THE EFFECT OF REAL EXCHANGE RATE DEVALUATION OR DEPRECIATION ON OUTPUT IN SUB – SAHARAN AFRICA

BY

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(10309463)

THIS THESIS/DISSERTATION IS SUBMITTED TO THE UNIVERSITY OF GHANA, LEGON IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE AWARD OF MPhil ECONOMICS DEGREE

JULY, 2016
DECLARATION

This is to certify that this thesis is the result of research undertaken by me, Emmanuel Kwasi Zewu towards the award of a Master of Philosophy (M. Phil) Degree in Economics in the Department of Economics, University of Ghana. I hereby declare that apart from references to other works, which have been duly acknowledged, this thesis is entirely my work under the guidance of my supervisors and has not been presented for another degree elsewhere.

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The importance of economic growth and development for social welfare improvement cannot be over emphasized. For this reason, every country across the globe, especially, the developing and less developed ones, are making every effort necessary to develop and provide their citizens with an improved standard of living. These efforts include opening up their economies more to the rest of the world through international trade, capital flows and cooperation. Therefore, exchange rate policy issues become very important in the management of the economies of these countries, especially the issue of exchange rate devaluation or depreciation and its effect on output. In many Sub – Saharan African countries devaluation has been one of the most often used policies, be it IMF-sponsored or government initiated reform programmes. The aim of this study is to examine empirically whether real depreciation is expansionary or contractionary in sub – Sahara Africa using data from 35 sub- Sahara African countries from 1984 to 2013. We also seek to examine the differential effects of the relative price ratio and the nominal exchange rate changes on real output.

Following some previous studies that emphasize major political events such as elections and change in governments as affecting the path of the real exchange rate as well as business cycles affecting productivity and growth and variables relating to long-term growth, we follow Edison et al. (2002) by generating 3-years non-overlapping averages for the variables to even out the political economy effect of exchange rate changes and also to eliminate business-cycle fluctuations. Using the Generalized Methods of Moments (GMM) estimation technique, we find that the real exchange rate has contractionary effect on real output in the short run but its effect is neutral in the medium and the long runs. We also find that the contractionary impact of the real exchange rate emanates from the nominal exchange rate and not the relative price ratio.
DEDICATION

This thesis is dedicated to God Almighty, my father Mr. Sam Zewu and the entire family.
First and foremost, I am very grateful to the Almighty God for His guidance and protection throughout the duration of the programme.

I am also grateful to my father, Mr. Sam Zewu and the entire family for their support and encouragement. They have been very resolute in their support throughout the period of this programme.

I wish to pay glowing tribute to the late Dr. Albert David Amarquaye Laryea, one of my two supervisors, who passed away mid-way into the writing of this thesis. It was a great loss to me as he had made very constructive comments on my first-three chapters and I was hoping to benefit from his rich comments on the remainder of the chapters. Alas, that was not to be. May his soul rest in perfect peace.

With the passing of Dr. Laryea, the whole mantle remained on Dr. Bernardin Senadza. I wish to thank him very sincerely for the time and effort he devoted to shaping this thesis to its current state. In fact, the commitment demonstrated by Dr. Senadza towards this thesis through his timely and insightful comments and suggestions is very commendable. God richly bless you.

Finally, I say thank you to all my friends and well-wishers who have in one way or the other contribute to the success of this study.

These notwithstanding, all errors and omissions are the sole responsibility of the author.

Emmanuel Kwasi Zewu

(July, 2016)
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CHAPTER ONE

INTRODUCTION

1.1 Background of the study

The importance of economic growth and development for social welfare improvement cannot be over emphasized. For this reason, every country across the globe, especially, the developing and less developed ones, are making every effort necessary to develop and provide their citizens with an improved standard of living. These efforts include opening up their economies more to the rest of the world via trade, capital flows and cooperation. In this regard, the issue of exchange rate which translates domestic currency into foreign currency becomes very important in the management of the economies of these countries. The exchange rate expresses the national currency's value in terms of foreign ones. For instance, if one US dollar is worth 100 South Africa Rand, then the exchange rate of dollar is 100 Rand. If an item costs 500 Rand, it translates to 5 US dollars. Essentially, it refers to the rate at which we exchange one currency for another. Therefore, the exchange rate can be seen as a conversion factor or a ratio, depending on the direction of conversion. We can view the exchange rate in nominal or real terms.

Nominal exchange rates are determined on currency financial markets called "forex markets". It can also be fixed by the central bank. That is, there are basically two ways of determining the nominal exchange rate; by the authorities and by the market. When the nominal exchange rate is set by the authorities of a country (for example, the central bank), that country is said to be operating a fixed exchange rate regime. However, when it is determined by market forces, the country is said to be operating a flexible or floating exchange rate regime. The value of any currency under a flexible regime is just like the value of any commodity, because
its price is determined by the forces of supply and demand. So, if for some reason the demand for the Ghana Cedi for example increases, then its price will rise (appreciation) provided the supply remains stable. However, if the supply goes up, its price will decline (depreciation), given that the demand remains constant. This mechanism ensures that any disequilibrium situation in the market is eliminated.

Real exchange rates are nominal exchange rates adjusted for inflation differentials between two countries. The purchasing power of two currencies relative to one another. Though two currencies can have a certain exchange rate on the foreign exchange market, it does not imply that goods and services bought using one currency cost the same amount in another currency. This is because of the different currencies and different inflation rates in the countries involve. Therefore real exchange rates are calculated by adjusting the nominal exchange rates using the different rates of inflation in the two countries. That is, “the real exchange rate measures the cost of foreign goods relative to domestic goods” (Barry, 2004). Nominal exchange rate is concerned with money for money exchange whiles real exchange rate concern itself with goods for goods exchange.

Exchange rate stability is often seen as favourable to trade and therefore improves welfare (Bacchetta and Wincoop, 2000). It has been argued by many economists that wrong relative prices of tradables and nontradables, as a result of bad foreign exchange rate and international trade policies, is one of the causes of poor economic performance and falling standard of living in Less Developed Countries (LDCs), particularly those in Sub-Saharan Africa (Gyimah-Brempong and Gyapong, 1993). Investments, imports, exports, technology transfer and economic growth are affected negatively by inappropriate exchange rate policies (Gyimah-Brempong and Gyapong, 1993). For instance, the results of Ghura and Grennes (1992) showed that real exchange rate misalignment and fluctuation have negative impact on agricultural production, exports and the growth rate of real per capita income as well as on investment which in turn affect welfare negatively.
Therefore, the choice of a correct exchange rate policy is a critical component of macroeconomic policy in a country (Jhingan, 2011). According to Obadan (2006), exchange rate is one of the crucial macroeconomic variables necessary for the conduct of economic policy. Aside linking the price systems in different countries, it is also key in promoting exports and discouraging imports, and can help under appropriate conditions to improve the balance of payments position of a country. The significance of exchange rate in economic growth and development is emphasized by the fact that nearly all World Bank and International Monetary Fund (IMF) reform programmes in LDCs have exchange rates reform measures as an integral part of the reform packages.

Throughout the 1970s and early 1980s, many Sub-Saharan African (SSA) countries implemented import substitution plans as a development strategy which advocate replacing foreign imports with domestic production. The main idea was to reduce foreign dependency through the local production of industrialized goods. Domestic industries were protected from foreign competition through import tariffs and frequent imposition of taxes on agricultural exports. Nominal exchange rates were fixed relative to a major international currency (for example, the French franc or United States dollar) for long periods of time because of colonial ties in some cases.

Until the mid-1970s, most SSA countries employed fixed exchange rate regimes (Rouis et al, 1994). Administrative controls regarding current account transactions and allocation of foreign exchange characterized the foreign exchange regimes of these countries. Also, due to persistent weak external accounts, large parallel market premiums, at times reaching 1,000–4,000 percent and importantly, stagnant or falling per capita real income, there was widespread rationing of foreign exchange in these countries (Maehle et al, 2013).

For many of the countries which are not part of the CFA franc zone, government budget deficits resulted in increased domestic money supplies, hence inflation. Relative price of non-tradable goods to tradable goods went up (real exchange rate appreciation) in the face of fixed
exchange rates. The incentive for export reduced dramatically because of falling real prices of export goods resulting in diminished foreign exchange earnings. At the same time, demand for imported goods increased (Sahn et al, 1994).

In addition, the severe oil and commodities market shocks of the mid-1970s, led to heavy depletion of foreign exchange reserves, bringing the fixed rate regimes under pressure. These pressures were aggravated by a slow fiscal adjustment in the recessionary situations. Programmes like rationing of foreign exchange, stricter import licensing regulations and increased import tariffs were used to resolve the disparity between foreign exchange demand for imports and foreign exchange supply from export earnings rather than through exchange rate adjustments.

