

THE IMPACT OF REAL EXCHANGE RATE VOLATILITY ON ECONOMIC  
GROWTH IN KENYA

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## **DECLARATION**

This Research Project is my original work and has not been presented for the award of a degree in any other University.

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X50/76157/2012

This Research Project has been submitted for examination with our approval as University Supervisors.

Signature .....

Date.....

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**DEDICATION**

This research paper is dedicated to my family especially my dear aunt Selimina Achieng Oluoch who contributed immensely in my school fee, my father Pius Onyango Awando, late mother Julita Aoko and siblings Silia Akinyi Onyango and Franco Omondi Onyango. Thanks for your unconditional support throughout the Master of Arts program.

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The above acknowledgements notwithstanding, all errors and omissions in this paper are solely mine.

## **ABSTRACT**

Kenya has witnessed exchange rate volatility following financial liberalization in the late 1980s which led to increased foreign private capital flows. Fluctuations in international world prices attributed to exchange rate volatility which hinders economic growth rate. These fluctuations increase risk and uncertainty in international transactions and thus discourage trade which consequently hampers economic growth. Changes have occurred in foreign exchange market as exhibited by strong appreciation of Kenyan Shilling between 2004 and 2007 of value 30.0% which is a major deviation from its past levels. Therefore, the relationship between exchange rate volatility and economic growth might have changed owing to these changes. This brings about the need of another study to inform the Kenyan monetary policy makers on the impact of exchange rate volatility to allow them make informed decisions concerning monetary. Therefore the main objective of the study was to identify the effect of exchange rate volatility on economic growth in Kenya. Using secondary time series data for the period 1980 to 2012, the study employed OLS estimation method to identify the effect of exchange rate volatility on GDP growth rate. Augmented Dickey-Fuller test (ADF) was used in unit root testing to determine whether the series was stationary or non-stationary and establish their order of integration. The study found that exchange rate volatility positively impacts on GDP growth but is not significant in affecting GDP growth rate. The result differed with Musyoki et al (2012) who found a negative relationship between exchange rate volatility and economic growth in Kenya. The study recommended that policy makers should find equilibrium on the devaluation and appreciation of exchange rate since devaluation of domestic currency provides important opportunity for economic growth, it promotes exports capacity and reduces volume of imports.

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## **LIST OF ABBREVIATION**

ARMA: Autoregressive Moving Average

CBK: Central bank of Kenya

RER: Real exchange rate

USD: united States dollar

GDP: Gross Domestic Products

FDI: Foreign Direct Investments

BOP: Balance of payments

OLS: Ordinary Least Square

GOK: Government of Kenya

PPP: Purchasing Power Parity

VAR: Vector Autoregression

GARCH: Generalised Autoregressive conditional heteroskedasticity

GMM: Generalised Methods of Moments

# **CHAPTER ONE**

## **1.1 Introduction**

Kenya is a small open economy and therefore is prone to both external and internal shocks which can destabilise her economy. Kenya being a developing country is faced with the challenge of designing policies to spur economic growth and mitigating challenges arising from the implementation of both microeconomic and macroeconomic policies. These policies range from fiscal policy, monetary policy to exchange rate policy. Exchange rate policy is of great importance considering it is a determinant factor in the international transaction. According to Stockman (1978), exchange rates and their rates of change overtime have been more volatile than the relative price levels and rates of inflation. Exchange rate volatility has seen Kenya evolved through various exchange rate regimes.

Kenya's exchange rate has undergone various transitions since the collapse of Bretton-Wood system in 1973. This has seen Kenya shifts from fixed exchange rate through crawling peg to flexible exchange rate regime from 1967 to 2009. Since the adoption of flexible exchange rate in 1993 by Kenya, exchange rate volatility has been witnessed in the Kenyan economy, (CBK, 2002).

Volatility captures the uncertainty faced by exporters due to unpredictable deviation of exchange rate from the benchmark or equilibrium (Todani, Munyama, 2005). The risks and investments decisions arising from exchange rate volatility impact on the macroeconomic performance, Azeez et al (2012). The problem of RER volatility has elicited a broad debate in economics across the globe, Musyoki et al (2012). Policy makers are faced with the challenge of choosing the exchange rate regime to adopt in order to promote economic growth. Exchange rate is a key in economic management and in the stabilization and

adjustment policies in developing countries, Ndung'u( 2001). Various studies have been conducted to investigate the impact of RER volatility on economic growth; however, no consensus has been reached. It is not known whether volatility in the RER have influenced the Kenyan economic growth. A study by Musyoki et al (2012) on the impact of RER volatility on economic growth reveals that RER volatility negatively impacts on economic growth. The study also found that RER was very volatile across the period and this contributed to deteriorated competitiveness in the international market.

There exists abundant literature on the relationships between RER volatility and economic growth. However, very few studies have been conducted with specific focus on Kenyan economy. The studies that have been conducted in Kenya on RER behaviour focuses on investigating the determinants of exchange rate behaviour. The study by Ndung'u (1999) determined whether exchange rates in Kenya were affected by the monetary policy and if these effects were transitory or permanent. Ndung'u (1999) was based on the premise that the choice of the exchange rate regime is determined by various factors such as the objective of the policy makers, sources of shock and once the choice is made, the authorities are presumed to adjust the macroeconomic policy to fit the chosen exchange rate policy.

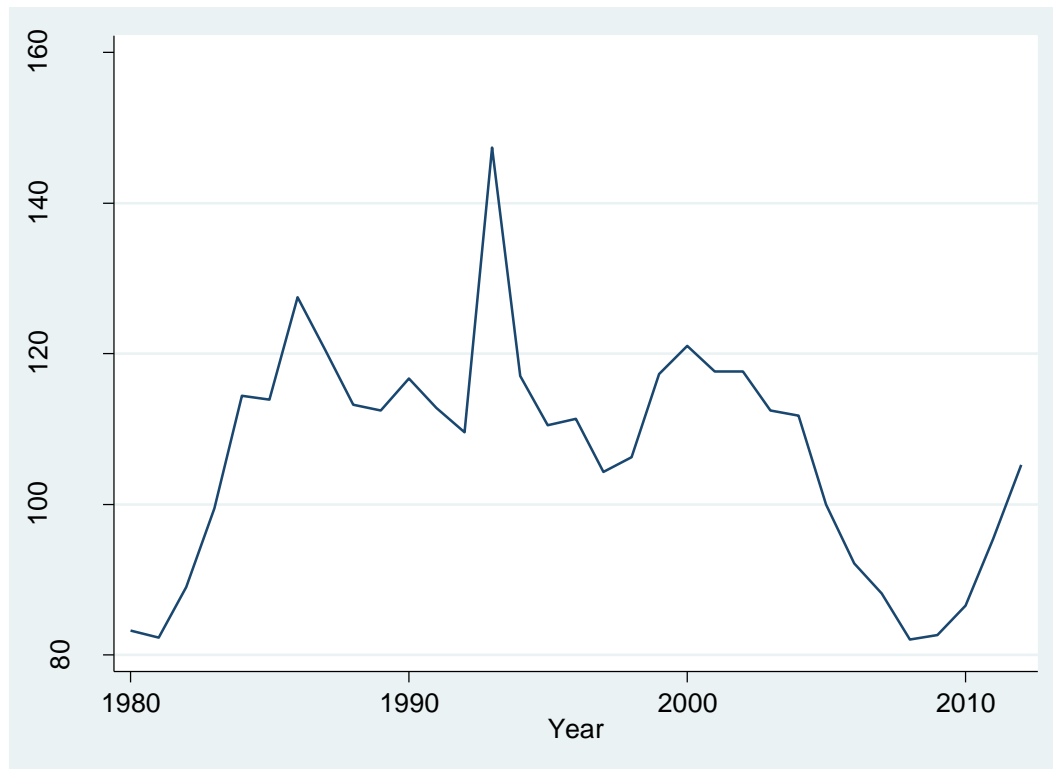
Since Kenya participates in international market through trade, it is not fully insulated against exchange rate shocks. Fluctuations in the exchange rate discourage risk-averse exporters and this could lead to low foreign income from the export sector. Exchange rate volatility has asymmetric effects on macroeconomic variables. Appreciation of exchange rate results to increase in demand for imports and a reduction in demand for exports while depreciation would expand export and discourages imports. Depreciation of exchange rate causes a shift from the consumption of foreign goods to domestically produced goods. Hence it leads to diversion of income from importing countries to countries exporting through a shift in terms

of trade, and this tends to have impact on exporting and importing countries economic growth.

## 1.2 Kenya exchange rate Trend

The graph below shows Kenyan exchange rate since 1980 to 2012.

**Figure 1.1 Real Exchange Rate**



Source: Research output

Kenya's exchange rate has evolved over the past decades with fixed exchange rate being maintained in the 1960s and 1970 with the currency being overvalued (Ndung'u 1999). Up to 1974, the exchange rate for the Kenya shilling was pegged to the US dollar, but after discrete devaluations the peg was changed to the special drawing rate. Between 1974 and 1981 the movement of the nominal exchange rate relative to the dollar was erratic. In general the rate depreciated by about 14% and this depreciation accelerated in 1981/82 with devaluations. The exchange rate regime was changed to a crawling peg in real terms at the end of 1982.

This regime was in place until 1990; a dual exchange rate system was then adopted that lasted until 1993, when, after further devaluations, the official exchange rate was abolished. That is, the official exchange rate was merged with the market rate and the shilling was allowed to float.

During this period of time the shilling exchange rate was only adjusted three times in 1967, 1975 and 1981 with a view in maintaining competitiveness of exports. In 1983, a fixed exchange system was replaced by a crawling peg system whereby discrete devaluation was undertaken to account for inflation and external payment conditions. The basic motive behind the foreign exchange controls stemmed from the balance of payment crisis of 1971/1972. This was aimed at conserving exchange rate and control pressure on the balance of payments; hence the government chose controls instead of liberalization. The adjustable crawling peg system implied adjusting the exchange ratio on a daily basis against a composite basket of currencies of Kenya's key trading partners based on inflation differential with those countries.

In October 1993 a floating exchange rate was adopted and since then, the value of the shillings has remained market determined with the CBK only intervening in the foreign exchange market to smoothen out excessive fluctuations in the exchange rate.

The floating exchange rate system adopted in the 1990s was expected to have several advantages for Kenya. First, it would allow a more continuous adjustment of the exchange rate to shifts in the demand for and supply of foreign exchange. Second, it would equilibrate the demand for and supply of foreign exchange by changing the nominal exchange rate rather than the levels of reserves. Third, it would give Kenya the freedom to pursue its monetary policy without having to be concerned about balance of payments effects. Thus the country would have an independent monetary policy, but one that was consistent with the exchange rate movements.

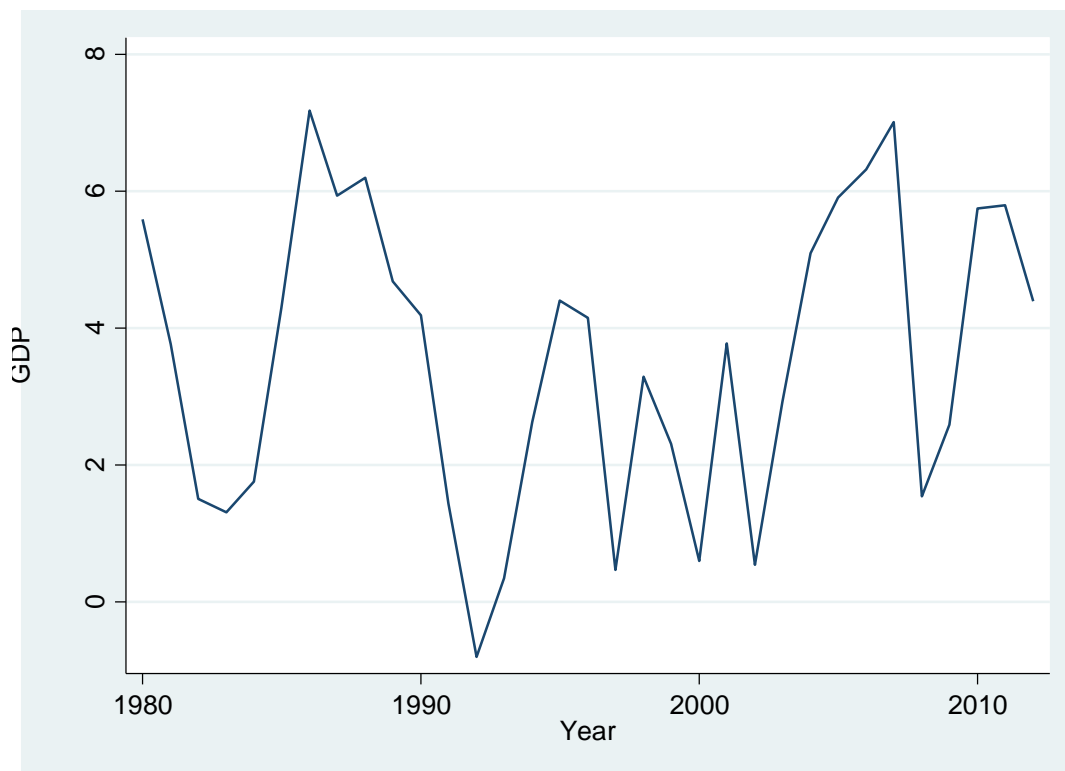
Under the floating system external imbalances would be reflected in exchange rate movements rather than reserve movements.

