio** | 1.169027 | 1 | 0.2796 |

The Ramsey RESET Test in Table 8 confirms that the model is correctly specified as both the F and t probabilities are greater than 0.05. Having passed the diagnostic tests, results in Table 6 can be said to be valid for reliable interpretation.

### 4.5. Interpretation of Results

The prime and policy coefficient of dollarization was found to be positive and statistically significant at 1%. This means the introduction of dollarization increased the economic performance in Zimbabwe by 7.140458 units. Similar results are alleged by Havrylyshyn and Beddies (2003) and Nkomazana and Niyimbanira (2014). However, these results contrasted those of Edwards and Mangedzo (2001) who found out that dollarized countries had lower economic growth compared to non-dollarized countries. The positive effect of dollarization met apriori expectations as dollarization brought with it economic stability and reduced inflation.

Gross Domestic Investment was also found to positively impact the economic activities in the economy. The results complement the findings of Eichengreen (2000), Molano (2000) and Edwards (2001). GDI was, however, found to be weakly significant implying the contribution of gross domestic investment to economic growth has not been high and the government can engage in public private partnerships to boost economic growth. For instance, the recent engagements with the private sector in road construction in major highways and mining will boost economic activity.

Trade openness coefficient was also found to be positive and statistically significant meaning trade was found to increase the intensity of economic activity for the period under study. This is in agreement with the argument raised by Frankel and Rose (1998); Rose and Engel (2000) and

Dallas and Tavlas (2001) purport that dollarization leads to real convergence in terms of GDPP levels and convergence of business cycles with the issuing country and that shocks also become more synchronized further fostering integration. Contrary to popular reasoning that imports have increased due to the depreciating rand over the period concerned, statistical results show that trade has been significantly positively contributing to economic growth.

Interest rates have been found to be negatively related to economic growth because its coefficient is negative and statistically significant at 1%. This is the expected result since the interest rate proxy considered was lending interest rate which measures the cost of borrowing. High lending rates have been cited to be one of the major variables affecting investment levels in Zimbabwe. Previous year income per capita was found to be negative against the prior expectations of a positive coefficient. This means the current income per capita would reduce economic activities by less than proportionate USD in the next year economic activity. This could be due to the fact that the economy is declining due to the closure of firms and reduced capacity utilization (CZI 2014).

### 4.6. Conclusion

Lagged Income per capita (GDPP_1) is the only variable that had results differing from the prior expectation while Gross Domestic Investment was the only variable with a coefficient that is weakly significant. However, all other variables met apriori expectations and are strongly significant at 1%. Dollarization was found to have a positive impact on economic growth hence the acceptance of the hypothesis that dollarization positively impacted the Zimbabwean economy. Interest rate, Trade openness and GDI were some of the variables also found to significantly affect economic growth. The next chapter will consider conclusions and policy recommendations.

# CHAPTER FIVE

# CONCLUSIONS AND POLICY RECOMMENDATIONS

## 5.0. Introduction

The study has investigated the impact of dollarization on economic growth with the latter being measured by Gross Domestic Product per Capita (GDPP) for Zimbabwe from 2000:Q1 to 2014: Q4 using Auto Regressive Distributive Lag (ARDL) procedure. This chapter provides a summary of findings and conclusions of the study. It further gives more insight on whether the objective was met and finally gives some policy recommendations.

## 5.1. Summary

We used quarterly time series data from 2000 to 2014 to determine the impact of dollarization on economic growth for Zimbabwe. Data was obtained from World Bank (2015) on variables except for dollarization which is a dummy variable. Estimation was done using OLS methodology applied in both E-views 7 and Gretl.

The results show that all the explanatory variables were statistically significant at 1% except for Gross Domestic Investment that was statistically weakly significant at 10%. The estimated model passed all the diagnostic tests which include autocorrelation, heteroskedasticity, normality and the Ramsey RESET. Parsimonious results were obtained by using stationary variables. In addition, the coefficient of determination[24] indicated that the explanatory variables or regressors accounted for a greater proportion of the total variation in Gross Domestic Product per Capita (GDPP).