Due to the economic costs of these policies, most nations have engaged in exchange rate reforms. Specifically, many SSA countries have moved towards giving their Central Banks more autonomy to adopt different forms of exchange rate systems. Also, the World Bank advocated for trade liberalization policies and exchange rate reforms and others deemed necessary to stimulate growth and deal with the balance of payments crisis (World Bank, 1981). As part of the reform processes, policies executed included fiscal tightening, and liberalization of trade and financial markets. In the early 1990s, many economies within the region were recovering.

Devaluation was one of the central policy recommendation of the World Bank at the time. This was necessary for many reasons. These include, fixing the problem of price distortions to arrive at right prices. The removal of the price distortions made it possible for the market mechanism of price determination to work correctly. Consequently, the relative prices of tradeable to non-tradeable merchandises changed, thereby making them more competitive on the global market (Mustafa, 2000). This can decrease foreign trade deficit and improve the balance of payments to achieve sustainable economic growth. In many cases, nominal depreciation exchange rate caused a real depreciation (Maehle et al, 2013).
Devaluation refers to the official lowering of the value of a country’s currency within a fixed exchange rate regime. When this lowering of the value of a currency is achieved through market forces, the term depreciation is used. Devaluation of a currency is decided by the government issuing the currency, not like depreciation, which is as a result of operations of the price mechanism. A devaluation occurs in a fixed exchange rate and depreciation occurs in a floating exchange rate system, however, both imply a fall in the value of the currency in question.

During the 1980s and the 1990s, devaluation was central to economic adjustment and stabilization policies and was frequently used as a policy tool to improve a country’s balance of payments position, increase domestic employment, and accumulate more foreign exchange reserves. It is a very important policy tool particularly when dealing with the problem of exchange rate misalignment. Many reasons account for the existence of price misalignments in developing countries, especially Sub-Saharan Africa. Some of these reasons according to Mustafa (2000) are: (1) high imports and exports taxes; (2) currency overvaluation and the adoption of import substitution strategy for industrial development rather than export led strategy; and (3) controls on capital flows as well as on commodity. Consequently, prices were distorted, thereby creating a causing domestic and foreign prices to differ. Devaluation performs a very important role in correcting the distortion and fixing the problem of misaligned prices and to stimulate output growth.

Therefore, the debate about the possibility of a trade-off between economic growth and devaluation or depreciation is a crucial subject matter within both economic and political circles. While there is consensus that devaluation is a valuable policy instrument for balance of payments adjustment, wide disagreement surrounds the issue of output reaction to devaluations and depreciations. The traditional understanding was that devaluation affects output positively by switching expenditure from imports to locally produced goods and increasing the production of traded goods (Guitian, 1976). But according to Krugman and
Taylor (1978), the usefulness of devaluation as a policy tool is in no doubt. It is however important that policymakers are aware of its contractionary effects. As they stated, depreciation can lead to a reduction in national output in the Keynesian model if; (i) imports initially exceed exports; (ii) there are differences in consumption propensities from profits and wages; (iii) government revenues are increased by devaluation, example, when there are significant export taxes. Similar effects are also shown to exist in monetarist models, via reductions in both real balances and the nominal money supply.

### 1.2 Problem statement

Economists have been examining the relationship between output and the movements of the exchange rate. This is because currency devaluation is considered mostly as a policy measure for improving the foreign sector of the economy. No serious disagreement existed regarding the likely effect of devaluation on output until the late 1970s. The foremost understanding was that, devaluation or depreciation of currency increases the price of traded goods in the domestic currency in relation to non-traded goods, and this results in improvement of the trade balance. Improved foreign sector rises production and reduce unemployment in the economy (Kalyoncu et al, 2008).

One of the well-known channels by which devaluations affect output positively is through switching demand to domestically produced commodities from imports. This is because exchange rate devaluation or depreciation increases the domestic price of imports. Devaluation also encourages production in the export sector because it increases the price of exports in terms of the domestic currency but decreases it in the foreign currency thereby increasing their competitiveness on the international markets. Devaluation can also be contractionary on output for some reasons. It redistributes income from people with higher marginal propensity to consume to those with a lower marginal propensity to consume. This
causes consumption expenditure to fall leading to a fall in aggregate demand and output (Krugman and Taylor, 1978).

Another channel through which nominal devaluation can reduce aggregate demand is the real balance effect. Devaluation increases price levels which reduces real balances and may result in the reduction in output levels. Given very low price elasticities of imports and exports, the trade balance expressed in the local currency might deteriorate resulting in an economic downturn. Devaluation can reduce output through supply – side channels aside from these demand-side channels. According to Upadhyaya (2013), nominal exchange rate devaluation or depreciation increases the prices of imported inputs, which increase production cost and reduces aggregate supply. Furthermore, currency devaluation or depreciation can through increased price levels increase the domestic interest rate (the cost of borrowing) and wage level. This will increase cost of production and decrease the aggregate supply in the economy.

For decades, the issues of devaluation or depreciation and its effect on output have played a vital role in the economic and political decisions of many Sub-Saharan African countries. In fact, devaluation has been one of the most often used policies, be it IMF-sponsored or government initiated reform programmes in these countries (Mustafa, 2000). The effect on output growth of real devaluation or depreciation is therefore important for these countries.

In this regard, a number of studies have been conducted to establish the relationship between devaluation or depreciation and output. Many of the recent studies to examine this relationship have not paid particular attention to Sub-Saharan Africa. Also, the recent trends in the depreciation and output dynamics within the Sub-Saharan African context has been under researched. In addition, there are mixed empirical findings on the effects of currency depreciation on output. This means that, the question of whether devaluation or depreciation is expansionary or contractionary remains largely unanswered in the context of Sub – Saharan Africa. Therefore, the relationship between devaluation or depreciation and output need to be explored more especially for Sub-Saharan Africa.
1.3 Research questions

1. What is the effect of real depreciation on output? That is, is real depreciation expansionary or contractionary?
2. Does the effect of real depreciation on output change over time?
3. What are the relative effects of changes in the nominal exchange rate and the foreign – to – domestic price ratios on output over time?

1.4 Objective of the study

The main objective of this study is to find out the nature of the relationship between real depreciation and output in SSA.

1.5 Specific objectives

1. To examine empirically whether real depreciation is expansionary or contractionary.
2. To find out whether the effect of real depreciation on output change over time.
3. To find out the relative effects on output of changes in the nominal exchange rate and the relative price over time.

1.6 Significance of the study

The issues of depreciation and output growth are very important subject matter for many developing countries especially those in Sub-Saharan African. As such, many studies have been conducted to examine the effect of depreciation on output. The literature on depreciation and output in Africa provides very little guidance as to what the relationship is between depreciation and output growth partly because the topic within the African context have been under researched.

Studies such as Yaqub (2010), Galebotswe and Andrias (2011), Ayen (2014), Genye (2010), Odusola and Akinlo (2001) are studies conducted on individual African countries mostly employing time series analysis techniques. One problem with these studies is the probability of finding a high correlation between or among variables may be higher and can give rise to spurious results. Consequently, regression coefficients biased by collinearity might cause
variables that show no significant relationship with the outcome when considered in seclusion to become highly significant in combination with collinear variables, resulting in a high possibility of false-positive results and vice versa. Also, studies of this nature does not allow for uncovering of dynamic relationships. According to Nerlove (2002), economic behavior is inherently dynamic, therefore most econometric relationships are explicitly or implicitly dynamic. Apart from the studies mentioned above, Yiheyis (2006) studied the effect of devaluation on output in African countries. The study used pooled data from 1981-1999 from twenty African countries. Our study will provide us with knowledge about the recent trends with reference to the depreciation and output dynamics. Another thing that distinguishes this study from the others is that, it uses more countries and data covering more years than most studies conducted on this subject on Sub-Saharan Africa. This will help us to better understand the role of real depreciation on output growth both in the short and the long runs.

1.7 Organization of the Study

The study is organized into six chapters. Chapter one looks at the general introduction, states the problem and the objectives. Chapter two concentrates on the review of relevant theoretical and the empirical literature. Chapter three discusses the background to policy and trends of some selected key economic indicators. Chapter four focuses on the methodology used in the study. Chapter five analyses the empirical results of the estimated models. The final chapter which is chapter six summarizes the major findings of the study, recommendation for policy consideration and conclusion.
CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter focuses on the review of the relevant literature on the study. Efforts are made to explore the theoretical linkages between changes in exchange rate and output. Attention is also given to various empirical studies conducted on changes in the exchange rate and its effect on output levels.

2.2 The theoretical linkage between devaluation and output

Traditionally, the real exchange rate has not played any central role in the analyses of changes in output. This is because the first generation of neoclassical growth models were closed-economy models which suggested, that there was no role for the real exchange rate, which is defined as the ratio of relative prices of nontraded goods (all goods are nontraded in closed economies) (Eichengreen, 2007). But other theories see the real exchange rate to be important in the analyses of changes in output. One of such theories is the export-led growth theory. The export–led growth models predict that depreciation/devaluation of the domestic currency makes that country’s imports expensive for domestic consumers and exports relatively cheaper for foreigners. This makes it attractive to shift resources into the production of exportable goods. In addition, a more depreciated local currency, by boosting the growth of the export sector and therefore the openness of the economy, is said to place a country on a developmental route with more potential for sustained growth (Kamin and Rogers, 2000).