However, the exchange rate was allowed to float in an environment of excess liquidity, and massive depreciation and high and accelerating inflation ensued. The exchange rate was devalued three times in 1993. After 1993, the exchange rate appreciated under the influence of short-term capital flows taking advantage of the high interest rate on the treasury bills. Those who were importing on trade credit during this time were uncertain as to what prices they would have to pay for foreign exchange when their letters of credit were called and hence wrote the expected foreign exchange redemption into their price structure. This increased the spiral of inflation.

### **1.3 Kenya's economic growth patterns**

Kenyan economy has posted a mixture of patterns in terms of growth in real Gross Domestic Product (GDP) as depicted by peaks and trough since independence. Kenya recorded an average growth rate of 6.5% in real GDP over the period 1964-1967 which was exceptional considering that Kenya is a developing country (CBK 2002). However, this growth momentum was slowed down by the first oil crisis of 1972 and as a result GDP growth rate decelerated to below 4 percent during the early 1970s. Following the unexpected coffee boom of 1976 and 1977, GDP growth rate averaged 8.2% (GOK1994).

**Figure 1.2: GDP Growth rate**



Source: Research output

During the most early 1980's, GDP growth rate remained below 5 percent and fell to below 1 percent in 1984. This was largely attributed to severe drought of that year. Agriculture was the most affected; its contribution to GDP fell to -3.9 percent. However, there was an economic recovery in 1985-1986 when growth rate 4.8 percent and 5.5 percent respectively were recorded. This was attributed to favourable weather conditions, government budgeting discipline and improved managerial principle (GOK, 1994). GDP growth rate continued to slide in the 1990's falling to 0.2 percent in 1993. Dismal performance of the economy during this period was attributed to decline in real output and value added in agriculture due to below average amount of rainfall; sluggish growth in aggregate private domestic demand and foreign exchange shortages leading to reduced imports of intermediate goods as well as suspension of donor aids ( GOK, 1994 ).

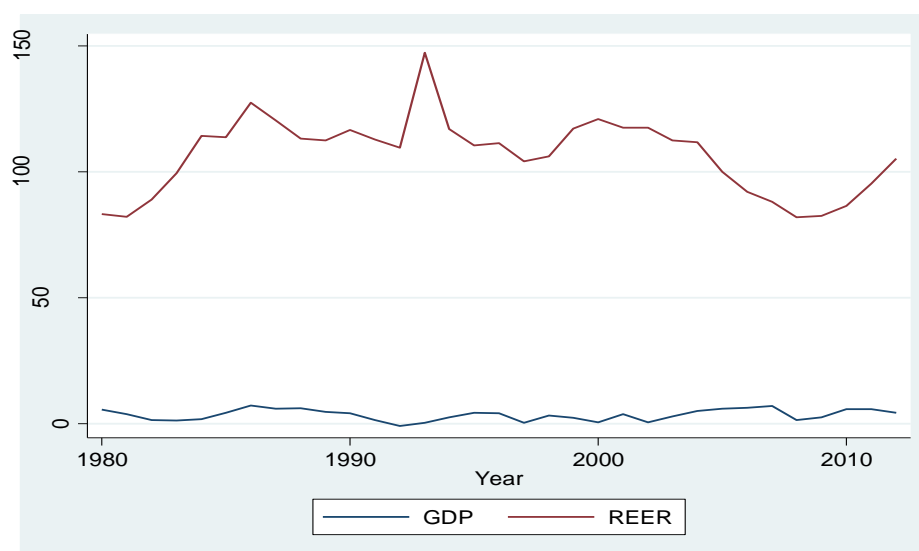


The economy recorded its worst performance since independence in the year 2000 when the GDP growth rate was -0.2 percent. This dismal performance of the economy was largely attributed to the decline in agricultural and manufacturing which contributed to about a third of GDP; both recorded growth rate of -2.4 percent.

After the economy registered a disappointing performance in the 1990's and early 2000, it resumed growth momentum again and there was a consistent increase in GDP growth rate from year 2002. The economy grew at a rate of 7.0 percent in 2007 compared to -0.2 percent in the year 2000. However, this growth momentum was slowed by post-election violence of 2008, and the economy grew at a rate of 1.7 percent.

Figure 1.3 below shows structural breaks for both RRE and GDP growth rate. Real exchange rate indicated structural breaks in 1984, 1995 and 2008. This was attributed to both internal and external shocks. However, GDP growth did not show any significant structural break during the study period.

**Figure 1.3: Structural breaks**



#### **1.4 Problem statement**

Changes in income earning of the export crop producers come as a result of fluctuations in international world price. Such price changes, however, may lead to a major decline in future output if they are unpredictable and erratic. These fluctuations therefore are not desirable since they increase risk and uncertainty in international transactions and thus discourage trade, that is, higher exchange risks lowers the expected revenue from exports thus reducing the incentives to trade ( Clark, 1973; Baron, 1976), and this therefore hampers economic growth in a country. A study by Canzoneri et al ( 1984 ) indicates that exchange rate volatility tends to induce undesirable macroeconomic phenomena such as inflation and also the giving of subsidies for instance by the government when prices of products are low which ultimately yield a wasteful loss.

However, the relationship between exchange rate volatility and economic growth in the existing literature is still controversial. While there are empirical studies which have established a significant negative relationship between them (Musyoki et al 2012; and Schnal (2007), other studies have instead concluded a positive relationship (Aliyu et al 2009). A negative relationship would imply that GDP growth rate is dampened by unstable RER and therefore risk-averse investors and traders do not fully participate in economic activities. A positive relationship would mean that traders and investors are induced to fully utilise their operation capacity with a view of exploiting unpredictable exchange rate and this could lead to increased economic growth.

In the case of Kenya there, there is gaps in empirical evidence. In Kenya, Musyok et al (2012) studied the causal relationship between exchange rate volatility and economic growth between 1993 and 2009 and found negative impact of exchange rate volatility on economic growth. Changes have occurred in foreign exchange market as exhibited by strong appreciation of Kenyan Shilling between 2004 and 2007 of value 30.0% which is a major

deviation from its past levels. Therefore, the relationship between exchange rate volatility and economic growth might have changed owing to these changes. This brings about the need of another study to confirm if Musyok's et al (2012) study is still relevant.

Specifically, there is need to inform the Kenyan monetary policy makers on the impact of exchange rate volatility to allow them make informed decisions concerning monetary instruments.

## **1.5 Research Objectives**

The main objective of this study is to identify the effect of exchange rate volatility on economic growth in Kenya.

### **1.5.1 Specific objectives**

Specific objectives include;

- I. Investigate the impact of exchange rate volatility on economic growth
- II. Draw policy implications from the research findings.

## **1.6 Justification and significance of the study**

There are few empirical studies that have been conducted to identify the effect of exchange rate volatility on economic growth in Kenya. Many of these studies are cross-section and panel studies. The outcomes of these studies vary depending on the aspect of volatility in consideration with some finding positive link, negative link and others find no link between economic growth and exchange rate volatility. There is only one study that has been done on Kenya with respect to the effect exchange rate volatility on economic growth. It is in bridging the identified gaps that this paper seeks to find the effect of exchange rate volatility on macroeconomic growth in Kenya given that Kenya is an open economy. The finding of this

study will be important to policy makers as it will enable them formulate policies that reduces volatility given that volatility reduces economic growth and is detrimental to welfare of the poor and the fact that macroeconomic stability plays an important role in economic growth.

### **1.7 Study scope and limitations**

The major limitation of this study concerns data on the Kenyan economy because it lacks consistency. Different data sources give different data for the same variable. To maintain accuracy and consistency, the study used data from international sources which are more harmonized.

## CHAPTER TWO

### LITERATURE REVIEW

#### 2.0 Introduction

This section consists of both theoretical and empirical literature review. Theoretical literature expounds on the link between exchange rate and economic growth rate while the empirical literature provides detailed previous studies that have done on the effect of exchange rate volatility on economic growth. In this section we begin with theoretical literature review followed by empirical literature review and finally an overview of literature.

#### 2.1 Theoretical literature

##### 2.2.1 The purchasing power parity theory

Purchasing power parity theory assumes the absence of the trade barriers and transactions cost and existence of the purchasing power parity (PPP). In its version the purchasing power parity (PPP) equates the equilibrium exchange rate of the ratio of domestic to foreign price level.

$$E = \frac{P_d}{P_E}$$

Where,

E = is the nominal exchange rate defined in terms of domestic currency per unit of foreign currency.

P<sub>d</sub> is the foreign price, P<sub>E</sub> level with perfect efficiency and absence of trade barriers transactions cost and the purchasing power parity. PPP is a major element of the monetary approach. The PPP between the two currencies as provided by Cassel (1998) is the amount of the purchasing power. The PPP is long-term approach used in the determination of

equilibrium exchange rate. It is often applied as a proxy for the monetary model in exchange rate analysis.

The relative version of PPP doctrine relates the equilibrium exchange rate to the product of the exchange rate in a base period and the ratio of the countries price Indices therefore definition, we have the relate

Purchasing power parity (PPP) as

$$E = \frac{p^d}{p^f} R_0$$

Where

$R_0$  is the actual exchange rate at the base period (the number of units of domestic currency per unit of foreign currency). The purchasing power theory parity theory defines two equilibrium rate systems. The first is the short run equilibrium exchange rate which is defined as the rate that would exist under a purely freely floating exchange rate balance. Second is the long-run equilibrium that would yield balance of payment equilibrium over a time period in cooperating and cyclical fluctuations in the balance of payments.

### **2.2.2: The traditional flow model**

The traditional flow model, views exchange rate as the product of the interaction between the demand for and supply of foreign exchange. In this model, the exchange rate is in equilibrium when supply equals demand for foreign exchange. The exchange rate adjusts to balance the demand for foreign exchange depends on the demand domestic residents have for domestic goods and assets. On the assumption that the foreign demands for domestic goods is determined essentially by domestic income, relative income plays a role in determined exchange rate under the flow model. Since assets demand can be said to demand on

difference between domestic and foreign interest rates differential is other major determinants of the exchange rate in this frame work.

Under the traditional flow model i.e. the balance of payments model, the exchange rate is assumed to equilibrate the flow supply of and the flow demand for foreign currency. The B.O.P by deficits (surplus) in current account is offset by surplus in (deficits) in the capacity account. The major limitation of the traditional model or the portfolio balance model include the over-shooting of the exchange rate target and the fact that substitutability between money and financial asset may not be automatic, this led to the development of the monetary approach.

### **2.2.3The elasticity approach**

According to this approach, the success of devaluation in improving the balance of trade, and the rough it the balance of payment depends upon the demand elasticity of import and export of devolving country. An improvement in the balance of trade will depend upon whether the demand for import and export is elastic. Devaluation makes import of the devaluing country costlier than before and in case her demand for imports is elastic, a higher amount will be adversely the balance of payment of the devaluing country. However, if her demand for exports is elastic then with a fall in the prices of exports as a result of devaluation, the foreigners, which in turn will help in resting equilibrium in her demand for imports is elastic, and then the imports of the country will be significantly reduced by devaluing country.

Let  $E_x^d E_m^d$  = price elastic of demand for exports and imports respectively

$E_x^s E_m^s$  = price elastic of supply for exports and imports respectively. Then, according to learners conditions devaluation will increase a country's balance of trade, then

$E_x^d = E_m^d > 1$  give infinite Ems

#### **2.2.4: The monetary approach**

It identifies- exchange rate as a function of relative shift in money stock. The Purchasing Power Parity (PPP) is also a major component of the monetary approach. The monetary approach is recent development in the theory exchange rate determination; it views the exchange rate as being the relative prices of two assets (national monies) is determined primarily by the relative supplies of and demand for those monies and that the equilibrium exchange rate is attained when the existing stocks of the two monies are willingly held. It therefore argues that a theory of exchange rate should be stated conveniently in terms of the supplies of and demands for these monies. This new theory of exchange rate determination can be presented in one or two terms: the monetary approach or the asset market approach of exchange rate determination. These are several versions of the monetary approach to exchange rate determination. The early flexible price model is based on the price monetary model as based on the assumptions of continued purchasing power parity (PPP) and the existence of stable money demand functions for the domestic and foreign economies. The sticky price monetary model is an extension of the flexible price model except that it allows for accommodation of short-term deviation from PPP in other words, the sticky price model accepts the fact that there may be deviations from PPP in the short-run both in the long-run; the deviations will tend to disappear.