Results showed that dollarization positively impacted economic activities in the economy for the period under study bringing us to the conclusion that Zimbabwe`s economic growth is positively and significantly affected by dollarization. Other factors that positively influence growth are trade openness and gross domestic investment. Interest rates and lagged per capita income were found to negatively affect growth for the period concerned. The main conclusion of the study is the argument that the present state of the economy cannot only be explained by the dollarization

[24] $R^2$ and Adjusted $R^2$

but also gross domestic investment, domestic interest rate and trade openness as evidenced by obtained results.

### 5.2. Policy Recommendations

Given the results and a careful study of existing literature, we recommend contrary to public reasoning that the government should maintain the dollarization stance due to the positive impact it has on economic growth. Dollarization has resulted in economic stability and financial sector improving in credibility which are key components for boosting investor confidence. However, policymakers should note that dollarization on its own is not a cure but rather create the necessary environment for other policies to succeed. In other words, dollarization creates the necessary but not sufficient environment for growth. Dollarization mostly brings stabilisation, improves credibility and promotes integration with anchor countries. Policy makers should therefore develop other policies that complement dollarization stance and current economic blueprints such as Zimbabwe Agenda for Socio-Economic Transformation (Zim-Asset) do not seem to synchronise sufficiently enough with the dollarization regime. Policies should foster economic integration like trade agreements and reduce credit risk as reflected by negative coefficient of interest rates on economic growth. In other words, higher interest rates are reflecting higher credit risk in the period under study. Higher interest rates could also be reflecting liquidity shortages and the government should introduce policies to inject liquidity and lower the cost of borrowing.

The liquidity constraints currently faced in the economy could be addressed by engaging and seeking a financial injection from the central banks of the respective anchor countries, especially the Federal Reserve Bank of America since 70% of our transactions are in USD. This option is preferred to that of introducing our own currency because the Reserve Bank of Zimbabwe has not yet gained enough credibility from economic stakeholders for it to effectively implement monetary policy. Policy makers should, however, note that such a financial injection from the Federal Reserve will come at a cost of losing sovereignty but such an injection will boost investment levels and activate the money market which is practically dead. However, the cost of losing sovereignty is viewed as negligible in this context given the desperate state of the economy in terms of liquidity needs. The Federal Reserve will not only contribute financially but assist Zimbabwe in developing structures that ensure sustainability of the monetary system.

Policy makers should also note that the country is currently characterised by policy inconsistencies, lack of central bank independence and fiscal indiscipline and this has negatively affected financial sector credibility. Therefore, a dollarization stance will ensure a 'strong commitment device' exists and there will be little room for government to intervene in central bank activities. Therefore, a dollarization stance will ensure some level of discipline still exists until the sufficient level of central bank credibility is attained before policymakers start considering de-dollarization.

### 5.3. Limitations of the Study and Suggested Areas of Further Research

This study estimated the impact of dollarization on economic growth and still there is room for further studies. Dollarization impact on Zimbabwe`s economic growth can be further researched since some variables were not used due to unavailability of quarterly data, for instance, labour or employment data and diaspora remittances. The inflation variable was not included for the period concerned because the inflation figures produced spurious results due to both the nature of data and some missing figures of inflation during the crisis era. In addition, the impact of dollarization was aggregated at national level and probably better results could have been obtained if the study is focusing on sectorial level. The impact of dollarization on the financial sector cannot be equated to that on mining sector. This study could not cover those areas because of both time and financial constraints.

The impact of dollarization on economic growth is not one way as literature has shown that it can also be two way. The idea of assuming dollarization to be an exogenous variable was motivated by lack of quantitative data to proxy dollarization since dollarization was considered a qualitative variable or dummy. The model used dollarization as a dummy yet there are many proxies that can be used to explore the same objective in Zimbabwe. Aslam (1998) highlighted that proxies of dollarization include foreign currency in circulation and amount of foreign currency in the underground economy. If data was available then causality tests could have been performed and maybe better result could have also be obtained to either support or dispute some arguments raised in the available literature. Lack of reliable and consistent inflation data during the crisis era has also limited the study in investigating the level of convergence between inflation and interest rates.