As a result, the country’s export increases and shifts demand to goods produced domestically and moves the aggregate demand curve to the right; that is an increase in demand (Dornbusch 1988). This transmission mechanism is well explained by the Mundell – Fleming model which shows the short - run relationship between the nominal exchange rate, interest rate, and output.

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If the economy is operating along an upward sloping aggregate supply curve, exchange rate depreciation will cause both output and the prices to rise (Choudhary and Chaudhry, 2007). However, if the economy is operating along a vertical aggregate supply curve, prices will rise proportionately and there will be no effect on the output level (Choudhary and Chaudhry, 2007). Depreciation/devaluation works like fiscal policy by affecting the level of demand for domestic goods positively thereby increasing income or output (Dornbusch, 1979). In developing countries additional channel through which devaluation could increase demand is price related switch of demand from imports and the added incentives to supply exports due to the rise in their domestic currency price (expenditure switching effect of devaluation) (Bird and Rajan, 2004).

Until the publication of an influential paper by Krugman and Taylor (1978), the prevailing view was that the substitution effects caused by a real devaluation were strong enough to ensure that the net outcome on output and employment would be expansionary (Lizondo and Montiel, 1988). Krugman and Taylor (1978) argued that those analysis that concluded that devaluation expands output ignores the fact that the movements in the price level caused by the devaluation will create enough losers in real terms leading to an initial excess supply of domestically produced goods. They suggested three main reasons why devaluation is contractionary especially in the developing countries;

First, when trade deficit exists before devaluation, the increase in the domestic price levels leads to a fall in real income in the home country and increase it in the foreign country, because foreign currency receipts is less that foreign currency payments. Therefore ‘foreign savings’ in the home country will increase ex ante and aggregate demand decrease ex post and import reduces along with it. This also suggests that, the larger the deficit, the larger the contractionary effects.

Second, even under balanced foreign trade conditions, devaluation increases the price of traded goods relative to the non – traded goods in the domestic economy resulting in a
windfall profits in the export and the import competing sectors. If the marginal propensity to save from wages is less than the marginal propensity to save from profits and if nominal wages do not go up national savings increases ex ante. In this case, the difference between the marginal propensities to save of the two groups determines the magnitude of the contractionary outcome.

Finally, in the presence of ad valorem taxes on imports or exports, devaluation redistribute income from the private sector to the government. The final outcome is a contraction in output.

Edwards, 1989; Lizondo and Montiel, 1989; and van Wijnbergen, 1986 propose various other channels through which devaluation may have a contractionary effect on both sides of aggregate demand and aggregate supply.

2.2.1 The Effects on Aggregate Demand

Cooper (1971), Krugman and Taylor (1978) Edwards (1986) and Caves et al. (1993) among others suggest that devaluation may affect aggregate demand negatively that result in the reduction of output and employment through the following channels:

Income Distribution Channel: It has been argued that devaluation redistribute income towards economic entities with a high marginal propensity to save (Cooper, 1971; Diaz-Alejandro, 1963; Krugman and Taylor, 1978). This argument is based on the proposition that there are two types of consumers in any given community; those who earn wages and those who earn profits with different marginal propensities to consume and save (Diaz-Alejandro, 1963; Krugman and Taylor, 1978). The Marginal propensity to save for wage earners is assumed to be lower compared to that of profit earners because the level of income of wage earners is lower, hence lower possibility for saving (Mustafa 2000).

Devaluation increases profits in exports and import-competing industries through increases in the relative prices for tradable goods. This results in lower real wages because of wage
rigidities which do not allow nominal wage increases immediately after price increases. This reduces the share of workers in national income, but that of profit earners increases. Since the marginal propensity to save for profit earners is more than that of wage earners there will be a decline in consumption hence a fall in aggregate demand (Mustafa, 2000). The magnitude of the contractionary effect on aggregate demand depends on the difference between the marginal propensities to consume of wage earners and of profit earners (Krugman and Taylor, 1978). But “those living closer to the margin of subsistence are likely to have little saving and even less scope for borrowing, so their marginal propensity to consume is likely to be very close to 1. This is why redistributional effects are likely to be larger in LDCs.” (Caves et al, p.477)

External Debt Channel: One factor that contributes to the poor economic performance of less developed countries is the existence of large debts and high interest burden (Mustafa 2000). In most instances, the debt is denominated in strong foreign currencies such as the US dollar. When a country with large external debt stock devalues, it affects both the private and the public sector negatively. The reason is that the cost of the foreign currency in terms of the domestic currency has gone up. Devaluation will raise the debt service burden of a country that has accrued external credits denominated in foreign currency (Cooper, 1972; Gylfason and Risager, 1984 and van Wijnbergen, 1986). In this case debt holders may reduce their spending since the value of their debts and its service requirements have gone up (Mustafa 2000). For instance, the sudden devaluation of the Mexican peso currency in 1994 resulted in increased external debt which led to the liquidation of some companies which in turn led to a recession in the Mexican economy (Caves et al, 1993).

Real Balance Channel: This is as a result of the higher price level after devaluation. Given initial nominal money balances and wealth, the increase in the price level results in a fall in real money balances and real wealth. The increase in the price level is more severe if the share of traded goods in consumption is large which also results in a more severe fall in the real
money balance and real wealth (Mustafa, 2000). Consequently, a reduction in spending is required to restore real balances (Bahmani-Oskooee and Miteza, 2006). Mustafa (2000) identified two different possibilities at this point. The first case is that when there is price flexibility, employment and total output do not change. This is because the fall in absorption or domestic spending is counterbalanced by increase in net exports, hence the aggregate output remains unchanged. But when there are price rigidities, prices of nontradeable goods will change gradually to the new level. As a result, there will be excess supply of goods due to the decreasing domestic spending. Here, if the demand for nontraded goods falls by more than the increase in net foreign demand for traded goods total output will fall.

Speculative Demand Channel: Another probable channel through which devaluation negatively affects aggregate demand and hence output is through speculative demand. Speculations about the value of the currency can affects demand. For example, the expectation that devaluation will take place soon can cause demand for goods to increase today. This is because, devaluation impacts wealth negatively (Mustafa, 2000). Such a speculative demand for physical goods is likely to occur in developing countries because of underdeveloped financial markets resulting in lack of investment opportunity (bonds, securities, etc.). Although such actions might be expansionary initially, it reverses and spending falls when the economy is hit by devaluation (Mustafa, 2000).

Tax Channel: When there is an ad valorem tariff on imports and exports, devaluation may affect aggregate demand negatively. The reason is that, devaluation raises the price of both tradable and non-tradable goods expressed in the local currency, and increases revenue from tax after devaluation. Private expenditures are likely to reduce because, higher taxes implies a reduction in purchasing power of the private sector (Bahmani-Oskooee and Miteza, 2006). This results in a fall in aggregate demand. Another way of looking at this is that, the increase in taxes redistributes income from households and firms to the government (Krugman and Taylor, 1978). But since government is assumed to have a marginal propensity to save out of
tax revenue close to unity in the short run, government expenditure does not change, but aggregate demand will fall because of the decrease in private consumption (Bahmani-Oskooee and Miteza, 2006).

2.2.2 The Effects on Aggregate Supply

Import Cost Channel: After devaluation, assuming that imports are more than exports, the higher price levels of tradable goods decrease the real income of the home country and raise the real income of the foreign country since payments for imports outweigh receipts from exports (Krugman and Taylor, 1978). Given that, new investments are often made up of imported capital goods than domestic resources, a devaluation which increases the cost of imported capital also reduces domestic investment. This leads to a reduction in aggregate supply.

Wage Indexation Channel: Aside from the import cost channel wage the wage system in a country can cause output to contract after devaluation through a fall in supply. As already noted, devaluation rises the price of tradable goods and general price levels, causing real wages to fall. Usually, to ensure that their purchasing power does not fall, workers will ask for increment in their nominal wages. Under a flexible wage system, the wage will adjust to the new price level after the devaluation (Mustafa 2000). Also, when wage indexation exists, nominal wages automatically go up in proportion to changes in the prices, resulting in higher production costs through higher wages (Edwards, 1986; Gylfason and Radetzki, 1985 and van Wijnbergen, 1986). This decreases production leading to fall in output. Wage indexation is uncommon in developing countries. But usually demand for increases in nominal wages is often through strikes which result in loss of man-hours, hence output contraction (Mustafa 2000).

Cost of Working Capital Channel: Another channel through which devaluation can reduce supply and contract output is through cost of working capital. It is not easy for firms to borrow
when they need short term funds from the financial market in an economy where this market is not developed (Mustafa, 2000). Financial markets are under developed in most less developed countries, thereby constraining firms’ access to borrowing. Hence the argument that short-term funds (working capital) that firms require for the day – to – day running is another factor of production in less developed countries (Mustafa, 2000).