The sticky-price monetary theory takes interest rate differentials as captured by exchange rate deviation. Price exchange is an automatic and in response to changes are automatic and in response to exchange rate changes.

Inflation therefore depresses the exchange rate unlike the BOP model where the effect of  $y$  on exchange rate is positive. It is negative in the sticky-price monetary theory



### **2.2.5 The Portfolio Model**

The portfolio balance model views exchange rate as the result of the substitution between money and financial assets. In the monetary approach, there is no room for current movements to play a role in determined exchange rate. Thus the monetary approach cannot explain the often observed tendency of the currency of a country with a current account supplies (deficit) to appreciate (depreciate). This apparent shortcomings of the monetary approach as said to be related to its rather narrow view of an exchange rate as the relative price of two monies in addressing this shortcoming the portfolio balance approach posits that an exchange rate as determined at least in short run by the supply and demand in the markets for a wide range of financial assets. The model assumes that individual allocate their (w) which is fixed at a point in time among alternative asset. Domestic money (m) domestically issued both (b) and foreign denominated in foreign currency (f) in a simple one-country model. Theories of economic growth provide the empirical framework for the study, the classical theory of economic growth assumed the existence of a perfectly competitive economy where invisible hand allocates resources efficiently. Though Adam Smith recognised the starts if the development process when argued that division of labour increased productivity which raised output relatively, the classicist regard capital accumulation as key of economic development. The Harrods – Domar growth model is that net investment has a dual effect in that, on the one hand it constitutes a demand for output and the other hand it increase the total productive capacity of the economy. The mechanism through which economic development is accomplished is net investment. Both Harod as well as Domar assume fixed capital –output ratio, i.e. rigid relationship between capital stock and output. The neoclassical growth theory on the other hand stresses efficiency in the allocation of resources and largely ignores social and political factors in economic growth in spite of growth in National output relative, poverty and imbalance – among sector continued to

increase. The structural imbalance – among sector continued to increase. The structural change theories of which Arthur Lewis two sector surplus labour theory addressed these structural distortions. The expected growth of output and employment in the modern sector may both be realised. This is so when capital stock embodying labour saving technical progress is used in the modern sector in such a situation the expected transfer of the assumed surplus labour from the traditional to the modern sector has often failed to nationalise structural change theory, therefore emphasise the desegregation of the economy to facilitate greater understanding of the development process. In traditional neoclassical growth theory the emphasis on capital formation has favoured the use of more – capital relative to labour in order to increase output. Capital formation has been emphasis as it related to the production of capital goods, like machines, plants and equipment. To measure economic growth economist use data on Gross Domestic product (GDP) which measures the total income of everyone in the economy, the real GDP per person, also observed large differences in the standard of living among countries.

The Solow growth model shows how growth in the labour force and advances in technology interact and how they affect output. The first steps in building the model, we examine how the supply and demand for goods determine the accumulation of capital. To do this, we hold the labour force and technology fixed later we relax these assumptions, fixed by introduction changes in technology. The Solow growth model enables us to describe the production, distribution and allocation of the economy's output at a point in time. More so, the Solow growth model shows how savings, population growth and technological process affect the growth of output over time. The supply of goods in the Solow model is based on the low familiar production function  $Y=F(K,L)$ . Output depends on the capital stock and the production function has constant returns to scale.

However the new endogenous growth model propounded that technological changes is endogenous to growth because it is responsible to the signal'' as price and profits in the economic system, the endogenous growth theorists introduced the concept of human capital as a factor for growth, these new growth theorist include mankiw, Romar and well, Arrow, Villanueva Rebelos A k Model. The increasing returns theorist opposed the one classical growth theory that are subject to decreasing return and said that the investment in some new area, product, and power source or production technology proceeds through time that each new increment or investment is more productive than the previous increment, the source of these increasing return can be seen through cost and ideas. Investment in the early stages of development may create new skill and attitudes in the work force whose cost may be lower than the previous investment at the initial stage. Also each investor may find environment that are conducive or favourable to invest because of the infrastructure that has been created by those who came before.

### **2.2.6 The Traditional model**

The traditional flow model, views exchange rate as the product of the interaction between the demands for and supply of foreign exchange. In this model, the exchange rate is in equilibrium when supply equals demand for foreign exchange. The exchange rate adjusts to balance the demand for foreign exchange depends on the demand domestic residents have for domestic goods and assets. On the assumption that the foreign demands for domestic goods is determined essentially by domestic income, relative income plays a role in determined exchange rate under the flow model. Since assets demand can be said to demand on difference between domestic and foreign interest rates differential is other major determinants of the exchange rate in this frame work. Under the traditional flow model i.e. the balance of payments model, the exchange rate is assumed to equilibrate the flow supply of and the flow

demand for foreign currency. The B.O.P by deficits (surplus) in current account is offset by surplus in (deficits) in the capacity account. The major limitation of the traditional model or the portfolio balance model include the over-shooting of the exchange rate target and the fact that substitutability between money and financial asset may not be automatic, this led to the development of the monetary approach.

## **2.3 Empirical literature**

The empirical studies on the effect of exchange rate volatility on economic growth include:

A study by Polodoo et al (2007) investigated the impact of exchange rate volatility on macroeconomic performance in small island developing states. He used yearly panel data spanning 1999 to 2010 and compute z-score to measure the exchange rate volatility. Plain panel ordinary least square regression was carried out with robust standard error to correct for heteroskedasticity. The result revealed that exchange rate volatility positively impacts on economic growth.

Investigation of the impact of exchange rate volatility on economic growth on small open economies at the European Monetary Unity (EMU) periphery was conducted by Schnabl (2007). He estimated a panel data of 41 countries in the EMU periphery from 1994 to 2005. Volatility was captured as a yearly average of monthly percentage exchange rate. He performed both GLS and GMM and the result provided evidence that exchange rate volatility has negative impact on economic growth. The study concludes that macroeconomic stability is necessary to maintain the peg since stable exchange rate positively influences economic growth.

Dornbusch (1989) investigated the differences in RER volatility between developing and industrialized countries. He identified the fact that volatility is higher in developing countries, when comparing to industrialized countries. The author further identified three times higher

volatility in developing countries than in industrialized countries, but failed to explained explicitly why such differences in volatility between the industrialized countries and developing countries exist.

Using panel estimations for more than 180 countries Edwards and Levy Yeyati (2003) found evidence that countries with more flexible exchange rate grow faster. Eichengreen and Lablang (2003) found strong negative relationship between exchange rate stability and growth for 12 countries over a period of 120 years.

Azid et al (2005) studied the impact of exchange rate volatility on growth and economic performance for Pakistan for the period 1973 to 2003. The study used GARCH estimation for exchange rate volatility. Johansen's multivariate co integration technique was used to capture both the short and long run dynamics in the study. Even after treating the volatility measure as either a stationary or non-stationary variable in the VAR, they were not able to find evidence suggesting that economic growth is affected by exchange rate volatility. However, the result would have been biased. This is because the treatment of volatility as either stationary or non-stationary is not realistic since volatility is characterised by clustering of large shocks to conditional variance.

The empirical work which has been undertake to explore possible links between exchange rates and macro-economic variables is based on the analytical framework developed by Kamin (1997) which provides evidence on the existence of an empirical relationship between the rate of inflation and the level of the real exchange rate in selected Latin and Asian countries and advance industrialisation economics.

Yoon (2009) showed that the real exchange rate demonstrates different patterns of behavior depending on the exchange rate regime in place. His findings show evidence that real exchange rate series behave as stationary processes during the fixed exchange rate regime.

But he acknowledged the fact that, more stationary episodes are found in the gold standard and the Bretton-Woods periods

The link between growth and exchange rate volatility was examined by Holland et al (2011) for a set of 82 advanced and emerging economies using a panel data set ranging from 1970 to 2009. They employed ARMA to derive the monthly volatility measure for RER. By estimating the dynamic panel data growth model, they found out that a more volatile RER has significant negative impact on economic growth and the results are more robust for different model specification.

Azee et al (2012) examined the effects of exchange rate volatility on macroeconomic performance in Nigeria for a period of 25 years ranging from 1986 to 2010. The study employed OLS and Johansen co integration estimation technique to test for the short and long run effect respectively. The ADF test reveals that all the variables were stationary. The result found that the RER volatility contributes positively to GDP in the long run.

Mauna and Reza (2001) studies the effect of trade liberalisation, real exchange rate and trade diversification on selected North Africa countries Morocco, Algeria and Tunisia. By decomposing in real exchange rate into fundamental and monetary determinants, and by using both standard statistical measures of exchange rate fluctuation and the measures of exchange rate risk developed by Puree and Steinher (1989), they reached the conclusion that exchange rate depreciation has a positive effect on the quantity of manufactured exports while exchange rate misalignment, volatility or fluctuation has a negative effect. According to them, the motivating result is that all manufacturing sub-sectors are responsive to exchange rate change but the degree of responsiveness differs across sectors.

In assessing the impact of exchange rate regime on growth, Levy and Yeyati (2003) conducted a study for a sample of 183 countries over post-Bretton wood period (1974-2003).

They used OLS technique for their estimation and de-factor classification of exchange rate regime. That result indicated that there is significant implication of the choice of a particular exchange rate regime on economic growth. They found out that fixed exchange rate regimes has negative impact on economic growth especially for developing countries as opposed to flexible exchange rate regime which is associated with higher economic growth.

Accam (1997), while assessing the exchange rate volatility and FDI flows in some selected 20 least developed countries, using OLS estimation, and employing standard deviation as a proxy for instability in exchange rate volatility, the result shows a significant negative relationship between exchange rate uncertainty and FDI flows for the period. Agodo (1978), using 33 U.S private manufacturing firms', having 46 investments in Africa and the findings of the research shows that domestic market size, raw-material endowment, presence of infrastructural facilities and relative political stability were the drivers of FDI rather than exchange rate volatility.

Huang and Molhorta (2004) investigated the impact of exchange rate regime on economic growth rates for developing Asian and advanced European countries. The study captured 12 developing and emerging Asian economies and 18 advanced European economies from 1976-2001. They adopted OLS for panel analysis and de-factor exchange rate classification. Their findings indicated that the importance choice of exchange rate regime depends on the level of economic development of a country. For developing economies, fixed exchange and managed float is associated with high economic growth. However, for advanced economics, regime choice has no significant impact on economic growth.

In their study, Broda and Romails (2003) found that real exchange rate volatility depresses trade in differentiated goods. The study used bilateral trade model, where the OLS (ordinary least square) and GMM (Generalized method of moment) methods were used. After taking into account the direction of causality, they ascertained that a 10percent increase in volatility

depresses differentiated product trade by 0.7percent, while a 10percent increase in trade reduces exchange rate volatility by 0.3percent. Their OLS estimated results showed that the effect of volatility on trade is reduced by 70percent. They justified the result by arguing that much of the correlation between trade and change to the effect that trade has in depressing fluctuation. Their study further revealed that a 10percent increase in the intensity of bilateral trading relationship reduces the volatility of the associated exchange rate by 0.3percent.

Moving to the studies of exchange rate volatility on trade in LDC'S Coes (1981) who used a log-level model specification to examine Brazilian exports, used annual data for 1965-1974 to arrive at the conclusion that a significant reduction in exchange rate uncertainty in Brazilian's economy during the crawling peg era.

The impact of exchange rate regime on economic growth was also determined by Baillui et al (2003) for the period 1973-1998. He used a panel data set of 60 countries and a dynamic generalised method of moment's estimation technique. The result revealed that exchange rate regimes characterised by a monetary policy anchor, regardless of the type of exchange rate regime adopted, exert positive influence on economic growth. The result also indicated that flexible exchange rate regime without an anchor impedes growth. The result suggests that strong monetary policy framework is important for economic growth rather than the peg type exchange rate regime.

Cushman (1985) in his study discovered higher exchange rate volatility accounts for FDI flows from U.S to Canada, France, Germany, and Japan. However, Barrel and Pain (1996) employed a dummy foreign exchange rate controls in a profit-maximizing regression model confirmed that expected appreciation in dollar temporarily postponed U.S outward FDI flows within the period under consideration.