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**APPENDIX 1**

Data

| year | gdp | open | doll | int | GDPP | GDI |
|---|---|---|---|---|---|---|
| Mar-00 | -0.69633 | 18.41778 | 0 | 16.75428 | 170.8323 | 2.268838 |
| Jun-00 | 0.046739 | 18.80528 | 0 | 18.43694 | 168.3956 | -0.17407 |
| Sep-00 | -0.90117 | 18.45204 | 0 | 17.69299 | 165.1157 | 3.320517 |
| Dec-00 | -0.48413 | 18.13345 | 0 | 15.12197 | 168.6881 | 3.167864 |
| Mar-01 | 0.249981 | 17.44724 | 0 | 11.73841 | 171.1547 | 3.047181 |
| Jun-01 | 0.835088 | 16.95618 | 0 | 9.258256 | 172.8769 | 3.113475 |
| Sep-01 | 0.664207 | 16.45932 | 0 | 8.019346 | 168.6011 | 3.019697 |
| Dec-01 | -0.29849 | 16.76479 | 0 | 8.755865 | 165.702 | 2.894385 |
| Mar-02 | -1.29925 | 16.70444 | 0 | 7.949035 | 161.2482 | 2.608105 |
| Jun-02 | -1.99375 | 16.53935 | 0 | 6.580194 | 158.157 | 2.371973 |
| Sep-02 | -2.57424 | 16.36782 | 0 | 8.288767 | 150.3506 | 2.380051 |
| Dec-02 | -3.03211 | 16.94452 | 0 | 13.52049 | 145.318 | 2.767525 |
| Mar-03 | -3.89426 | 17.2294 | 0 | 16.0574 | 136.2217 | 3.371687 |
| Jun-03 | -4.79649 | 17.41865 | 0 | 17.41185 | 128.0019 | 3.852243 |
| Sep-03 | -4.66729 | 17.45951 | 0 | 24.84093 | 121.4513 | 3.656586 |
| Dec-03 | -3.60413 | 18.09724 | 0 | 38.84652 | 123.3705 | 2.895607 |
| Mar-04 | -2.26949 | 18.60248 | 0 | 57.4011 | 123.0322 | 1.977181 |
| Jun-04 | -1.34066 | 19.06728 | 0 | 73.39443 | 121.0716 | 1.316236 |
| Sep-04 | -0.92571 | 18.98107 | 0 | 77.35201 | 117.3532 | 0.89655 |
| Dec-04 | -1.2088 | 19.1281 | 0 | 70.40914 | 117.5293 | 0.866729 |
| Mar-05 | -3.60413 | 18.09724 | 0 | 38.84652 | 123.3705 | 2.895607 |
| Jun-05 | -1.48227 | 18.86763 | 0 | 56.56854 | 115.5856 | 0.721906 |
| Sep-05 | -1.52014 | 18.72973 | 0 | 47.65085 | 113.5779 | 0.458798 |
| Dec-05 | -1.42545 | 18.65995 | 0 | 53.40616 | 110.4186 | 0.349946 |
| Mar-06 | -1.26174 | 19.50505 | 0 | 77.01746 | 111.4276 | 0.450892 |
| Jun-06 | -1.02532 | 20.18259 | 0 | 103.3627 | 110.6857 | 0.47961 |
| Sep-06 | -0.83424 | 20.71885 | 0 | 123.3769 | 109.6786 | 0.440051 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Dec-06 | -0.74891 | 20.69112 | 0 | 133.2153 | 106.9855 | 0.528682 |
| Mar-07 | -0.60362 | 20.40979 | 0 | 132.8402 | 107.8348 | 1.099384 |
| Jun-07 | -0.33366 | 20.00518 | 0 | 134.0143 | 108.0028 | 1.37338 |
| Sep-07 | -0.76412 | 20.53182 | 0 | 143.4536 | 103.5198 | 1.398259 |
| Dec-07 | -1.93912 | 22.91968 | 0 | 166.8134 | 99.19599 | 1.19914 |
| Mar-08 | -0.60362 | 20.40979 | 0 | 132.8402 | 107.8348 | 1.099384 |
| Jun-08 | -0.33366 | 20.00518 | 0 | 134.0143 | 108.0028 | 1.37338 |
| Sep-08 | -0.76412 | 20.53182 | 1 | 143.4536 | 103.5198 | 1.398259 |
| Dec-08 | -3.89458 | 26.43174 | 1 | 211.7654 | 91.31157 | 0.773226 |
| Mar-09 | -5.54321 | 29.41018 | 1 | 252.0161 | 84.67585 | 0.451104 |
| Jun-09 | -5.229 | 28.55992 | 1 | 232.5076 | 81.31882 | 0.640957 |
| Sep-09 | -2.98864 | 24.80836 | 1 | 159.4438 | 85.88127 | 1.401832 |
| Dec-09 | -0.34199 | 19.15233 | 1 | 66.50377 | 88.56531 | 2.114443 |
| Mar-10 | 1.515979 | 14.94873 | 1 | -3.00524 | 89.31183 | 2.618085 |
| Jun-10 | 2.487554 | 14.21971 | 1 | -32.2587 | 89.69236 | 3.179248 |
| Sep-10 | 2.439766 | 21.98306 | 1 | 5.546287 | 96.07193 | 4.753593 |
| Dec-10 | 2.877539 | 24.22799 | 1 | 5.537941 | 98.24438 | 5.634561 |
| Mar-11 | 3.040133 | 25.65554 | 1 | 5.413283 | 99.19341 | 5.811639 |
| Jun-11 | 2.996341 | 27.02981 | 1 | 5.41981 | 102.971 | 5.418253 |
| Sep-11 | 3.07676 | 29.15512 | 1 | 5.321077 | 105.9494 | 4.960793 |
| Dec-11 | 3.25521 | 31.49139 | 1 | 5.236115 | 108.8854 | 4.769945 |
| Mar-12 | 3.024092 | 30.94977 | 1 | 5.12621 | 108.9397 | 4.534065 |
| Jun-12 | 1.883651 | 25.50703 | 1 | 5.312358 | 111.0053 | 4.403046 |
| Sep-12 | 1.407111 | 23.40116 | 1 | 5.365044 | 112.0302 | 4.297806 |
| Dec-12 | 1.048029 | 21.88975 | 1 | 5.220451 | 110.5848 | 4.045806 |
| Mar-13 | 0.934516 | 22.29771 | 1 | 5.110822 | 111.5085 | 3.853795 |
| Jun-13 | 0.746026 | 21.98399 | 1 | 4.873556 | 110.6357 | 3.546484 |
| Sep-13 | 0.490955 | 21.25327 | 1 | 4.685051 | 110.1132 | 3.269675 |
| Dec-13 | 0.305379 | 20.90105 | 1 | 4.541937 | 108.373 | 3.04879 |
| Mar-14 | 0.13182 | 24.8033 | 1 | 5.140402 | 120.1495 | 2.979392 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Jun-14 | -0.01862 | 27.28127 | 1 | 5.539983 | 129.4386 | 2.844869 |
| Sep-14 | -0.08173 | 24.26417 | 1 | 4.881909 | 114.0426 | 2.776583 |
| Dec-14 | -0.03815 | 16.67701 | 1 | 3.367938 | 78.68158 | 2.918501 |