Given these conditions, if devaluation occurs, there will be a decrease in the real volume of bank credit in the market and the monetary base and a rise in the interest rate (Bruno, 1979; and van Wijnbergen, 1986). The real volume of bank credit will fall because devaluation rises the demand for money, hence the increase in the interest rate and the cost of borrowing. This increases the cost of production and affect quantity supplied negatively. This negative effect is somewhat similar to wage indexation. The process through which the interest rate is increased is almost like the real balance mechanism. The only dissimilarity is that in this case the negative effect on output is not through the demand channel but the supply channel (Mustafa, 2000).

2.3 Empirical review

In this section we review previous empirical studies conducted on changes in the exchange rate and its effect on output levels. For purposes of clarity and convenience, we grouped these studies into specific country studies and cross – country panel studies.

2.3.1 Country-specific studies

Domac (1997) using data from 1960 – 1990 studied the hypothesis of contractionary effect of devaluation (both anticipated and unanticipated) on output growth using Turkey as a case study. The study examined the effect of unanticipated devaluation on output in two stages. These are, the effect on output of given underlying demand shock and the magnitude of the change in the demand in reaction to the underlying demand shock produced by unanticipated devaluation. The empirical results showed that unexpected devaluation has expansionary effects on output growth whereas expected devaluation does not have any significant effect
on output growth. But the final effect of unanticipated devaluation on output is moderate. This is because, the change in demand resulting from the unanticipated devaluation is comparatively small.

Odusolo and Akinlo (2001) examine the link among the Naira depreciation, inflation, and output in Nigeria using quarterly data from 1970.Q1 to 1995.Q4 and used the method of moments technique by Bernanke (1986) and Blanchard and Watson (1986). The study showed mixed results about the effect on output of exchange rate depreciation. The impulse response functions shows that exchange rate depreciation expands output in both medium and long runs but contracts it in the short-term period. Based on these results the study concluded that the adoption of a flexible exchange rate system does not lead to expansion of output, specifically in the short term. Following Dordunoo and Njinkeu (1997), they stated that credibility, confidence and discipline on the part of the government are essential for output growth. Finally, the results of the contemporaneous models showed that the impact of the parallel exchange rate is contractionary on output but only in the short term.

Berument and Pasaogullari (2003) assesses the effects of real depreciation on the economic performance of Turkey by considering quarterly data for the period 1987: I to 2001: III. After employing various Vector Auto Regression models using variables such as inflation, U.S. interest rate, output, the real exchange rate, capital account, current account and government size. The study suggests that, in contrast with the classical view, even if external variables such as capital flows, international trade and the world interest rates are controlled for, the real depreciation reduces output growth. The findings suggest that, the overvaluation of a currency must be prevented in order to reduce the negative effects of devaluation on output.

Miteza, (2006), assesses the effect of changes in real exchange rates on output growth by applying a smooth transition regression (STR) model using Bulgaria as a case study. The study chose Bulgaria to examine this relationship due to the fact that the nature of the link between exchange rates and output is particularly critical for transition economies, and even
more so for countries aspiring to join the European Union. The study employed a nonlinear estimation technique to estimates a reduced form equation where output growth is expressed as a function of change in the real exchange rate, real money growth, and change in government expenditure. The nonlinear estimation technique employed here offers more flexibility in terms of allowing for possible asymmetric effects of real appreciations on growth, contingent upon the behavior of relevant economic variables. The nonlinear model reveals that real appreciations have helped growth in Bulgaria for most of the period 1994-2004. Real appreciations can turn contractionary only under excessive real money growth, which has occurred only sporadically (Miteza, 2006).

Narayan and Narayan (2007) examined the assertion that traditionally if expenditure switching occurred as a result of nominal devaluation, it improves the external position of the country devaluing by improving. Using Fiji as case study and following the methodology of Bahmani-Oskooee et al. (2002). The study modify the traditional model to include additional fiscal and monetary policy measures and used an annual data from 1970 to 2000 to estimate this model. The results indicated that devaluation has a positive impact on output in Fiji.

Eme and Johnson (2010), studied the movement of exchange rate in Nigeria for the sample period 1986 to 2010. The paper examined the probable direct and indirect relationships between exchange rate and GDP growth by using a simultaneous equation framework within a fully specified (but small) macroeconomic model and a generalized method of moment (GMM) technique. The empirical results suggest that there is no sign of strong positive relationship between changes in exchange rate and output growth. They however concluded that Nigeria’s economic growth had been positively affected by monetary variables and that improvements in exchange rate management were necessary but not necessary to revive Nigerian economy.
Acharya (2010) measures the possible effects of the devaluation of domestic currency of Nepal. The paper also measured the effects on growth, distribution, price changes in factor and product markets, and on other macroeconomic variables. The study employed a computable general equilibrium model applied to social accounting matrix data in its analysis. The results suggested that devaluation is expansionary on output. This however leads to a more uneven income distribution because, the increase in output favours only the rich.

Yaqub (2010) analysed the effect of exchange rate variations on output of different sectors of the Nigerian economy. The study used an improved IS-LM model and estimated the behavioural models as a system using separate regression estimation techniques and data from 1970 to 2007. The result showed that the agricultural and manufacturing sectors are affected negatively by exchange rate devaluation, but it affected the services sector positively. Hence, the study concluded that during the period covered by the study, exchange rate devaluations or depreciations were contractionary rather than expansionary.

Yilanci and Hepşağı (2011) studied the effect of real devaluation on gross domestic product for Turkey. They employ cointegration test and use quarterly data from 1987:Q1 to 2008:Q4. Following approaches of Narayan and Narayan (2007) and Bahmani-Oskooee et al. (2002), they included monetary and fiscal variables as well as foreign income in their model. The results from the estimation shows that real depreciation reduces output in the short run but increases it in the long run for Turkey.

Galebotswe and Andrias (2011) using Botswana as a case study, studied the impact of devaluation on output in a small open import-dependent economy. The authors employed a two-step Engle and Granger (1987) error-correction method which controls for fiscal and monetary policies, foreign output and interest rates. They find that exchange rate devaluations expand output in the short run but contracts it in the long run. Also, the result showed that South African output the key driver of non-mining private output in the long run. The study
concluded that the results have vital policy effects for Botswana and other import-reliant countries. First, because devaluation reduce output in the long run; it implies that care ought to be taken when using currency devaluation to stimulate economic growth. Second, public spending remain key variable in determining economic performance in Botswana, meaning that its reduction must steady so that the economy will not be destabilized. The large effect of South African output also proposes a need to diversify the economy to decrease dependence on that country.

Genye (2011) analyze the effects of devaluation on GDP per capita growth in Ethiopia using data from 1980 to 2010. Beside the exchange rate the paper used variables such as education, private investment, openness to determine Ethiopian GDP per capita growth. The study showed that devaluation has a negative effect on GDP per capita in the same year whereas the coefficient for the one year lagged exchange-rate was significantly positive. Wan (2012) investigated how China’s real output responded to the appreciation of Chinese Yuan during the period 1980 to 2010. Employing cointegration technique and error correction techniques, the evidence suggested that Yuan appreciation has had a negative impact on China’s output in the long run, indicating currency appreciation is indeed contractionary in China.

Datta (2012) investigates the effects of currency depreciation on the growth of output of the economy of Pakistan for the time period 1993 to 2009 by using a time series approach. In this regard the classical unit root test namely Augmented Dickey-Fuller (ADF) and Phillips-Perron Unit Root tests are employed. The study concluded that currency depreciation has expansionary effect on output growth in the short run. That is, in the short run, the relationship between currency depreciation and output growth is positive. However in the long run currency depreciation is contractionary on output growth in the economy of Pakistan.

Ayen (2014) examined the short and the long run impact of changes in the exchange rate on output growth in Ethiopia. The study used quarterly time series data from 1998.Q1 to 2010.Q4 and employing a vector auto regression (VAR) model. By controlling for monetary
and fiscal policies, the result showed that devaluations reduce output in the long run, however it is neutral in the short run. This is contrary to the findings of Genye (2011) that devaluation reduce GDP per capita in the same year but increase it after one year.

Pal (2014) studied the effects real exchange rate changes on output in India by employing a non-linear smooth transition regression methods as a continuous process depending on the transition variable. This makes it possible to include regime changing behavior in the model for when the exact time of regime change is not known without doubt and times of short transition to a new regime. Using data from 1970 to 2006 obtained from Reserve Bank of India website and International Financial Statistics of the International Monetary Fund, the paper find evidence that, the effect on output depends on the direction of the change in the real exchange rate. Real appreciation of the exchange rate the effects on output positively and negatively in the case of real depreciation.

2.3.2 Cross – country and panel studies

Nunnenkamp and Schweickert, (1990) tested the hypothesis that devaluation is contractionary on growth, using data from 48 developing countries. In doing so, they constructed a pooled time series cross country study of dissimilar income group of these countries to test the relationship that exists between GDP growth per capita and the exchange rate. The hypothesis that countries that exported manufactured goods mostly experienced contractionary effect in the short run but these effects in the long run were offset by the positive effects was rejected based on the result of their study. For exporters of agricultural products, the result suggested that devaluation increase economic growth in the short run and in the long run.