Musyoki et al (2012) examined the impact of RER volatility on economic growth for Kenya from a period of 1993 to 2009. The study used GARCH analysis to measure for exchange rate volatility. Employing GMM, the result indicated that RER volatility has a significant negative impact on economic growth of Kenya

## **2.4 Overview of the literature**

Overview of the empirical literature gives a clear indication that consensus has not yet been reached in regards to the impact of RER volatility on economic growth. Previous studies have produced mixed and conflicting result on the link between RER volatility and economic growth. Very few studies have been conducted in the developing countries in regards to exchange rate volatility and economic performance and specifically to Kenya. It is evident from the literature review that most of the studies have focussed on more industrialised countries as far as exchange rate uncertainty impacts on macroeconomic performance. It suffices to note that majority of these studies have also used panel data in their analysis on the assumption that exchange rate is determined by cross country transactions.

Various methods were employed in estimating exchange rate volatility and GARCH based measure was prominent in these studies. GARCH based measures of volatility have been increasingly preferred because its ability to capture non-constant time varying conditional variance and describe volatility clustering. Unlike the previous studies, this study will employ standard deviation to capture exchange rate volatility.

However, in relation to exchange rate volatility on economic growth and specifically to Kenya, there exist scanty studies which have been conducted in Kenya. Only a study by Musyoki et al (2012) has been conducted to assess the impact of exchange rate volatility on economic growth in Kenya. Therefore this study aims to provide further evidence on the impact of real exchange rate volatility on economic growth of Kenya and taking into account

some of the unresolved issue in terms of the exchange rate volatility measure to use and the estimation methodology to apply. This study focuses on post liberalization period (1993 – 20012) and investigates the impact of exchange rate volatility on Kenyan’s economic growth using quarterly data.

## **CHAPTER THREE**

### **METHODOLOGY**

#### **3.1 Introduction**

This chapter describes how time series properties of the data used in the study will be analysed, specification of the empirical model, data sources and measurement of variables.

#### **3.2 Model specification**

Various economic growth models have used different variables to attempt to explain what causes growth. The model that will be adopted in to capture the effect of exchange rate volatility on economic growth will be the neoclassical growth model. It shall adopt the Solow growth model and modification done on it to capture the effects of exchange rate volatility so as to inform the inference that is meant to aide in making policy recommendation. The Solow model added labour as a factor of production and relaxed the assumption of having capital-labour ratios fixed which the Harrod-Domar model assumes. As it is a neoclassical growth model, it captures the effects of long-run economic growth having productivity, capital accumulation, population growth and technological progress as its main variables.

This study seeks to determine the effect of exchange rate volatility on economic growth and as a consequence will include the determinants of growth in the neoclassical framework together with the exchange rate volatility and control for them.

This study is going to build from the Solow growth model as modified by Robert Barro in his study of 1991 where he expanded the Summers and Heston data set to estimate the relationship in an endogenous growth model.

The relationship that determines growth according to the neoclassical growth model as expressed by Solow can be expressed in the following:

$$Y=f(K, L, T) \dots\dots\dots (1)$$

This study seeks to establish the effect of exchange rate volatility on economic growth and as a result will add to this and run a regression as described by Barro in the form below;

$$Y=\beta_0+ \beta_1 .Y +\beta_2. X +\varepsilon_{it} \dots\dots\dots (2)$$

Where;

$Y$  -Represents the growth rate.

$Y$  - Represents the level of per capita GDP.

$X$  –Represents vector of explanatory variables.

In Barro’s model,  $X$  represented the determinants of long run economic growth. The empirical model that will be estimated in this study on the basis above that will enable the meeting of the objectives will be specified as follows:

$$Y=\beta_0+ \beta_1 .Y +\beta_2. X +\varepsilon_t \dots\dots\dots (3)$$

$Y$  –Exchange rate volatility.

$X$  –vector of explanatory variables

The estimated model will be specified as:

$$Y = \beta_0+\beta_1K+ \beta_2V+ \beta_3 L+\beta_4 OP + \beta_5GNS + \beta_6ED +\beta_7INF+ \beta_t \dots\dots\dots (4)$$

Where;

$\beta_0$  = constant

$\beta_{1-7}$ = estimated coefficients

$\beta_t$  = random variable

### 3.3 Definition and measurement of variables

Table 3.1: Variables used

Variable Name	Definition	Measurement
<i>Y</i>	GDP Growth rate	Change in value of GDP as a percentage of GDP of previous year
<i>K</i>	Capital	(gross capital accumulation as a percentage of GDP)
<i>L</i>	Population	Growth rate of productive workforce (ages 18 to 60 years)
<i>V</i>	Exchange rate volatility	Measured as standard deviation of exchange rate
<i>OP</i>	Trade openness	Trade Openness (imports and exports of goods and services as a share of GDP in million US\$).
<i>GNS</i>	Gross national savings	This is Gross Disposable National Income (GNDI) less final consumption expenditure.
<i>ED</i>	External Debt	As a Percentage of GDP
<i>INF</i>	Inflation	The percentage change in Consumer Price Index (CPI) on a year-on year basis

Table 3.2 Expected Signs

Variables	Expected Signs
Exchange rate volatility	Negative (-)
Capital	Positive(+)
Population	Positive(+)
Degree of trade openness	Positive(+)
Gross National Savings	Positive(+)
External Debts	Negative (-)
Inflation	Negative (-)

### 3.4 Estimation procedure

Since the study used time series data; a unit root test was conducted before estimation to ensure efficient estimates. Unit root testing is done to determine whether a series is stationary or non-stationary and establish their order of integration. A time series is said to be stationary if its mean, variance and covariance remain constant over time, Thomas (1997).

Time series analysis assumes that the underlying time series is stationary. However the underlying time series may be non-stationary and this can lead to spurious regression (Granger and Newbold, 1974).

The first step is to test the variables for unit roots to establish their order of integration. To test the level of integration of the variables that will be employed in this study, Augmented Dickey-Fuller test (ADF) will be applied. The aim is to determine whether the variables follow a non-stationary trend and are of the order 1 denoted as  $I(1)$  or whether the series are stationary, that is, of the order of 0 denoted as  $I(0)$ . ADF test is based on the estimate of the following regression. The test model is defined as below:

$$\Delta Y_t = \beta_1 + \beta_2 t + \delta Y_{t-1} + \sum_{i=1}^m \alpha_i \Delta Y_{t-i} + \varepsilon_t \dots \dots \dots (5)$$

Where  $\Delta Y_t$  is the first difference operator,  $\delta = (\rho - 1)$  and  $-1 \leq \rho \leq 1$ . If  $\delta = 0$  then  $\rho = 1$  implying that there is a unit root problem or time series is non stationary but if  $\rho < 1$  then the underlying time series is stationary. The null hypothesis is that there is unit root ( $\delta = 0$ ) that is non stationary time series while alternative hypothesis is stationary time series (Gujarati, 2004).

If the series are non-stationary, the use of classical methods of estimation such as OLS could lead to a spurious relationship thus rendering the results meaningless. The traditional suggestion to deal with series that are non-stationary around their means is to difference the series. However, first differencing is not an appropriate solution to the above problem and has

a major disadvantage: it prevents detection of the long-run relationship that may be present in the data.

### **3.5 Co-integration and Vector Error Correction Model**

Most economic variables are non-stationary in their levels (integrated of order 1,  $I(1)$  but stationary,  $I(0)$ , in their first difference. If all variables are  $I(1)$  the second step is to test for co-integration. Engle and Granger (1987) introduced the concept of co-integration in which economic variables may reach a long-run equilibrium that depicts a stable relationship.

Two variables,  $x$  and  $y$  are said to be co-integrated of order one ( $CI(1, 1)$ ) if both are integrated of order 1 and there exists a linear combination of the two variables that is stationary,  $I(0)$ . The linear combination is given by either equation (2) or (3):

$$y_t = \alpha_0 + \beta_0 x_t + \mu_{0t} \quad (6)$$

$$x_t = \alpha_1 + \beta_1 y_t + \mu_{1t} \quad (7)$$

For cointegration testing the study will use the Engle and Granger (1987) two step method abbreviated as EG. Engle and Granger (1987) established a number of new results concerning cointegration and the ECM. A simple static OLS regression is run on the levels of each variable, and the null hypothesis of non-cointegration is tested. If rejected, the parameter estimates of the variables provide an estimate of the long-run relationship. In the second step, the dynamic specification is considered, with lagged value of the residuals from the cointegrating regression appearing among the regressors.

The use of error-correction modelling provides an additional channel through which causality in the Granger sense can be assessed. The standard Granger test may provide invalid causal information due to the omission of error-correction terms from the tests. If the error-correction term is excluded from causality tests when the series are cointegrated, no causation may be detected when it exists, that is, when the coefficient of the error-correction term is

statistically significant. Once cointegration is detected, it must follow that  $x$  causes  $y$ ,  $y$  causes  $x$  or that there exists a feedback between the variables (Granger, 1986; 1988).

### 3.6 Testing for Granger Causality (GC)

According to the Thomas (1997)  $x$  is said to be a **Granger cause**  $y$  if present  $y$  can be predicted with greater accuracy by using past values of  $x$  rather than not using such past values, all other information being identified.

Granger causality measures precedence and information content but does not by itself indicate causality. If  $x$  causes  $y$  then changes in  $x$  should precede changes in  $y$ . the underlying assumption is that only stationary series are involved.

Consideration of a simple bi-variate model can enable the testing if  $x$  is granger causing  $y$  by estimating equation 4 and the testing the hypothesis in 5, using the standard F test.

The simple granger bi-variate causal model is written as shown below:

$$y_t = \mu_1 + \sum_{j=1}^p \gamma_{11j} y_{t-j} + \sum_{j=1}^p \gamma_{12j} x_{t-j} + u_{1t} \quad (8)$$

Where  $\mu_1$  is a constant and  $u_{1t}$  is a white noise process and  $p$ , the lag length is assumed to be finite and shorter than the given time series.

The null hypothesis in this case is that the variable  $x$  does not granger cause variable  $y$ .

$$\gamma_{12j}=0 \text{ for } j=1, \dots, p.$$

The variable  $x$  is said to granger-cause variable  $y$  if we reject the null hypothesis.

$\gamma_{12}$  is the vector of the coefficients of the lagged values of the variable  $x$ .

Similarly, this test can be conducted to test if  $y$  is granger causing  $x$ .

The null hypothesis in this case is that the variable  $y$  does not granger cause variable  $x$ .

$$\gamma_{22j}=0 \text{ for } j=1 \dots p.$$

The variable  $y$  is said to granger-cause variable  $x$  if we reject the null hypothesis.



$\gamma_{22}$  is the vector of the coefficients of the lagged values of the variable  $y$ .

Prior to testing for a causal relationship between the time series, we have to ensure that the variables series used as regressors are either individually stationary or non-stationary. This is to verify if the series had a stationary trend, and, if non-stationary, to establish the order of integration.

### **3.7: Data Sources and Analysis**

All the data used in this study is annual secondary data from 1980 to 2012 and is extracted from the Government of Kenya Economic Surveys, Statistical Abstracts and Kenya Bureau of Statistics. This study will employ computer software Stata Version 12, to analyze the data.

## CHAPTER FOUR

### RESEARCH ANALYSIS AND FINDINGS

#### 4.1 Introduction

We discuss our research findings and analysis in this section. It consists of descriptive statistics, unit root test and the analysis on the impact of exchange rate volatility on GDP growth rate.

#### 4.2 Descriptive Statistics

A descriptive analysis of the data was conducted to determine whether the data exhibited normality. The result of the descriptive statistics was presented in table 4.2 below.

Table 4.2: Summary statistics

						<b>Skewness</b>	<b>Kurtosis</b>
<b>Variable</b>	<b>Obs</b>	<b>Mean</b>	<b>Std.Dev.</b>	<b>Min</b>	<b>Max</b>	<b>Statistic</b>	<b>Statistic</b>
<b>GDP</b>	33	3.54486	2.18465	-0.8	7.18	-0.225	-0.896
<b>INF</b>	33	12.7682	9.00567	1.55	45.98	1.927	4.995
<b>OPEN</b>	33	0.58818	0.06802	0.48	0.73	-2.433	4.17
<b>REER</b>	33	106.72	15.0160	82.04	147.41	0.069	0.271
<b>Grossfixed~n</b>	33	18.2569	1.63863	15.38	21.38	-0.239	-0.977
<b>Population~a</b>	33	51.0603	3.12678	46.99	54.93	-0.06	-1.68
<b>Grossdomes~P</b>	33	13.2530	5.57563	5.09	22.55	0.165	-1.604
<b>Externaldebt</b>	33	12.1060	11.2949	3.44	66.26	3.695	16.632

The result from the table indicates that GDP growth rate had a mean of 3.544 percent and standard deviation of 2.1846 during the study period. The economy recorded a maximum GDP growth rate of 7.18 percent and a minimum GDP growth rate of -0.8. Both internal and external shock contributed to Kenya mixed economic performance.