**Appendix 2: Descriptive Statistics**

| | GDI | DOLL | GDPP_1 | INT | OPEN |
|---|---|---|---|---|---|
| Mean | 2.498859 | 0.433333 | 119.0281 | 51.95528 | 20.87541 |
| Median | 2.772054 | 0.000000 | 110.8455 | 16.40584 | 20.00518 |
| Maximum | 5.811639 | 1.000000 | 172.8769 | 252.0161 | 31.49139 |
| Minimum | -0.174069 | 0.000000 | 78.68158 | -32.25868 | 14.21971 |
| Std. Dev. | 1.515445 | 0.499717 | 25.58854 | 65.82314 | 4.082497 |
| Skewness | 0.220242 | 0.269069 | 0.844586 | 1.317829 | 0.886384 |
| Kurtosis | 2.211470 | 1.072398 | 2.764933 | 3.857919 | 3.044214 |
| | | | | | |
| Jarque-Bera | 2.039511 | 10.01310 | 7.271399 | 19.20679 | 7.861654 |
| Probability | 0.360683 | 0.006694 | 0.026365 | 0.000067 | 0.019627 |
| | | | | | |
| Sum | 149.9315 | 26.00000 | 7141.688 | 3117.317 | 1252.525 |
| Sum Sq. Dev. | 135.4978 | 14.73333 | 38631.63 | 255628.5 | 983.3400 |
| | | | | | |
| Observations | 60 | 60 | 60 | 60 | 60 |