Agénor (1991) analyzed the impact of real exchange rate variations on output for twenty three countries from 1978 to1987. The study used an aggregate output equation derived from a rational expectations macro- model with imported inputs. The result indicates that, expected depreciation of the real exchange rate affects output negatively, however, unexpected depreciation of the real exchange rate has a positive effect on output. Furthermore, the
The contractionary effect of anticipated real depreciation of the exchange rate remain significant even after a year. This is contrary to the findings of Edwards (1986) that after one year devaluation will expand output.

Kamin and Klau (1998) examined the effect of devaluation on output for twenty-seven countries selected from the industrialized world, Asia and Latin America. The results showed that devaluation affects output negatively in the short run but there is no evidence of negative effect of devaluations on output in the long run. However, after they control for sources of spurious correlation and reverse causality, the measured contraction in output in the short run reduced. Finally, they found that, while most literature on contractionary devaluation has focused on developing countries, there is no evidence that the negative effect of devaluation on output is small in industrialized countries compared to developing ones.

Mustafa (2000) examined the effect on output growth of devaluation in a sample of 18 less developed countries using data over 25 years. Employing the fixed-effect technique, the results suggest that devaluation contracts output in the first year and expands it in the next year. The findings also show that qualitatively, there is no dissimilarity between exporters of agricultural products and exporters of manufactured products regarding the effect of devaluation on economic growth.

Bahmani- Oskooee et al. (2002) examined empirically whether devaluation is expansionary or contractionary in Asian countries employing quarterly data over the 1976.QI – 1999.QIV period for Indonesia, Korea, Malaysia, the Philippines, and Thailand. The study used Johnson’s (1988) cointegration analysis and estimated a reduced form – equation to analyse the long – run and the short – run response of real output to change in government spending, money supply, real exchange rate, foreign economic activity and the world energy price. The reduced- model captures two main channels that drive these economies; the internal sector and the external sector. The changes in the government expenditure and money supply
captures the internal sector. The external sector is captured by the exchange rate, the index of
foreign real output (to capture repercussion effect) and world energy price. For the real output
and the exchange rate relationship, results show that in the long-run real output of Indonesia
and Malaysia moves positively with the real exchange rate, while that of Philippines and
Thailand moves negatively with the real exchange rate. The study also found that, real output
growth for Korea does not significantly respond to the changes in the real exchange rate.

Kandil (2004), studied the effect of exchange rate instabilities on price inflation and real
output growth using 22 developing countries. By a theoretical rational expectations model he
divided changes in exchange rate into expected and unexpected. Expected exchange rate
depreciation determines the cost of imported inputs, therefore output supplied. However,
unexpected currency variations determine aggregate demand via exports, imports, and the
demand for currency, and determine aggregate supply through the cost of imported inputs.
Over all, the study concluded that exchange rate depreciation; both expected and unexpected
reduces real output growth.

Aguirre and Calderon (2005) formulate three fundamentals-based indices of real exchange
rate overvaluation and misalignment from 1965 to 2003 for a panel of 60 developed and
developing countries to examine their relationship with economic growth. The first
fundamental misalignment is calculated by using the time series estimates of equilibrium real
exchange rates. The second is computed using the dynamic ordinary least squares (DOLS)
estimates for the sub samples of industrialised and developing countries and the third is
computed using the panel DOLS estimates for the complete sample of countries. Their results
showed that the indices are negatively correlated with economic growth. Also, the relationship
seems to be disproportionate and non-linear: the estimated coefficients are smaller for cases
of undervaluation than those of overvaluation and they tend to increase in absolute terms with
lower degrees of overvaluation. The negative relationship between overvaluation and output
growth continues to hold when the fundamentals-based indices are replaced by purchasing power parity (PPP) based indices.

Miteza (2006) examined the impact of devaluations on aggregate output for five transition economies from 1993-2000. The study estimated a reduced form equation for output with real wage, real money, and real effective exchange rates as regressors. The study used panel unit root tests and panel cointegration in order avoid spurious regression results and establish the existence of long run relationship between these four variables. The results support the contractionary devaluation hypothesis which is contrary to a large part of the literature which holds that devaluations have no effect on output in the long run. The study therefore suggested that the contractionary effect of devaluations in these economies may be part of the reasoning behind a long standing unwillingness shown by China in devaluing its own currency, but instead pursuing export tax rebates to stimulate its external sector. Also, the substantial effect of devaluation on output in these transition economies can likewise encourage some policies of exchange rate rigidity in countries like Albania, Bosnia and Herzegovina, Macedonia, and Serbia and Montenegro in their efforts to join the European Union Miteza (2006).

Yiheyis (2006) examined the effect devaluation on output by using sampled data from twenty (20) selected African countries. The results show the contemporaneous effect of nominal exchange rate devaluation on output to be negative, providing empirical backing for the supposition that devaluation is contractionary in the short run. However, the coefficient of the lagged devaluation rate was positive, suggesting that the contractionary effect is not permanent. The size of the observed contraction in output seems to hinge on the degree of capacity utilization and the rate of net capital inflows. Finally, the results suggest that devaluation policies implemented in the presence of unemployment of resources and accompanied by net capital inflows are less contractionary than equivalent exchange rate changes.
Rodrik (2008) examined the relationship between real exchange rate and output using data set consisting of a maximum of 184 countries from 1950-54 through 2000-04. The study provided evidence that currency undervaluation leads to economic growth. This is true particularly for developing countries. The study also suggested that the operative channel is the size of the tradable sector especially industry. These findings suggest that tradable goods suffer disproportionately from government or market failures that keep poor countries from converging towards higher income levels. He argues that sustained real exchange rate depreciations increase the relative profitability of investing in tradables, and act in second-best fashion to alleviate the economic cost of these distortions. That is why episodes of undervaluation are strongly associated with higher economic growth Rodrik (2008).

Saxena and Tovar (2008) examined the relationship between output and devaluation and also provide estimates of how devaluation episodes affect output trend by using 109 emerging market and developing economies from 1960 to 2006. The study used two – way fixed effects panel models and found that the relationship between devaluation and output is not robust across time and regions, and that the persistence of devaluations matters. At ten year horizons, one-time devaluations in particular induce output trend gains, while successive devaluationary episodes have no effect. The role of the external sector was also examined to determine how it explains the heterogeneity of the findings. They concluded that real imports, not exports cause most of the change, implying that there is a strong expenditure switching effect.

Kalyoncu et al (2008) examined the effect of exchange rate changes on aggregate output using unit root and cointegration test to analyse the short-run and long – run effects on output levels of real exchange rate depreciation in 23 OECD countries. The empirical results show that, currency devaluation affected output growth in 9 (Austria, Finland, Germany Hungary, Poland, Portugal, Sweden, Switzerland and Turkey) out of 23 countries. In the long run in Austria, Hungary, Poland, Portugal, Switzerland and Turkey, depreciation affects output growth negatively but positively in Finland, Germany and Sweden. The result also show that
depreciation contract output for Finland, Germany and Turkey while affecting it positively for Hungary and Switzerland in the short run.

Constant (2012) assesses the relationship between the devaluation of the CFA franc and output growth in the Franc Zone. The paper used the data of 13 African countries of the franc zone over the period 1995-2008. The objective was to ascertain whether the January 12th, 1994 CFA franc devaluation had an impact on the output growth in these countries. The estimated results show that this devaluation had no impact on output growth. The authors concluded that the absence of impact on growth is justified by the failure of the structural adjustment programmes which should have accompanied the devaluation of the CFA franc.

West African Monetary Institute (2012) investigates the impact of changes in the exchange rate on output growth and inflation and the proportion of inflation and output variance that can be explained by the changes in the exchange rate in the West African Monetary Zone (WAMZ) economies. Employing quarterly data series for the period 1981Q1 to 2010Q4 for all countries except Ghana (1983Q2 to 2010Q4) and Guinea (1989Q1 to 2010Q4), the study uses the vector autoregressive (VAR) model to estimate the impulse response functions and variance decompositions for inflation and output. The results of the study suggest that exchange rate had significant impact on inflation in all the Member States. The results reveal a negative relationship between real exchange rate and real GDP growth for both Liberia and Sierra Leone. However, the impact of exchange rate on output in The Gambia, Ghana, Guinea and Nigeria though positive, remained weak, which may be partly due to supply side factors as evident from the results.