On the average, inflation rate recorded a mean of 12.7682 percent with standard deviation of 9.00507. Kenya also experienced high levels of inflation in the study period as indicated by a maximum overall annual inflation rate of 45.98 percent with a minimum inflation rate

reaching 1.55 percent. High inflation rate was attributed to increase in crude oil price; drought and a low agriculture produce which pushed the consumer price index.

Trade openness ratio had a mean of 0.5888 percent with standard deviation of 0.06802. On the average real exchange rate was 106.72 with a maximum of 147.41 during the study period. Gross fixed capital accumulation had a mean of 18.25 percent with standard deviation of 1.6386 in the study period. Growth rate of productive workforce on the average was 51.060 percent of the total population. Kenya's level of gross national savings is still very low with a record minimum and maximum of 5.09 percent and 22.55 percent of GDP respectively. External debt had a mean of 12.1060 percentage of GDP with standard deviation of 11.2949.

### 4.3 Correlation Matrix

Correlation matrix was used to determine the strength of relationship between the dependent variable (GDP growth rate) and the explanatory variables (independents variables).

Table 4.3: Correlation matrix of the variables

	GDP	INF	OPEN	Grossf~n	Popula~a	Grossd~P	Extern~t	VOL
GDP	1.0000							
INF	-0.4503	1.0000						
OPEN	0.0448	0.3904	1.0000					
Grossfixed~n	0.4974	-0.0680	0.3788	1.0000				
Population~a	0.1364	-0.2410	0.3307	-0.1209	1.0000			
Grossdomes~P	-0.0543	0.4612	-0.0336	0.2464	-0.8458	1.0000		
Externaldebt	-0.3125	0.6609	0.3922	-0.1141	-0.2588	0.5414	1.0000	
VOL	-0.0317	0.3714	0.6036	0.1607	-0.1971	0.4246	0.6795	1.0000

Table 4.3 above indicates the correlation between variables used in this study. The entries on the main diagonal give the correlation between one variable and itself while the entries off the main diagonal give pair-wise correlation among the variables. The pair-wise correlation is very low indicating that there is no problem of collinearity. The second column shows the

relationship between dependent variables and the explanatory variables. Exchange rate volatility is negatively related to GDP growth rate ( $R=-0.0317$ ). This illustrates that an increase in exchange rate volatility will lead to a decrease in GDP growth rate for Kenya.

#### 4.4 Structural breaks

A structural break was established to determine an unexpected shift in the variable used in the study.

Figure 4.4 Structural breaks

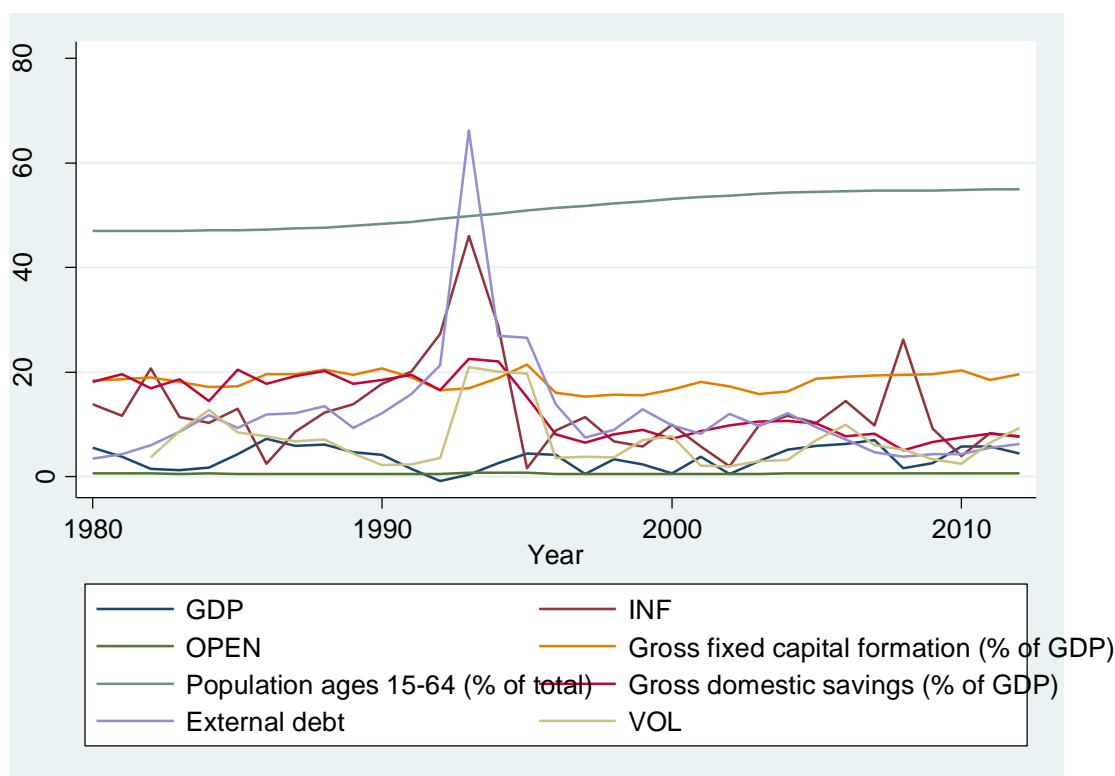


Figure 4.4 above indicates structural break in 1993 for external debts, inflation and exchange rate volatility. Unexpected shift in external debt witnessed in 1993 was due accumulated large debt arrears which the government neglected in repayment. Unprecedented increase in inflation rate in 1993 was largely due to excessive growth in money supply and depreciation of the local currency. A big shift in exchange rate volatility reported in 1993 was due to the changes in exchange rate policy. The Central Bank depreciated the shilling by 22 percent

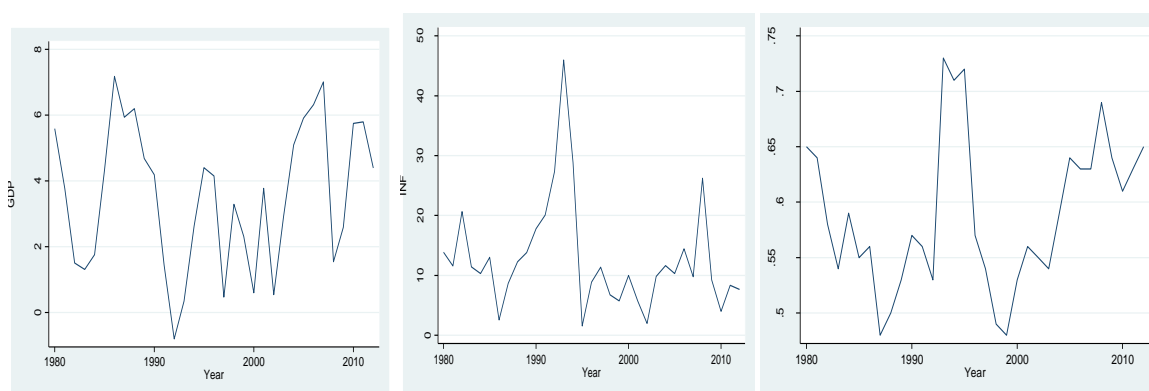
against the dollar in 1992 and by 85 percent in the first nine months of 1993. During this period the bank liberated the foreign exchange regime, allowing a free market rate to be determined by commercial banks in addition to the official rates. However, no structural breaks was observed for GDP growth rate, trade openness, gross fixed capital, gross domestic savings and working age population.

## 4.5 Estimation and interpretation of the result

### 4.5.1 Unit root test result

Before performing the unit root test, we graph the variables to compare their long run behaviour as indicated in figure 4.5. From the graph, it is evident that most of the variables are non stationary while a few are non-stationary at levels. The variables GDP growth rate, inflation rate, gross capital formation, external debt and exchange rate volatility are all stationary since they don't show linear trend as depicted by the graph. However productive work force, trade openness and gross domestic savings are non-stationary as they showed linear time trend. This implies that we have to transform them by differencing to become stationary.

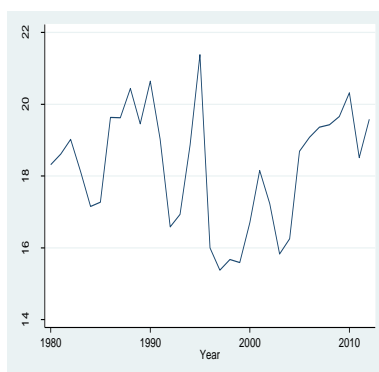
Figure 4.5: Graphs showing the movement of variables at levels.



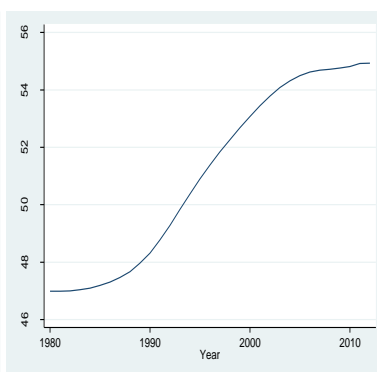
GDP Growth rate

Inflation

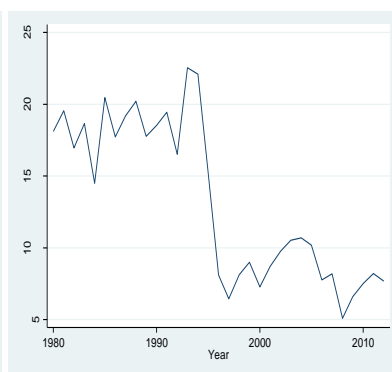
Trade openness



Gross capital formation

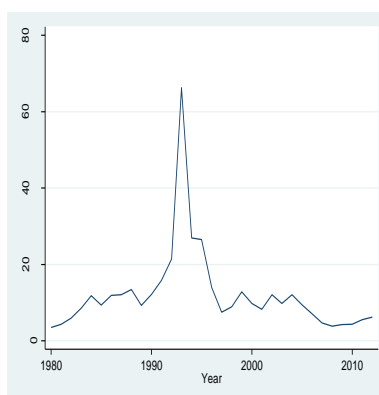


Population

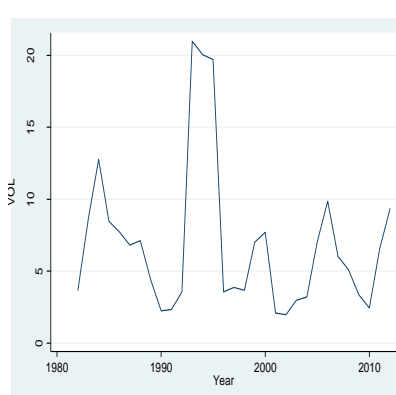


Gross domestic saving

External debt



Exchange rate volatility



The result below is from Dickey-Fuller test to examine unit root. The null hypothesis that the variable  $x$  is non-stationary ( $H_0: \beta = 0$ ) is rejected if  $\beta$  is significantly negative, when compared with the Augmented Dickey-Fuller (1979), critical values. Variables with p values (z-scores) less than 0.005 are stationary while variables with p values greater than 0.005 are non-stationary. The result was presented in table 4.4 below. The unit root test result showed that GDP growth rate, inflation, gross fixed capital, external debt and exchange rate volatility. However, trade openness, population age of working force and gross domestic savings were established to be non-stationary. The result confirmed graphical representation of the variables. Trade openness was integrated of order one and was difference once to become stationary. Population age of work force was integrated of order three (I(3)) therefore we

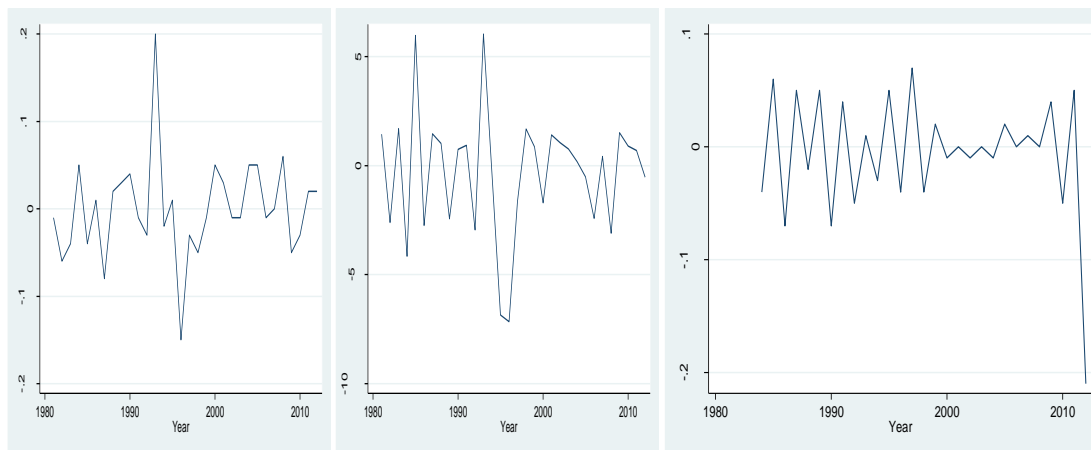
differenced it thrice to make it become stationary while gross domestic saving was of integrated of order one and was stationary at first difference.