**Appendix 3: Correlation**

| | GDI | GDPP_1 | INT | OPEN |
|---|---|---|---|---|
| GDI | 1 | 0.05161310462565032 | -0.6881518742167836 | 0.2492239553842743 |
| GDPP | 0.05161310462565032 | 1 | -0.4219777975079101 | -0.4635847315390872 |
| INT | -0.6881518742167836 | -0.4219777975079101 | 1 | 0.2601704313106219 |
| OPEN | 0.2492239553842743 | -0.4635847315390872 | 0.2601704313106219 | 1 |

**Appendix 4: Unit Root Tests**

Stationarity

Augmented Dickey-Fuller test for d_GDPP
including 3 lags of (1-L)d_GDPP
(max was 10, criterion AIC)
sample size 55
unit-root null hypothesis: a = 1

test with constant
model: (1-L)y = b0 + (a-1)*y(-1) + ... + e
1st-order autocorrelation coeff. for e: 0.067
lagged differences: F(3, 50) = 5.767 [0.0018]
estimated value of (a - 1): -0.605841
test statistic: tau_c(1) = -2.26819

asymptotic p-value 0.1825

with constant and trend
model: (1-L)y = b0 + b1*t + (a-1)*y(-1) + ... + e
1st-order autocorrelation coeff. for e: 0.068
lagged differences: F(3, 49) = 5.674 [0.0020]
estimated value of (a - 1): -0.692176
test statistic: tau_ct(1) = -2.13418
asymptotic p-value 0.526

Augmented Dickey-Fuller test for GDPP
including 4 lags of (1-L)GDPP
(max was 10, criterion AIC)
sample size 55
unit-root null hypothesis: a = 1

test without constant
model: (1-L)y = (a-1)*y(-1) + ... + e
1st-order autocorrelation coeff. for e: 0.066
lagged differences: F(4, 50) = 8.480 [0.0000]
estimated value of (a - 1): -0.0110378
test statistic: tau_nc(1) = -1.67847
asymptotic p-value 0.0883

Augmented Dickey-Fuller test for GDPP_1
including 2 lags of (1-L)GDPP_1
(max was 10, criterion AIC)
sample size 56

unit-root null hypothesis: a = 1

test with constant
model: (1-L)y = b0 + (a-1)*y(-1) + ... + e
1st-order autocorrelation coeff. for e: -0.002
lagged differences: F(2, 52) = 2.810 [0.0693]
estimated value of (a - 1): -0.052455
test statistic: tau_c(1) = -1.98418
asymptotic p-value 0.2941

with constant and trend
model: (1-L)y = b0 + b1*t + (a-1)*y(-1) + ... + e
1st-order autocorrelation coeff. for e: -0.008
lagged differences: F(2, 51) = 2.496 [0.0924]
estimated value of (a - 1): -0.0368916
test statistic: tau_ct(1) = -0.901905
asymptotic p-value 0.9544

Augmented Dickey-Fuller test for d_GDPP_1
including 0 lags of (1-L)d_GDPP_1
(max was 10, criterion AIC)
sample size 57
unit-root null hypothesis: a = 1

test without constant
model: (1-L)y = (a-1)*y(-1) + e
1st-order autocorrelation coeff. for e: 0.051
estimated value of (a - 1): -0.686693
test statistic: tau_nc(1) = -4.91094
p-value 4.166e-006