Upadhyaya et al (2013) examines the effect on output of currency devaluation in South-East Asian countries. The study used data from Malaysia, Thailand, the Philippines and Indonesia from 1980 to 2010. A model which contains exchange rate, fiscal and monetary variables is developed and estimated using the fixed effect technique. The study estimated two forms of
the model, the first contains the real exchange rate and the second one contains the relative price ratio and the nominal exchange rate. The second model decomposes the real exchange rate into the relative price ratio and the nominal exchange rate to ascertain their different impact on real output. The results show that currency devaluations or depreciations contracts output in the short run and the medium run and this effect comes from the change in foreign-to-domestic price ratio but as a result of the change in nominal exchange rate. Table 2.1 shows the summary of empirical literature for cross – country and panel studies.

Table 2.1 Summary of empirical literature for cross – country and panel studies.

<table>
<thead>
<tr>
<th>Author</th>
<th>Country/data/time period</th>
<th>Variables</th>
<th>Method</th>
<th>Summary of findings</th>
</tr>
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<tbody>
<tr>
<td>Nunnenkamp and Schweicke rt (1990)</td>
<td>48 developing countries Pooled time-series cross-country 1982-1987</td>
<td>Real growth of GDP per capita, real effective exchange rate, economic policy measures, external shocks variables</td>
<td>ordinary-least squares</td>
<td>Devaluation is contractionary in the short run for manufactured goods but expansionary on agricultural products in the short run and the long run.</td>
</tr>
<tr>
<td>Agenor (1991)</td>
<td>23 developing countries Cross-section panel data/Pool time data 1978-1987</td>
<td>Real output, real exchange rate, Money supply, government spending, foreign output</td>
<td>OLS Fixed effect procedure</td>
<td>Unanticipated depreciation will boost output growth; anticipated depreciation reduces output growth</td>
</tr>
<tr>
<td>Kamin and Klau (1998)</td>
<td>27 countries from Asia, Latin America 1970-1996</td>
<td>Real output, real exchange rate, output gap, real interest rate, government budget balance, treasury bill interest rates, terms of trade, change in capital account</td>
<td>Fixed effects panel method</td>
<td>there is no evidence of negative effect of devaluations on output in the long run</td>
</tr>
<tr>
<td>Mustafa (2000)</td>
<td>18 Less Developed Countries 1970-1994</td>
<td>real output, relative size of government, money surprise term, terms of trade, real exchange rate</td>
<td>OLS fixed-effect technique</td>
<td>Contractionary in the first year, expansionary in the following year,</td>
</tr>
<tr>
<td>Author</td>
<td>Sample and Time Period</td>
<td>Variables Considered</td>
<td>Methodology</td>
<td>Findings/Results</td>
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<tr>
<td>Bahmani-Oskooee et al.</td>
<td>5 Asia countries</td>
<td>Real output, Real exchange rate, real money supply, government spending, foreign output and world energy price</td>
<td>ADF test, J-J test, ECM, CUSUM</td>
<td>Mixed results for five Asia countries.</td>
</tr>
<tr>
<td>Kandil (2004)</td>
<td>22 developing countries</td>
<td>Real output, government spending, money supply,</td>
<td>Panel and time series integration methods</td>
<td>Exchange rate depreciation; both expected and unexpected reduces output growth</td>
</tr>
<tr>
<td>Aguirre and Calderon</td>
<td>of 60 developed and</td>
<td>Output growth, effective real exchange rate, government consumption expenditure, net foreign assets and terms of trade</td>
<td>Panel and time series integration methods</td>
<td>Exchange rate devaluation is contractionary</td>
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<td></td>
<td>developing countries</td>
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<td>1965-2003</td>
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<td>Miteza (2006)</td>
<td>five transition</td>
<td>Output, real effective exchange rates, real money, and real wage rates</td>
<td>Panel unit root tests and panel cointegration</td>
<td>Devaluation is contractionary in the long run</td>
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<td>1993-2000</td>
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<td>Yiheyis (2006)</td>
<td>20 selected</td>
<td>real GDP, real exchange rate, government consumption expenditure, unanticipated component, external debt, net capital inflow, parallel currency premium, political instability index</td>
<td>OLS method, fixed-effects</td>
<td>Devaluation is contractionary in the short run but positive in the long run</td>
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<td>African countries</td>
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<td>1981–1999</td>
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<td>Kalyoncu et al. (2008)</td>
<td>23 OECD countries</td>
<td>Real output, Real exchange rate</td>
<td>ADF test, E-G test</td>
<td>Mix results for different countries in the long run and short run.</td>
</tr>
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<td></td>
<td>Quarterly data</td>
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<td>Rodrik (2008)</td>
<td>184 developed and</td>
<td>Output growth, initial income, real exchange rate</td>
<td>Dynamic panel technique</td>
<td>Currency devaluation leads to economic growth</td>
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<td>1950-54 through 2000-04</td>
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CHAPTER THREE

EXCHANGE RATE POLICY AND OVERVIEW OF MACROECONOMIC PERFORMANCE IN SUB-SAHARA AFRICA

3.1. Introduction

This chapter discusses the background to policy and trends of some selected key development indicators within Sub – Saharan Africa that are relevant to the study. It reviews exchange rate policies and regimes in the region. In addition, we discuss the financial system of sub – Sahara Africa. This is because developments in the financial system have implications for the exchange rate. Therefore, it is improper to discuss issues of exchange rate without looking at
the financial system. The chapter also discusses the nature of the economies in the region and their performance. Finally, this chapter looks at the trends of some selected development indicators of the region.

3.2. Sub–Sahara Africa at a glance

Sub-Saharan Africa is, geographically, the area of the continent of Africa that lies south of the Sahara Desert. Politically, it consists of all African countries that are completely or partly situated south of the Sahara (apart from Sudan, even though Sudan sits in the Eastern portion of the Sahara desert). The population of the region is estimated to be over 930 million and it is currently growing at the rate 2.3%. The United Nations (UN) projects that the population of the region will reach between 1.5 and 2 billion by 2050. There are 48 countries in the region which vary both in size and economic history, with many small countries and giants like Nigeria. The majority of the poor people in the world (those living on US$1 or less a day) are in Sub – Sahara Africa (Acemoglu and Robinson, 2010). The region recorded economic growth rate of 4.5 percent in 2014 (AfDB, 2015).

Notwithstanding the different national economic circumstances, the economic history of Sub-Saharan Africa can be largely classified into four sub-periods according to Olamosu and Wynne (2015); (1) 1960-1980, during which the annual growth rate of GDP of many African countries was 4.8 percent. This equaled that in many other areas of the world—annual GDP growth of 4.8 percent on average. (2) 1980-2000, during which economic growth shrunken in several African countries due to external shocks of oil price increases, decreasing terms of trade and increased real interest rates. (3) 2000-2007, during which several countries in the region grew reasonably largely due to increase in the prices received for primary products—annual GDP growth of 3.9 percent on average. (4) 2008-present, when economic uncertainty led to a fall in demand for raw materials with the slowdown in the European and American markets and reduced economic growth rate China. In 2011, Africa was one of the fastest growing regions in the world. Six of the ten fastest-growing economies over the previous
decade in the world were in Sub – Sahara Africa. According to the World Bank, the economic growth rate in the region had risen to 4.7% in 2013. This continued increase was attributed to rising investment in infrastructure. The trends of economic growth and inflation in sub-Saharan Africa from 1984 -2013 are shown in figure 3.1.

The strong growth propulsion seen in most countries in region especially between 2000 and 2007 has dissipated of late, as commodity prices and global financing situations have become less favourable. The Difficulties from the external environment is compounded mostly by limited buffers, both on the external and fiscal fronts. As a result, Sub-Saharan Africa’s economy is projected to grow at a slower pace than the 2010 rate of 5.2 percent, before strengthening somewhat in 2016 (Punam et al., 2011).

The second half of the 20th century can be described as a period of economic stagnation if not decline for many Sub-Saharan Africa countries. Recent statistical studies have shown that, many Africans are worse off than they were at the start of independence, due to serious health and nutrition challenges and with poor economic infrastructure (Rowley, 2000). This suggests that, many Africans are economically worse off than their predecessors were before independence. The dismal economic performance of Sub - Sahara African countries since independence can be traced to a number of factors. Institutionally, this can be explained on two levels; the micro level and the macro level. At the micro level, the poor economic
performance of Sub-Saharan Africa over the years is as a result of wrong methods for allocating land, lack of local accountability (chiefs) and social institutions of common obligation (Acemoglu and Robinson, 2010). At the macro level, greedy and kleptocratic rule, weak states and failure to enforce rules or order and lack of inappropriate mechanisms for national accountability which allow rent extraction are causes for Africa’s poor economic performance (Acemoglu and Robinson, 2010).