Table 4.4: Unit root result

Variable	test statistics	5% critical value	P value z=(t)	Stationarity
GDP growth rate	-3.239	-2.98	0.0179	Stationary
Inflation	-3.187	-2.98	0.0207	Stationary
Trade Openness	-2.551	-2.98	0.1035	Non-Stationary
Gross fixed capital	-2.875	-2.98	0.0484	Stationary
Population age	-0.417	-2.98	0.9073	Non Stationary
Gross domestic saving	-1.414	-2.98	0.5757	Non Stationary
External debt	-3.151	-2.98	0.023	Stationary
Exchange rate volatility	-2.957	-2.986	0.0391	Stationary

Figure 4.6 below shows that the transformed trade openness, population age and gross domestic saving do no show time trend after differencing.

Figure 4.6: Graphical representation of transformed variables



**Trade openness**

**Gross domestic saving**

**Population age (work force)**

#### 4.5.2 Cointegration test

Since the gross domestic savings and trade openness are non-stationary at level but stationary at first difference a cointegration test was conducted using Engel-Grange Test.

Table 4.5: Regression of gross domestic saving against trade openness

Source	SS	df	MS
Model	0.000080156	1	0.000080156
Residual	0.148010753	31	0.00477454
Total	0.148090909	32	0.004627841

Number of Observations	33
F(1, 32)	0.02
Prob>F	0.8977
R-Squared	0.0005
Adj R-squared	-0.0005
Root MSE	0.0691

OPEN	Coef.	Std.Err.	t	P>t	(95% Conf.Interval)
GrossdomesticsavingsofGDP	0.000284	0.0021908	0.13	0.898	-0.0041842 0.004752
cons	0.58442	0.0314273	18.6	0.000	0.5203234 0.6485163

Table 4.6: Lagged values of gross domestic saving and trade openness

Source	SS	df	MS
Model	0.019357173	2	0.0097
Residual	0.082567741	28	0.0029
Total	0.101924914	30	0.0034

Number of Observations	31
F(1, 32)	3.28
Prob>F	0.0524
R-Squared	0.1899
Adj R-squared	0.1321
Root MSE	0.0543

D.ehat	Coef.	Std.Err.	t	P>t	(95% Conf.Interval)
ehat					
L1.	-0.4042126	0.1598651	-2.53	0.017	-0.731681 -0.0767437
LD.	0.1278232	0.1875331	0.68	0.501	-0.256321 0.5119674
cons	-0.0011126	0.0097718	-0.11	0.91	-0.0211291 0.0189039

The t-ratio on the lagged value of residuals is -2.53. The 5% critical value for a cointegrating regression from table 4.5 containing an intercept is 0.13 and that t-ratio is less than this. The



null hypothesis of no cointegration is rejected when  $t \leq t_c$ , and not rejected when  $t \geq t_c$ . Since in this case t-statistics is  $-2.53 < 0.13$  and the null hypothesis that the least square residuals are non-stationary is rejected; the residuals are stationary. This implies that trade openness and gross domestic savings are cointegrated.

### 4.5.3 Diagnostic test

After estimation diagnostic test were conducted to ascertain the validity of the model used in the estimation. The diagnostic tests presented below indicate that the overall model does not suffer from serial correlation as shown in table 4.7.

#### Test for serial correlation

Table 4.7 indicates that there is no serial correlation in the model at one and two lags since the p-values is greater than 0.05.

Table 4.7: Serial correlation

lags (p)	chi2	df	Prob>chi2
1	0.893	1	0.3448

#### Normality test

The study used Shapiro–Wilk test to test for the normality of the variables used in the study.

The null-hypothesis of this test is that the population is normally distributed. Thus if the p-value is less than the chosen alpha level, then the null hypothesis is rejected and there is evidence that the data tested are not from a normally distributed population. In other words, the data are not normal. On the contrary, if the p-value is greater than the chosen alpha level, then the null hypothesis that the data came from a normally distributed population cannot be rejected. In other words the value above 0.05 indicates normality, if the test is significant

(less than), then the variable is non-normal. From table 4.8 below, the result showed that GDP growth rate, trade openness and gross fixed capital formation are normally distributed while inflation, population age, gross domestic savings, external debt and exchange rate volatility are not normally distributed

Table 4.8: Normality test result

Variable	Obs	w	v	z	Prob>Z
GDP	33	0.96152	1.314	0.568	0.28518
INF	33	0.8321	5.732	3.332	0.00014
OPEN	33	0.95948	1.383	0.675	0.24993
Grossfixed Capital	33	0.95444	1.555	0.919	0.17913
Population	33	0.85387	4.989	3.343	0.00041
Gross domestic Saving	33	0.88341	3.98	2.873	0.00203
External debt	33	0.59519	13.82	5.462	0.00000
VOL	31	0.78927	6.864	3.991	0.00003

#### 4.6 Regression coefficients result

After ensuring that all the variables are stationary equation 6 was run using the ordinary least squares (OLS) technique. The result for the regression model are shown in tables below,

Table 4.9: Model summary

Number of Observations	29
F(1, 32)	2.76
Prob>F	0.0336
R-Squared	0.4793
Adj R-squared	0.3057
Root MSE	1.858

Table 4.9 for the model summary above indicates determination of coefficient of  $R^2$  of 0.4793 implying that 47.93% of the total variation in Kenya GDP growth rate was attributed to the changes in the explanatory variables (trade openness, exchange rate volatility, inflation, gross fixed capital formation, population age, gross national saving and external debt).

Table 4.10: Regression coefficient result

GDP	Coef.	Std.Err.	t	P>t	(95% Conf.Interval)
INF	-0.0878278	0.0532678	-1.65	0.114	-0.1986042 0.0229486
D1OPEN	-2.55153	7.475354	-0.34	0.736	-18.09738 12.99432
VOL	0.0789522	0.1010275	0.78	0.443	-0.131146 0.2890505
GrossFixedCapitalformation	0.5981509	0.2185441	1.74	0.012	0.1436637 1.052638
D3Population	-1.099556	6.44345	-0.17	0.866	-14.49944 12.30033
D1GDS	0.1436511	0.1327866	1.08	0.292	-0.1324937 0.4197959
External debt	-0.034288	0.0558675	-0.61	0.546	0.1504708 0.0818948
cons	-6.230011	4.029018	-1.55	0.137	-14.60881 2.148791

From the regression coefficient result in table 4.10, the estimated model becomes:

$$Y = -6.230011 - 0.08782INF - 2.55153OP + 0.07895V + 0.59815K - 1.0995L + 0.1436GNS - 0.0342ED$$

#### 4.7: Discussion of the result

Exchange rate volatility has positive relationship with economic growth rate. The result of the effect of exchange rate volatility on GDP growth rate does not confirm our expected sign of negative effect. The coefficient of exchange rate volatility is positive but insignificant ( $t=0.78$ ,  $p = 0.443$ ,  $p>0.05$ ) at 5% level of significance in explaining the variation in GDP growth rate. The finding is in line with Polodoo et al (2007), Schnabl (2007), Azee et al (2012) who found that exchange rate volatility positively impacts on economic growth.

Schnabl (2007) estimated a panel data of 41 countries in the EMU periphery from 1994 to 2005. Volatility was captured as a yearly average of monthly percentage exchange rate and the result provided evidence that exchange rate volatility has negative impact on economic growth which contradicts our result. The study concludes that macroeconomic stability is necessary to maintain the peg since stable exchange rate positively influences economic growth.

Our result further shows that exchange rate volatility is insignificant in determining economic growth in Kenya. This is in agreement with Azid et al (2005) who studied the impact of exchange rate volatility on growth and economic performance for Pakistan for the period 1973 to 2003. Even after treating the volatility measure as either a stationary or non-stationary variable in the VAR, they were not able to find evidence suggesting that economic growth is affected by exchange rate volatility.

However, the result contradicts Musyoki et al (2012), Holland et al (2011) and Baillui et al (2003) who found that exchange rate volatility negatively impacts on Kenya growth rate. Positive effective of exchange rate volatility on GDP growth rate was due to Kenya cushioning her currency against international pressure.

The result of the effect of inflation on GDP growth rate confirms our expected result of the coefficient of the regression. Regression result reported negative coefficient for inflation, however, inflation is statistically insignificant at 5% level of significance in causing the variation GDP growth rate. A unit increase in inflation rate will lead to 0.0878 unit decrease in GDP growth rate. Kenya's rate of inflation has been increasing at a high rate and this implies that in order to increase her levels of GDP growth rate, Kenya needs to reduce her high level of inflation so as to attract both local and foreign investors.

The result for trade openness indicates negative coefficient which contradicts our predicted expected sign. However, trade openness is insignificant ( $t = -0.34$ ,  $p = 0.736$ ,  $p > 0.05$ ) in

effecting changes in GDP growth rate. Gross fixed capital formation is statistically significant at 5% level of significance ( $t=2.74$ ,  $p=0.012$ ,  $p<0.05$ ) in explaining the variation in GDP growth rate for Kenya. The result confirms our predicted expected sign for the coefficient of gross fixed capital formation. This illustrates that a unit increase in gross fixed capital formation will lead to 0.5981 units increase in GDP growth rate. Regression coefficient for population age for the work force reported negative coefficient which contradicts our predicted expected sign.

Negative coefficient for population age for the work force implies that continued increase in population growth rate reduce GDP growth rate for Kenya. This is attributed to high rate of unemployment where productive work force does not contribute to economic development and growth. Gross domestic saving has a positive coefficient with GDP growth rate.

However, gross domestic saving is insignificant at 5% level of significance in causing variation in GDP growth rate. The result for external debt agrees to our earlier prediction of negative coefficient. However, the effect of external debt on GDP growth rate is insignificant ( $t=-0.61$ ,  $p = 0.546$ ,  $p>0.05$ ) at 5% level of significance.

## **CHAPTER FIVE**

### **CONCLUSION AND POLICY RECOMMENDATIONS**

#### **5.1 Conclusion**

Kenya GDP growth rate has posted mixed patterns since independence. Policy makers have been in the forefront for ensuring Kenya register positive economic growth rate. However, these policies have been hampered by some inherent factors and the growth was slowed down by the first oil crisis of 1972 and as a result GDP growth rate decelerated to below 4 percent during the early 1970s. During the most early 1980's, GDP growth rate remained below 5 percent and fell to below 1 percent in 1984. Kenya experienced economic recovery in 1985-1986 when growth rate 4.8 percent and 5.5 percent respectively were recorded. The question which worried the policy makers is what could have caused poor Kenya economic performance over the years.

Since exchange rate volatility is important factor in influencing economic growth an attempt has been made in this study to examine the effect of exchange rate volatility on economic growth rate in Kenya.

The linear regression result has shown that exchange rate volatility positively affect GDP growth rate for Kenya. However, the result further indicates that exchange rate volatility is insignificant in contributing to GDP growth rate. This implies that policy makers should consider other factors that significantly contribute to GDP economic growth rate.

The result in this study has also shown that gross capital formation is significant and positively affect GDP growth rate.

#### **5.2 Policy Recommendation**

From the findings from chapter four we make the following recommendations:

Policy makers should not interfere with free exchange rate policy. Since exchange rate volatility positively impacts on GDP growth rate it implies that exchange rate volatility can support growth in small open economies by encouraging international capital inflows, excessive capital inflows into the country. Policy makers should therefore find equilibrium on the devaluation and appreciation of exchange rate since devaluation of domestic currency provides important opportunity for economic growth, it promotes exports capacity and reduces volume of imports.

The study has established that gross capital formation positively and significantly contributes GDP growth rate for Kenya. Therefore policy makers need to design policies geared towards investing in more fixed assets to enable rapid economic growth.

Our results established that gross capital formation is positively and significantly contributes GDP growth rate for Kenya. If the capital formation is the engine of growth then policy makers must boost private domestic savings by enhancing interest rate. Among others, there is the need for the government to continue to create favourable investment climate and improve the infrastructural base of the economy to improve capital formation. Policies that address only savings without the economic infrastructure may not be sufficient to improve capital formation and growth. For policies to effect a sustainable development, all components, the saving rate, the lending rate, the exchange rate the inflation rate, the private domestic investment, public domestic investment must be addressed all together.