Augmented Dickey-Fuller test for INT
including 3 lags of (1-L)INT
(max was 10, criterion AIC)
sample size 56
unit-root null hypothesis: a = 1

test with constant
model: (1-L)y = b0 + (a-1)*y(-1) + ... + e
1st-order autocorrelation coeff. for e: 0.051
lagged differences: F(3, 51) = 15.556 [0.0000]
estimated value of (a - 1): -0.0576178
test statistic: tau_c(1) = -1.38069
asymptotic p-value 0.5935

with constant and trend
model: (1-L)y = b0 + b1*t + (a-1)*y(-1) + ... + e
1st-order autocorrelation coeff. for e: 0.046
lagged differences: F(3, 50) = 15.254 [0.0000]
estimated value of (a - 1): -0.0575887
test statistic: tau_ct(1) = -1.37767
asymptotic p-value 0.8676

Augmented Dickey-Fuller test for d_INT
including 2 lags of (1-L)d_INT
(max was 10, criterion AIC)
sample size 56
unit-root null hypothesis: a = 1

test without constant
model: (1-L)y = (a-1)*y(-1) + ... + e
1st-order autocorrelation coeff. for e: 0.044

lagged differences: F(2, 53) = 7.546 [0.0013]
estimated value of (a - 1): -0.772382
test statistic: tau_nc(1) = -5.78498
asymptotic p-value 1.447e-008

Augmented Dickey-Fuller test for OPEN
including 2 lags of (1-L)OPEN
(max was 10, criterion AIC)
sample size 57
unit-root null hypothesis: a = 1

test with constant
model: (1-L)y = b0 + (a-1)*y(-1) + ... + e
1st-order autocorrelation coeff. for e: -0.058
lagged differences: F(2, 53) = 14.447 [0.0000]
estimated value of (a - 1): -0.194713
test statistic: tau_c(1) = -2.66488
asymptotic p-value 0.08024

with constant and trend
model: (1-L)y = b0 + b1*t + (a-1)*y(-1) + ... + e
1st-order autocorrelation coeff. for e: 0.087
estimated value of (a - 1): -0.427522
test statistic: tau_ct(1) = -4.92496
asymptotic p-value 0.0001

Null Hypothesis: GDI has a unit root

Exogenous: Constant, Linear Trend

Lag Length: 0 (Automatic - based on SIC, maxlag=10)

| | | t-Statistic | Prob.* |
|---|---|---|---|
| Augmented Dickey-Fuller test statistic | | -2.177044 | 0.4931 |
| Test critical values: | 1% level | -4.121303 | |
| | 5% level | -3.487845 | |
| | 10% level | -3.172314 | |

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(GDI)

Method: Least Squares

Date: 04/22/15 Time: 10:23

Sample (adjusted): 6/01/2000 12/01/2014

Included observations: 59 after adjustments

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| GDI(-1) | -0.155146 | 0.071265 | -2.177044 | 0.0337 |
| C | 0.247957 | 0.234988 | 1.055189 | 0.2959 |
| @TREND(3/01/2000) | 0.004988 | 0.006338 | 0.787040 | 0.4346 |

| | | | |
|---|---|---|---|
| R-squared | 0.078077 | Mean dependent var | 0.011011 |
| Adjusted R-squared | 0.045152 | S.D. dependent var | 0.798617 |
| S.E. of regression | 0.780379 | Akaike info criterion | 2.391435 |
| Sum squared resid | 34.10351 | Schwarz criterion | 2.497072 |

| | | | |
|---|---|---|---|
| Log likelihood | -67.54733 | Hannan-Quinn criter. | 2.432672 |
| F-statistic | 2.371313 | Durbin-Watson stat | 1.979341 |
| Prob(F-statistic) | 0.102670 | | |

Null Hypothesis: D(GDI) has a unit root

Exogenous: None

Lag Length: 0 (Automatic - based on SIC, maxlag=10)

| | | t-Statistic | Prob.* |
|---|---|---|---|
| Augmented Dickey-Fuller test statistic | | -9.726809 | 0.0000 |
| Test critical values: | 1% level | -2.605442 | |
| | 5% level | -1.946549 | |
| | 10% level | -1.613181 | |

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(GDI,2)