In addition, inappropriate macroeconomic policies especially monetary policies also contributed to the poor economic performance of Sub-Saharan African countries (Ghura and Hadjimichael, 1996). In 2008, about half of the countries in Sub-Saharan Africa anchor monetary policy on an exchange rate peg, which means that monetary policy is left to the dictates of exchange rate policy and cannot be employed independently to target other variables like domestic output or inflation (Kasekende and Brownbridge, 2011).
In the 1980s, monetary policy was used mostly to finance huge fiscal deficits in the region (Nguyen et al, 2015). From the mid-1980s to the late 1990s many countries in the region began reform programmes, mostly with exchange rate reallignment and a shift to market-determined exchange rates, rapid decreases in central bank financing of fiscal deficits and financial sector liberalization (Nguyen et al, 2015). As a result, inflation and economic instability in the region have been steadily reduced. In 1984, average inflation was about 11.12 percent and peaked to 28.81 percent subsequently in 1994. Average inflation has remained relatively low since then, recording a decade low of 4.2 percent in 2004 (Obeng – Adu, 2013). It however increased to 10.55 percent in 2008. The increase in inflation across the region for this period was as a result of various factors. For example, domestic food prices went up sharply in countries like Guinea, Kenya, Madagascar and Sierra Leone. Other factors such as political crisis and foreign exchange shortages drove inflation in Cote d'Ivoire and Guinea respectively (IMF, 2011). Average inflation in the Sub-Saharan Africa region has since declined to an average of 6.3 percent in 2013 from about 9 percent in 2011–12 (IMF, 2015).

3.3. Overview of exchange rate policies and regimes in sub-Saharan Africa

There are generally three types of exchange rate regimes according to the March 2008 Finance and Development quarterly magazine of the International Monetary Fund (IMF). The first is the hard exchange rate pegs also known as fixed exchange rate regime. These involve either the legally authorized use of another country's currency (also known as full dollarization) or a legal mandate that requires the central bank to keep foreign assets at least equal to local currency in circulation and bank reserves (also known as a currency board) (IMF 2008). Hard pegs mostly go hand in hand with sound fiscal and structural policies coupled with low inflation rates. Conversely, the central banks do not have independent monetary policy in countries with fixed exchange rate regimes. This is because the central bank has no exchange rate to change and its interest rates are also tied to those of the anchor-currency’s country.
The second type is soft exchange rate peg regimes. In this regimes, currencies maintain a stable value against an anchor currency or a composite of currencies. The exchange rate can be pegged to the anchor within a range narrow of +1 and –1 percent. Though soft pegs keep a firm "nominal anchor" to calm down inflation expectations, they allow for low flexibility in monetary policy to deal with shocks (IMF 2008).

The final type is the floating exchange rate regimes. As its name suggests, the exchange rate is determined by the market mechanism where the forces of demand and supply jointly determines the exchange rate. In this regime, when there are shocks either internal or external (or both), the central bank gets involve by using its policy tools to limit the possible short-term instabilities in the exchange rate. However, in some countries the central banks almost never get involved to manage the exchange rates. Nations that use the flexible regime have the benefit of keeping an autonomous monetary policy.

The primary aim of the exchange rate regime is “to establish an exchange rate consistent with a sustainable current account balance and with the promotion of exports needed for continued growth” (Duesenberry, et al, 2001, p.1). Hence choice of a suitable exchange rate regime for sub - Sahara Africa has been a debate in international finance for many decades. The tremendous rise in the variability and the magnitude of international capital flows into the region has intensified the debate in the past decade (Ernst and Young, 2014). However, there are areas where some agreement has emerged. The exchange rate regime that would possibly suit the economic interest of a country would be determined by factors such as country specific circumstances (such as the level of financial development, the size and the level of openness to trade and financial flows, production structure and export composition, its inflationary history and the nature of shocks to the country’s economy and the source of these shocks); the preferences of policymakers for the trade-offs among the core policy goals; political circumstances; and the integrity of its policy makers, institutions and structures (Yagci, 2001).
Exchange rate policy was static since independence up to the 1980s for most Sub-Saharan Africa countries (Aron and Elabadawi, 1994). Countries of the region were at first following the policies resulting from their colonial experience. The CFA zone countries maintained their membership in the West and Central African monetary unions and consequently maintained fixed parity with the French franc (Duesenberry et al., 2001). The currency boards established by the colonial regimes continued to operate in the other Sub-Saharan African countries for a time before many of them were replaced by central banks in the 1960s (Duesenberry et al., 2001).

Also, in the 1970s and early 1980s, many countries in Sub-Saharan Africa implemented fixed exchange rate regimes where exchange rates were fixed to a major trading currency. This is because, at the time most Sub-Saharan African countries adopted import substitution as a development strategy which advocated replacing foreign imports with domestic production. Import tariffs were used to protect domestic businesses from foreign competitors. In addition, agricultural exports were heavily taxed in these periods. Many of these countries saw the implementation of a fixed exchange rate regime and usually adjusted their exchange rates in response to adverse changes in relative competitiveness to ensure that the chosen development strategy succeed (Klaau, 1998).

The fixed exchange rate regimes of this period seemed sustainable, given consistent macroeconomic policy and a relatively favourable external environment. However, by the second half of the 1970s, these economies begun experiencing challenges. This was occasioned by excessive public expenditure due to the positive shocks in oil and commodities markets. Persistent unfavourable terms of trade shocks further weakened foreign exchange reserves positions in many sub-Saharan African countries, bringing their exchange rate regimes and overvalued currencies under pressure (Aron and Elabadawi, 1994).

The overvalued exchange rates in most cases were defended by the rationing of foreign exchange, and more harsh capital and import controls leading to the emergence of illegal,
parallel markets in foreign exchange (Aron and Elabadawi, 1994). Beside the official exchange rate, the black market offers foreign currency at another, usually much higher rate. Most sub – Sahara African countries apart from the CFA zone countries, which combine a peg to the French franc with full currency convertibility, had closed trade and capital accounts, and therefore provided incentives for the emergence of parallel markets in foreign exchange regimes (Rouis et al, 1994). Also, the dominance of black markets in SSA have been attributed to inconsistent policies and failure to adjust to adverse macroeconomic shocks and current account deficits (Kiguel and O’Connell, 1992). At least up until the mid-1980s black markets were common in SSA. The parallel markets in SSA countries have tended to be big and flourishing markets, with considerable spreads (premia) between the official and black rates relative to other developing regions of the world (particularly Latin America) (Kiguel and O’Connell, 1992).

Most of the SSA countries were growing and with few exceptions until they failed their management abilities tested in the 1970s during the period of the economic crisis. Most countries outside the CFA zone experienced, capital flight, high inflation rates, large public sector debts, adverse terms of trade and serious droughts (Duesenberry et al, 2001). These challenges were worsened by the refusal of governments to make the required adjustments in fiscal and monetary policy to have the problems solved. Their efforts to sustain unrealistic exchange rates by using exchange controls resulted in capital flight and lowered productivity through distorting prices.

The economic crisis of the mid-1970s and the debt crisis of the early 1980s forced many Sub – Sahara African countries to undertake reform programmes. Most of them as a major policy decision started the unification of exchange rates so as to integrate the parallel market into the official economy (Aron and Elabadawi, 1994). In the presence of large parallel markets, the fundamental aims of stabilizing the macro economy and achieving real depreciation of the
exchange rates became similar to the aims of making sure that the parallel market is integrated into the official economy and unify the exchange rates (Rouis et al, 1994).

To ensure a sustainable unification of multiple markets, flexible exchange rate arrangements characterized most IMF and World Bank supported programmes since 1983 (Quirck et al, 1987). As part of broader reform programmes, virtually all countries outside the CFA zone moved away from fixed exchange rate regimes towards flexible exchange rate regimes (Rouis et al, 1994). As a result, they have succeeded in reducing the spread between official and parallel exchange rates (Gordon, 1994). By the end of the 1990s, most countries in the region ensured that exchange rates were determined by the market with few international controls. Even so, parallel market premiums continued in many countries (Duesenberry et al, 2001).

However, until 1994, the CFA zone countries maintained parity between the CFA franc and the French franc. The CFA zone countries had relatively good inflation records. Nevertheless, due to changes in terms of trade and exchange rate depreciation elsewhere, the CFA franc became extremely overvalued (Gordon, 1994). Despite generous French aid and the accumulation of large external debt, it was essential to adopt protectionist measures and to sustain restrictive fiscal and credit policies that caused the economies of the CFA zone countries to stagnate (Gordon, 1994). In 1994, the CFA franc was devalued by a doubling of the exchange rate relative to the French franc. The pattern of changes in exchange rate arrangements for the sub-Saharan African countries as a whole for a period of nearly two decades from 1976 – 1991 is shown in Table 3.1 Excluding the countries in the CFA zone, which continued to have a currency union arrangement pegging to the French franc during the period, the table shows single currency peg regimes failed by almost 66 percent between 1976 and 1992. Also, the proportion of countries in Sub-Saharan Africa pegging to a single currency reduced from 78 percent in 1976 to 46 percent in 1992. In addition, pegs specifically to the US dollar reduced from 25 to 11 percent within the same period. Countries which peg their currencies to a composite basket of currencies such as the special drawing rights (SDR)
increased from 20 percent to 24 percent between 1976 and 1992. This is as a result of the instabilities in the exchange rates of major currencies.

Table 3.1: The Evolution Exchange Rate Arrangements in Sub-Saharan African:
1976-91 (% countries).