### **5.3 Areas of Further Research**

The study uses time series analysis, OLS method of estimation and standard deviation to capture exchange rate volatility. A similar study could be done in Kenya by adopting GARCH to capture exchange rate volatility since most studies from the literature have used GARCH to calculate exchange rate volatility.

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## APPENDICES

### Appendix I: Time series trend for variables

Figure 8 shows the trends in inflation rate. The overall picture indicates that over the years the country has experienced fluctuation in inflation with 1993 experiencing higher inflation rate. This could be attributed to drought and low agricultural output .

Figure 7 : Inflation trend

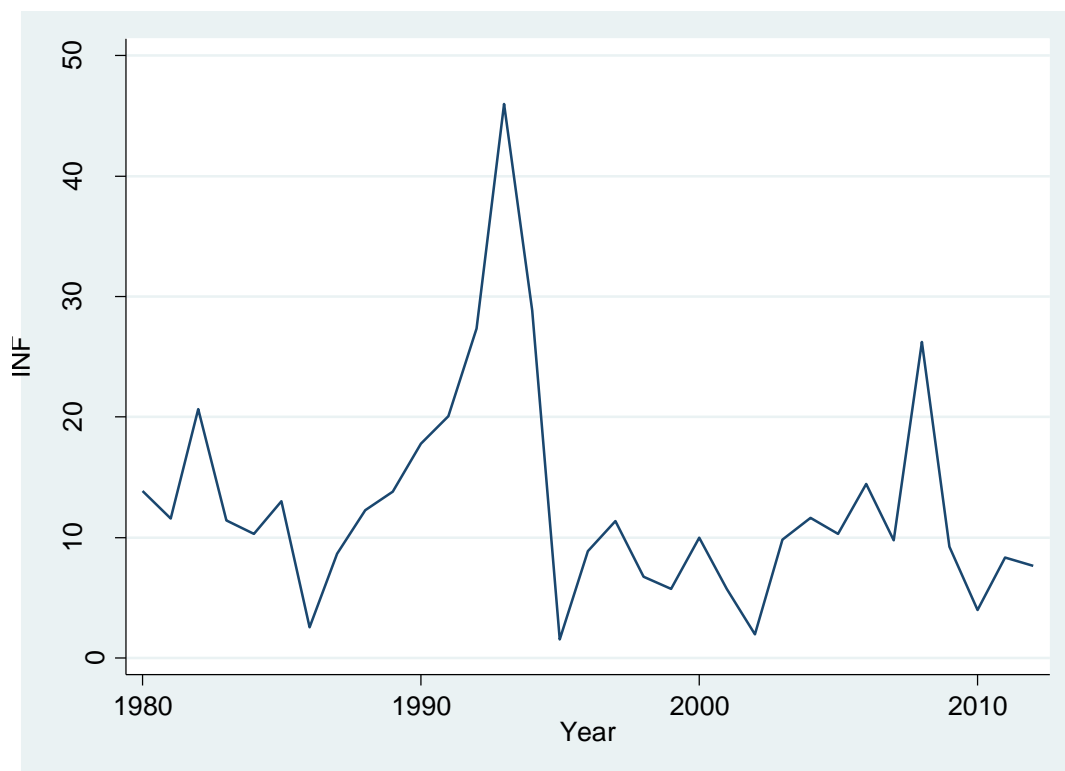


Figure 8: Trend in Trade openness

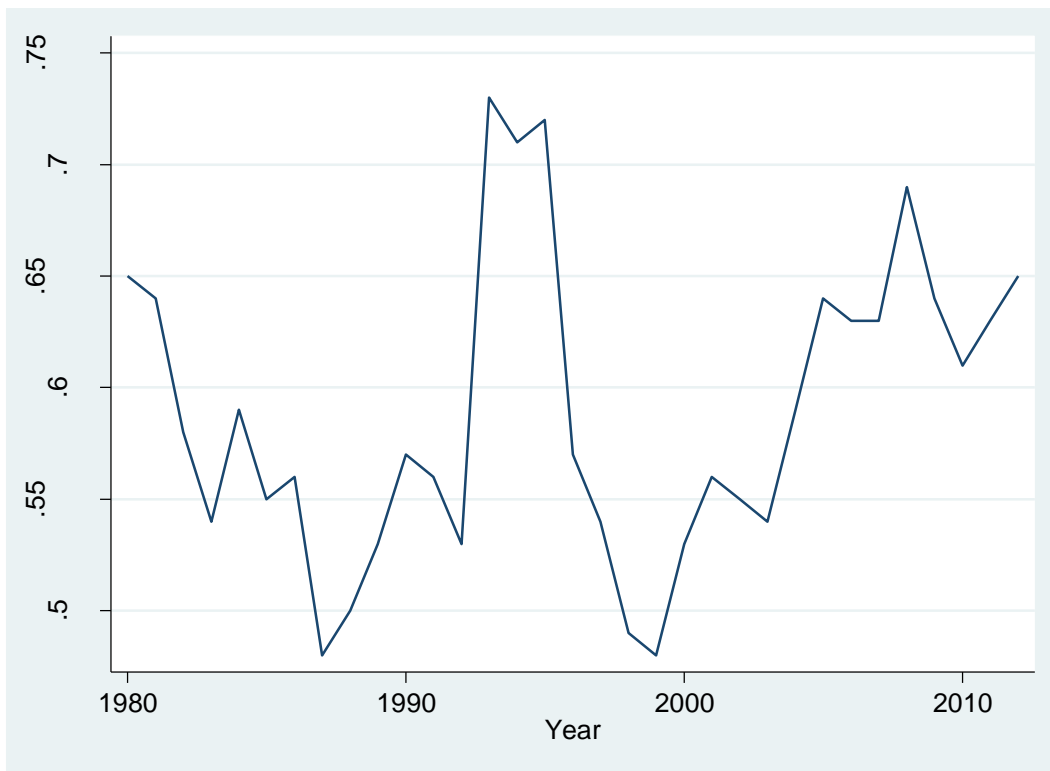


Figure 9: Trend in Gross fixed capital formation

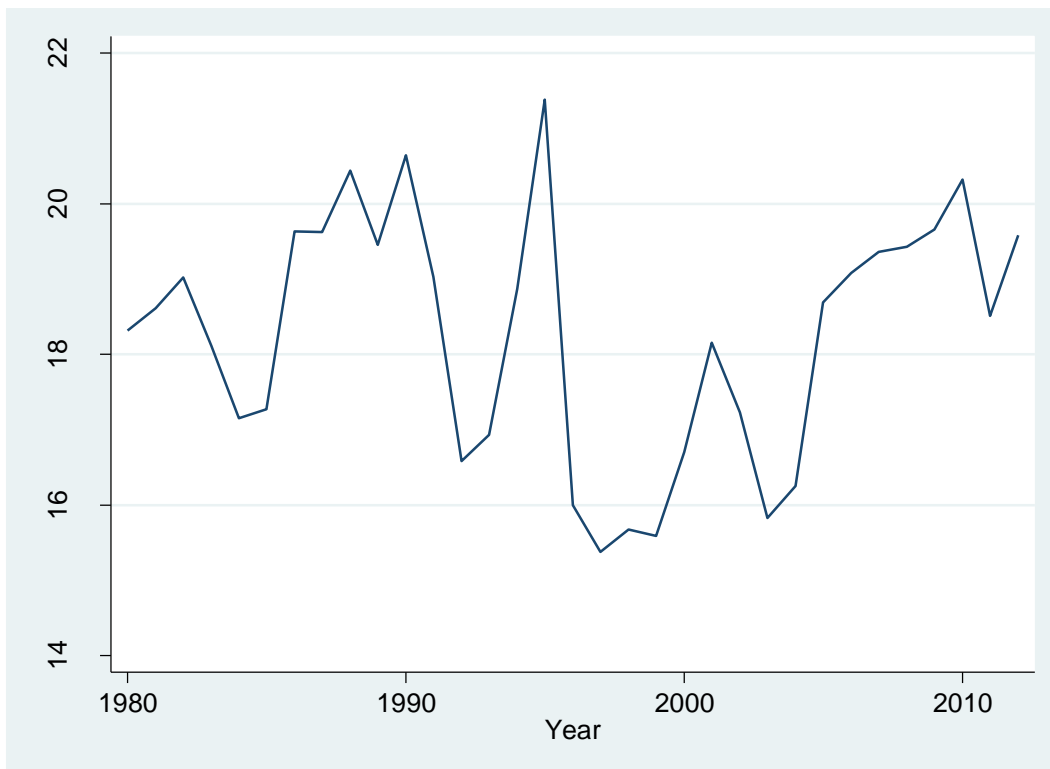


Figure 10: Trend in population age 15-64(% of total)

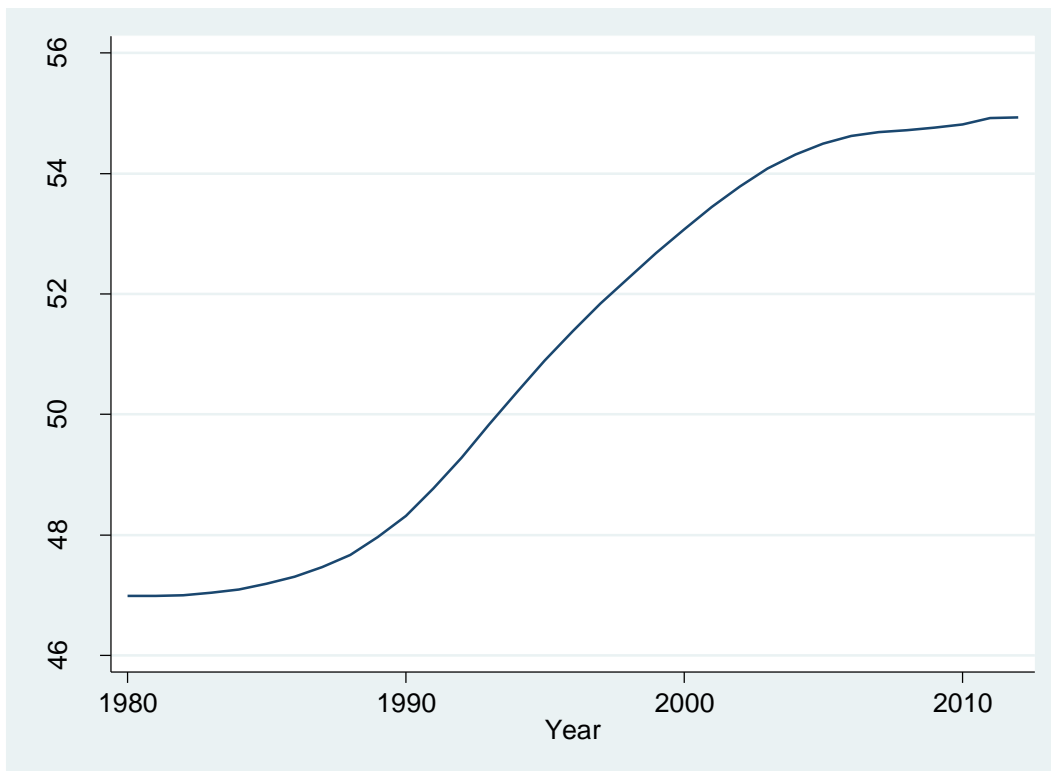


Figure 11: Trend in gross domestic savings (% of GDP)