Method: Least Squares

Date: 04/22/15 Time: 10:24

Sample (adjusted): 9/01/2000 12/01/2014

Included observations: 58 after adjustments

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| D(GDI(-1)) | -1.161673 | 0.119430 | -9.726809 | 0.0000 |

| | | | |
|---|---|---|---|
| R-squared | 0.623495 | Mean dependent var | 0.044566 |
| Adjusted R-squared | 0.623495 | S.D. dependent var | 1.183598 |

| | | | |
|---|---|---|---|
| S.E. of regression | 0.726256 | Akaike info criterion | 2.215263 |
| Sum squared resid | 30.06453 | Schwarz criterion | 2.250788 |
| Log likelihood | -63.24262 | Hannan-Quinn criter. | 2.229100 |
| Durbin-Watson stat | 1.170151 | | |

**Appendix 5: Results**

Model 10: Cochrane-Orcutt, using observations 2001:1-2014:4 (T = 56)

Dependent variable: d_GDPP

rho = 0.69236

| | *Coefficient* | *Std. Error* | *t-ratio* | *p-value* | |
|---|---|---|---|---|---|
| C | −24.3369 | 6.79434 | −3.5819 | 0.0008 | *** |
| DOLL | 7.140458 | 2.216102 | 3.222079 | 0.0038 | *** |
| d_INT | −0.110827 | 0.0384626 | −2.8814 | 0.0058 | *** |
| OPEN | 1.13364 | 0.326822 | 3.4687 | 0.0011 | *** |
| d_GDI | 2.03927 | 1.12569 | 1.8116 | 0.0761 | * |
| d_GDPP_1 | -0.048246 | 0.017224 | -2.801088 | 0.0101 | *** |

| | | | |
|---|---|---|---|
| R-squared | 0.849001 | Mean dependent var | 1.032159 |
| Adjusted R-squared | 0.784361 | S.D. dependent var | 7.338085 |
| S.E. of regression | 4.556937 | Akaike info criterion | 6.061818 |
| Sum squared resid | 519.1419 | Schwarz criterion | 6.382448 |
| Log likelihood | -89.98909 | Hannan-Quinn criter. | 6.168098 |
| F-statistic | 9.231022 | Durbin-Watson stat | 2.080841 |
| Prob(F-statistic) | 0.000023 | | |

**Residual test from equation 1**

Heteroskedasticity Test: Breusch-Pagan-Godfrey

| | | | |
|---|---|---|---|
| F-statistic | 0.543624 | Prob. F(6,25) | 0.7700 |
| Obs*R-squared | 3.693186 | Prob. Chi-Square(6) | 0.7181 |
| Scaled explained SS | 1.477260 | Prob. Chi-Square(6) | 0.9610 |

Test Equation:

Dependent Variable: RESID^2

Method: Least Squares

Date: 04/19/15 Time: 07:08

Sample: 2001:1-2014:4

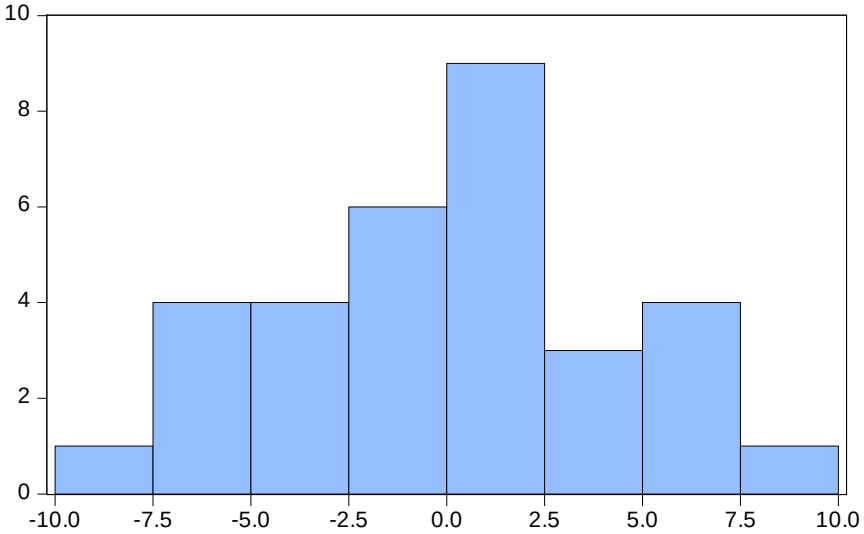
Included observations: 56

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C | 11.28668 | 11.35411 | 0.994061 | 0.3297 |
| DOLL | 2.476029 | 2.863166 | 0.864787 | 0.3954 |
| d_INT | 1.021660 | 1.127808 | 0.905881 | 0.3736 |
| OPEN | 10.32879 | 8.774049 | 1.177197 | 0.2502 |
| d_GDI | 1.603139 | 1.392176 | 1.151534 | 0.2604 |
| d_GDPP_1 | -0.150891 | 1.002253 | -0.150551 | 0.8815 |

| | | | |
|---|---|---|---|
| R-squared | 0.115412 | Mean dependent var | 16.22318 |
| Adjusted R-squared | -0.096889 | S.D. dependent var | 18.87049 |
| S.E. of regression | 19.76353 | Akaike info criterion | 8.996193 |
| Sum squared resid | 9764.924 | Schwarz criterion | 9.316823 |
| Log likelihood | -136.9391 | Hannan-Quinn criter. | 9.102473 |
| F-statistic | 0.543624 | Durbin-Watson stat | 2.724512 |

Prob(F-statistic) 0.770030

**Normality test**




| Series: Residuals | |
|---|---|
| Sample 1981 2012 | |
| Observations 32 | |
| Mean | 4.04e-15 |
| Median | 0.127461 |
| Maximum | 7.917566 |
| Minimum | -8.149665 |
| Std. Dev. | 4.092250 |
| Skewness | 0.080052 |
| Kurtosis | 2.310707 |
| Jarque-Bera | 0.667677 |
| Probability | 0.716169 |

**RESET test**

Ramsey RESET Test

Equation: UNTITLED

Specification: DGDP DOLL DINT OPEN DGDI D_GDP_1 C

Omitted Variables: Powers of fitted values from 2 to 3

| | Value | df | Probability |
|---|---|---|---|
| F-statistic | 3.944651 | (2, 23) | 0.0337 |
| Likelihood ratio | 9.437303 | 2 | 0.0089 |

F-test summary:

| | Sum of Sq. | df | Mean Squares |
|---|---|---|---|
| Test SSR | 132.5918 | 2 | 66.29588 |
| Restricted SSR | 519.1419 | 25 | 20.76567 |

| | | | |
|---|---|---|---|
| Unrestricted SSR | 386.5501 | 23 | 16.80653 |
| Unrestricted SSR | 386.5501 | 23 | 16.80653 |

LR test summary:

| | Value | df |
|---|---|---|
| Restricted LogL | -89.98909 | 25 |
| Unrestricted LogL | -85.27044 | 23 |

Unrestricted Test Equation:

Dependent Variable: d_GDPP

Method: Least Squares

Date: 04/09/15 Time: 07:11

Sample: 2001:1-2014:4

Included observations: 56

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| DOLL | -7.140458 | 2.216102 | -3.222079 | 0.0038 |
| d_INT | 0.863435 | 0.318925 | 2.707329 | 0.0126 |
| OPEN | -0.174711 | 0.208911 | -0.836292 | 0.4116 |
| d_GDI | -0.226574 | 0.067028 | -3.380303 | 0.0026 |
| C | 16.75129 | 4.300776 | 3.894946 | 0.0007 |
| FITTED^2 | -0.048246 | 0.017224 | -2.801088 | 0.0101 |
| FITTED^3 | 0.001396 | 0.002063 | 0.676803 | 0.5053 |

| | | | |
|---|---|---|---|
| R-squared | 0.768432 | Mean dependent var | 1.032159 |
| Adjusted R-squared | 0.687887 | S.D. dependent var | 7.338085 |
| S.E. of regression | 4.099576 | Akaike info criterion | 5.891903 |
| Sum squared resid | 386.5501 | Schwarz criterion | 6.304141 |
| Log likelihood | -85.27044 | Hannan-Quinn criter. | 6.028548 |
| F-statistic | 9.540358 | Durbin-Watson stat | 2.223340 |

| | |
|---|---|
| Prob(F-statistic) | 0.000010 |