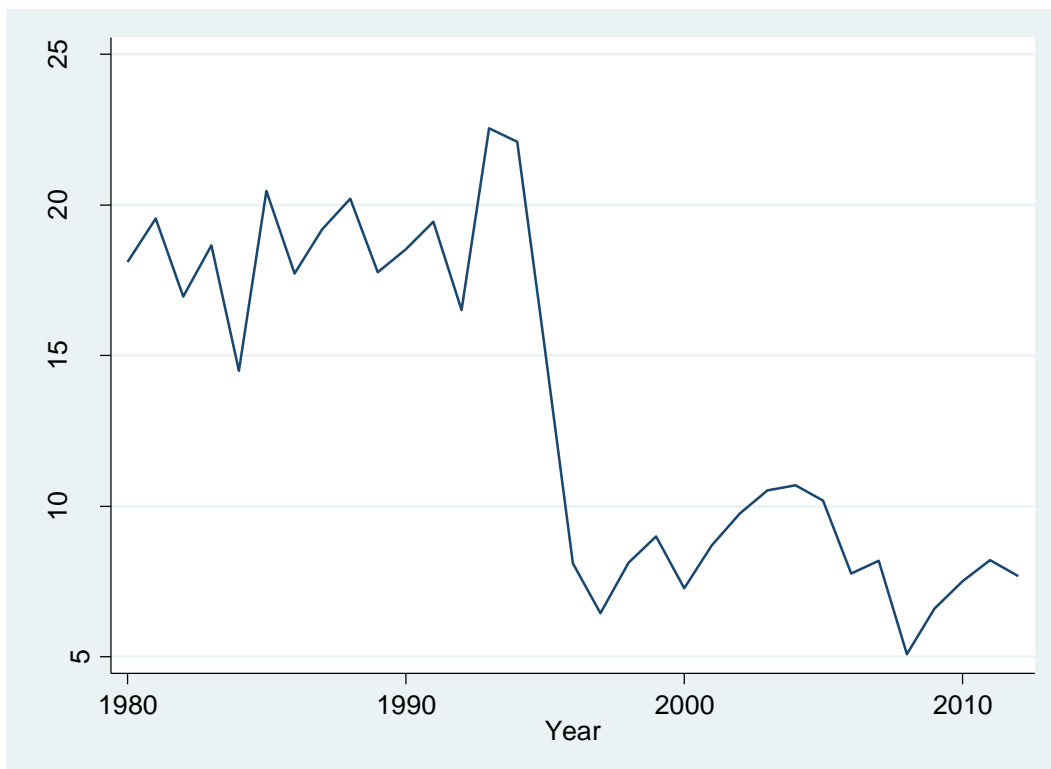


Figure 12: Trend in external debt

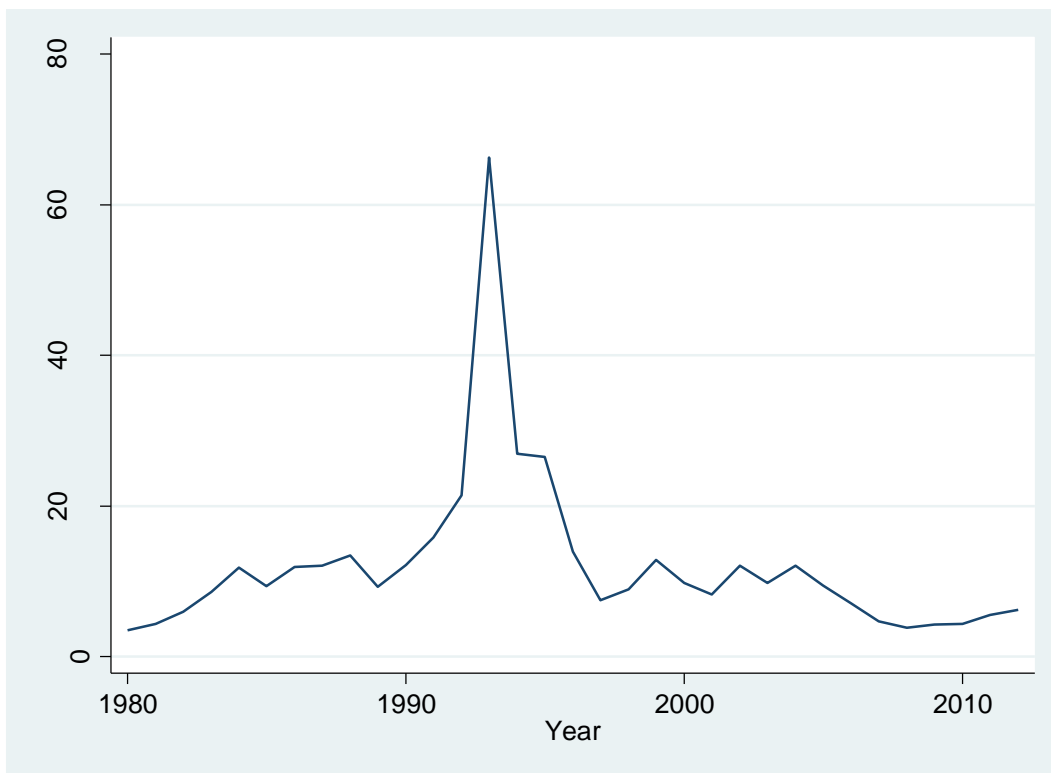
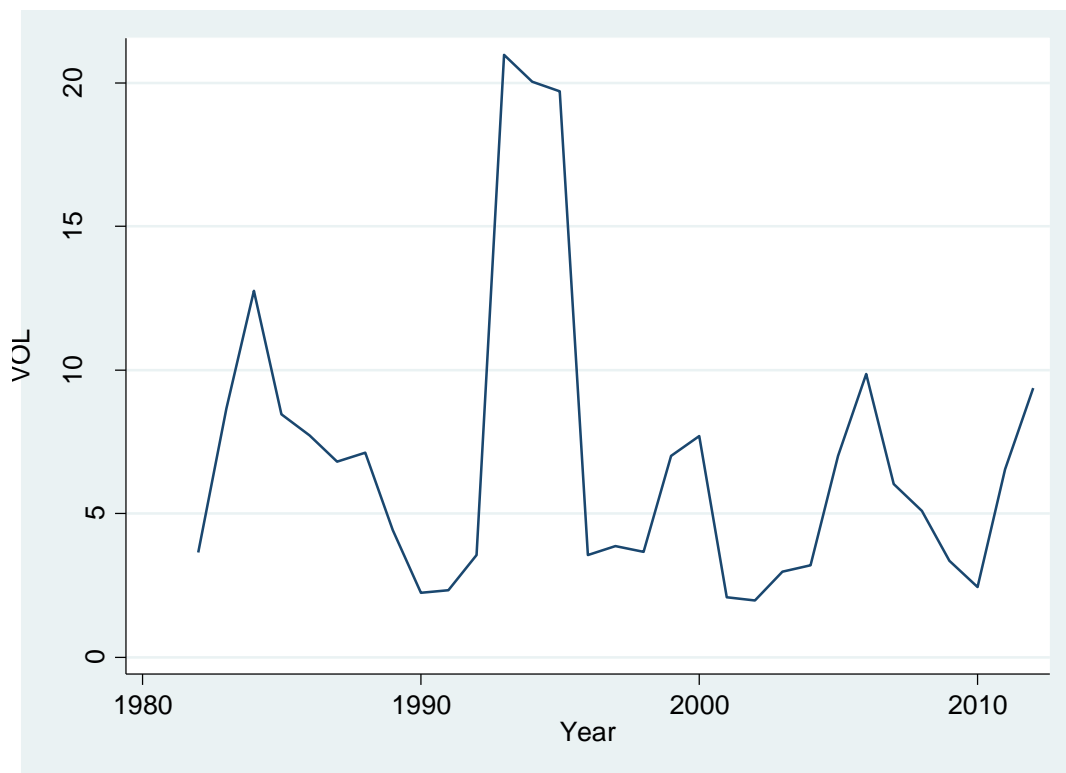


Figure 13: Trend in exchange rate volatility



## Appendix II: Data

Year	GDP Growth rate	INF	OPEN	REER	Gross fixed capital formation (% of GDP)	Population ages 15-64 (% of total)	Gross domestic savings (% of GDP)	External debt
1980	5.59	13.86	0.65	83.22	18.32	46.99	18.11	3.44
1981	3.77	11.6	0.64	82.26	18.61	46.99	19.55	4.31
1982	1.51	20.67	0.58	89.00	19.02	47	16.95	5.98
1983	1.31	11.4	0.54	99.46	18.11	47.04	18.66	8.6
1984	1.76	10.28	0.59	114.37	17.15	47.09	14.5	11.78
1985	4.3	13.01	0.55	113.86	17.27	47.19	20.47	9.36
1986	7.18	2.53	0.56	127.48	19.63	47.31	17.72	11.93
1987	5.94	8.64	0.48	120.51	19.62	47.47	19.19	12.09
1988	6.2	12.26	0.5	113.22	20.44	47.67	20.21	13.43
1989	4.69	13.79	0.53	112.49	19.45	47.96	17.77	9.28
1990	4.19	17.78	0.57	116.69	20.64	48.32	18.52	12.11
1991	1.44	20.08	0.56	112.82	19.03	48.77	19.45	15.81
1992	-0.8	27.33	0.53	109.59	16.58	49.28	16.51	21.37
1993	0.35	45.98	0.73	147.41	16.93	49.83	22.55	66.26
1994	2.63	28.81	0.71	117.05	18.87	50.37	22.1	26.96
1995	4.41	1.55	0.72	110.48	21.38	50.9	15.25	26.52
1996	4.15	8.86	0.57	111.38	16	51.38	8.09	13.89
1997	0.47	11.36	0.54	104.28	15.38	51.84	6.45	7.43
1998	3.29	6.72	0.49	106.25	15.67	52.27	8.13	8.93
1999	2.31	5.74	0.48	117.29	15.59	52.68	8.99	12.86
2000	0.6	9.98	0.53	121.05	16.7	53.07	7.28	9.77
2001	3.78	5.74	0.56	117.6	18.15	53.44	8.7	8.26
2002	0.55	1.96	0.55	117.62	17.23	53.78	9.76	12.04
2003	2.93	9.82	0.54	112.44	15.83	54.08	10.52	9.74
2004	5.1	11.62	0.59	111.79	16.25	54.32	10.7	12.09
2005	5.91	10.31	0.64	100	18.69	54.5	10.18	9.41
2006	6.32	14.45	0.63	92.18	19.08	54.62	7.76	7.06
2007	7.01	9.76	0.63	88.14	19.36	54.69	8.19	4.69
2008	1.55	26.24	0.69	82.04	19.43	54.72	5.09	3.84
2009	2.59	9.23	0.64	82.62	19.66	54.76	6.6	4.25
2010	5.75	3.961	0.61	86.53	20.32	54.81	7.51	4.29
2011	5.8	8.36	0.63	95.38	18.51	54.92	8.21	5.51
2012	4.4	7.67	0.65	105.26	19.58	54.93	7.68	6.21



```
. dfuller GDP
```

		Interpolated Dickey-Fuller		
	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-3.239	-3.702	-2.980	-2.622

```
. dfuller INF
```

	Test Statistic	Interpolated Dickey-Fuller		
		1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-3.187	-3.702	-2.980	-2.622

```
. dfuller OPEN
```

		Interpolated Dickey-Fuller		
	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-2.551	-3.702	-2.980	-2.622

55

Dickey-Fuller test for unit root                      Number of obs    =         30

MacKinnon approximate p-value for  $Z(t) = 0.0391$

Dickey-Fuller test for unit root                      Number of obs    =            32

MacKinnon approximate p-value for  $Z(t) = 0.0484$

Dickey-Fuller test for unit root                      Number of obs     =            32

MacKinnon approximate p-value for  $Z(t) = 0.9073$

```
. dfuller GrossdomesticsavingsofGDP
```

```
Dickey-Fuller test for unit root                Number of obs   =          32
```

Test Statistic	Interpolated Dickey-Fuller		
	1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-1.414	-3.702	-2.980
			-2.622

```
MacKinnon approximate p-value for Z(t) = 0.5757
```

```
. dfuller Externaldebt
```

```
Dickey-Fuller test for unit root                Number of obs   =          32
```

Test Statistic	Interpolated Dickey-Fuller		
	1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-3.151	-3.702	-2.980
			-2.622

```
MacKinnon approximate p-value for Z(t) = 0.0230
```

## Appendix IV: Transformed Non-Stationary variables

Trade openness was differenced once to become stationary

```
. gen D1 = D.OPEN  
(8 missing values generated)
```

```
. dfuller D1
```

Dickey-Fuller test for unit root                      Number of obs    =            31

Interpolated Dickey-Fuller				
Test	1% Critical	5% Critical	10% Critical	
Statistic	Value	Value	Value	
Z(t)	-5.741	-3.709	-2.983	-2.623

MacKinnon approximate p-value for Z(t) = 0.0000

## Population Age

Population was of integrated of order one

```
. gen D1 = D.Populationages1564oftota  
(8 missing values generated)
```

```
. dfuller D1
```

Dickey-Fuller test for unit root                      Number of obs    =            31

Interpolated Dickey-Fuller				
Test	1% Critical	5% Critical	10% Critical	
Statistic	Value	Value	Value	
Z(t)	-0.758	-3.709	-2.983	-2.623

MacKinnon approximate p-value for Z(t) = 0.8311

## Gross domestic saving

```
. gen D1 = D.GrossdomesticsavingsofGDP
(8 missing values generated)
```

```
. dfuller D1
```

Dickey-Fuller test for unit root                      Number of obs    =        31

Interpolated Dickey-Fuller				
Test	1% Critical	5% Critical	10% Critical	
Statistic	Value	Value	Value	
Z(t)	-6.167	-3.709	-2.983	-2.623

MacKinnon approximate p-value for Z(t) = 0.0000

## Autocorrelation of GDP and Exchange rate using collerogram