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<thead>
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<tr>
<td><strong>One currency pegs</strong></td>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>United State Dollar</td>
<td>25.00</td>
<td>19.50</td>
<td>14.00</td>
<td>12.80</td>
<td>10.90</td>
</tr>
<tr>
<td>French Franc</td>
<td>36.00</td>
<td>34.20</td>
<td>30.20</td>
<td>35.90</td>
<td>30.40</td>
</tr>
<tr>
<td>Others</td>
<td>16.70</td>
<td>9.70</td>
<td>9.30</td>
<td>2.50</td>
<td>4.30</td>
</tr>
<tr>
<td><strong>Composite currencies pegs</strong></td>
<td>19.50</td>
<td>31.70</td>
<td>37.20</td>
<td>30.80</td>
<td>23.90</td>
</tr>
<tr>
<td><strong>Restricted flexibility</strong></td>
<td>2.80</td>
<td>0.00</td>
<td>2.30</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td><strong>More flexible Arrangements</strong></td>
<td>0.00</td>
<td>4.90</td>
<td>6.90</td>
<td>17.90</td>
<td>30.40</td>
</tr>
<tr>
<td>Adjusted according to a set of indicators</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>25.00</td>
<td>6.50</td>
</tr>
<tr>
<td>Other managed floating</td>
<td>0.00</td>
<td>4.90</td>
<td>6.90</td>
<td>7.70</td>
<td>10.90</td>
</tr>
<tr>
<td>Independently floating</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>7.70</td>
<td>13.00</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>100.00</td>
<td>100.00</td>
<td>100.00</td>
<td>100.00</td>
<td>100.00</td>
</tr>
</tbody>
</table>

SOURCE: IMF, Exchange Arrangements and Exchange Restrictions (various issues) as produced in Rouis et al. (1994).

In conclusion, several Sub-Saharan African countries, embarked on major reforms to liberalize their exchange rate regimes during the 1980s and early 1990s. Generally, Sub-Saharan African countries have practiced several exchange rate regimes. These include; exchange rates fixed over the longer term (CFA franc countries), exchange rates fixed over the shorter term but adjusted regularly (many non-CFA countries prior to structural adjustment), and flexible exchange rates (many non-CFA countries after structural adjustment) (CEPA, 2009). By 1992 some form of flexible exchange rate arrangement was introduced in nearly a third of SSA countries, increasing from a negligible 3 percent in 1976 (Rouis et al., 1994)
3.4 Financial system of sub – Sahara Africa

One cannot ignore the financial system and its development in sub- Sahara Africa when discussing exchange rates in the region especially when most investors hold their investments in foreign currencies. In addition, the level of financial depth has implications for exchange rate volatilities (Nguena and Abimbola, 2014). Financial system is a concept with many aspects which includes the synagoy of many markets, instruments and participants. Its market component includes, primary market, the retail market and the secondary market. There are loans, foreign exchange, deposits, bonds and debt securities in terms of instruments and the participants include, contractual savings institutions, banks and companies. At independence, most sub-Saharan African countries had comparatively simple financial systems for financing of foreign trade. Financing of other domestic activities was limited, and there was little or no need for monetary policy expertise, because of the prevalence of rules-based fixed exchange rate regimes (Gelbard and Leite, 1999). Financial systems in most of the sub – Sahara African countries show heterogeneity in terms of the depth and sophistication of their financial markets. Table 3.2 shows the characteristics of the financial systems of selected sub – Sahara African countries between 2008 and 2010.

Generally, the financial sector in sub – Sahara Africa is underdeveloped on various fronts of financial development such as depth and efficiency (Cihak et al., 2012). Financial depth and development in sub-Saharan Africa in the post – independence era often suffered because of inappropriate policies such as excessive government intervention to ensure faster economic growth. In many countries, national banks were created and the
Table 3.2: Characteristics of Financial System in Selected Sub Sahara African Countries: 2008-2010

<table>
<thead>
<tr>
<th>Country</th>
<th>Private Credit (% of GDP)</th>
<th>Accounts per 1000 people</th>
<th>Interest rate spread (%)</th>
<th>Commercial bank’s weighted average z-score</th>
<th>Stock market turnover ratio (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethiopia</td>
<td>17.20</td>
<td>91.70</td>
<td>3.30</td>
<td>10.30</td>
<td>3.50</td>
</tr>
<tr>
<td>Ghana</td>
<td>14.00</td>
<td>298.80</td>
<td>5.00</td>
<td>15.40</td>
<td>5.90</td>
</tr>
<tr>
<td>Kenya</td>
<td>29.00</td>
<td>328.40</td>
<td>9.10</td>
<td>19.20</td>
<td>13.90</td>
</tr>
<tr>
<td>Malawi</td>
<td>11.70</td>
<td>102.40</td>
<td>21.50</td>
<td>18.90</td>
<td>2.10</td>
</tr>
<tr>
<td>Mauritius</td>
<td>80.80</td>
<td>823.40</td>
<td>11.00</td>
<td>23.50</td>
<td>10.10</td>
</tr>
<tr>
<td>Namibia</td>
<td>44.50</td>
<td>635.30</td>
<td>5.00</td>
<td>41.10</td>
<td>3.40</td>
</tr>
<tr>
<td>Nigeria</td>
<td>31.10</td>
<td>245.60</td>
<td>6.50</td>
<td>13.30</td>
<td>24.30</td>
</tr>
<tr>
<td>South Africa</td>
<td>75.80</td>
<td>882.90</td>
<td>3.40</td>
<td>27.10</td>
<td>69.90</td>
</tr>
<tr>
<td>Tanzania</td>
<td>14.40</td>
<td>126.60</td>
<td>17.30</td>
<td>19.90</td>
<td>6.70</td>
</tr>
<tr>
<td>Uganda</td>
<td>12.30</td>
<td>169.50</td>
<td>11.20</td>
<td>10.60</td>
<td>0.50</td>
</tr>
<tr>
<td>Zambia</td>
<td>11.80</td>
<td>153.70</td>
<td>13.70</td>
<td>7.60</td>
<td>14.80</td>
</tr>
</tbody>
</table>


banking system nationalized with the provision of credit seen as a powerful policy tool for economic development (Gelbard and Leite, 1999). This resulted in unsatisfactory services, high proportion of nonperforming loans, high interest rate spreads (measure of efficiency) and misallocation of resources. Figure 3.2 shows trends interest rate spread in sub – Sahara Africa.

In the mid-1980s, many countries in the region embarked on reform programmes that included liberalization of interest rates, elimination of credit controls, restructuring and privatization of state-owned commercial banks, adoption of indirect instruments of monetary policy, and developing financial markets (Gelbard and Leite, 1999). These reforms create favorable grounds for investment leading to more foreign bank entry and purchase of foreign assets by domestic financial firms (Moyo et al., 2014).
Figure 3.2 shows the trends interest rate spread in sub-Saharan Africa.

**Source**: Author based on data from world development indicators

### 3.5. Trade performance in Sub – Sahara Africa

Sub-Saharan Africa’s trade recorded fast growth during the last two decades with more than 500 percent increase in export volumes over the period of 1995 – 2013 while global trade expanded by 260 percent over the same period (IMF, 2015). Also export-to-GDP ratio of the region increased from 20.5 percent in 1995 to 27.5 percent in 2013, whereas the import-to-GDP ratio increased from 19 percent to 23 percent (IMF, 2015). In addition, sub-Saharan Africa countries increase their global exports from $94 to $424 billion, with a slightly positive balance of trade between 2000 and 2013 (Schmieg, 2015). This shows that over the years, sub – Sahara Africa countries have increase their trade openness. The trends of Sub-Saharan Africa’s openness to trade from 1984 -2013 are shown in figure 3.3. Trade openness is measured as the sum of exports and imports ad as a percentage of GDP. The past decade has seen a major structural change in the destinations of Africa’s exports.
Emerging markets, for example China, have formed a new partnership with sub-Saharan Africa countries for the purposes of trade. China is now the single most important trading partner of the region. Asia took the largest single share (34 percent) in 2013, after surpassing the European Union as largest trading partner in 2009 (Schmieg, 2015). Regional trade within sub-Saharan Africa accounts for only 16 percent, however, trade patterns are very heterogeneous across the region. It is argued that even though sub-Saharan Africa’s place in world trade is small, it managed to keep this place because the region was able to redirect trade toward these new trade partners, especially China, a place that nonetheless remains small in the global scene.

3.6. Investment flows to Sub-Saharan Africa

This section reviews trends of portfolio equity and foreign direct investment flows into sub-Saharan Africa. According to the World Bank, portfolio equity net inflows includes the elements of net inflows of equity securities except those documented as direct investment. It comprises of stocks, depository receipts and direct acquisition of shares by foreign investors on local stock markets. Sub-Saharan African countries have experience considerably
improvement in the inflow of portfolio equities over the last decade. This suggests the gradual integration into the global financial system of the sub-region. This is due to several factors that have made sub – Sahara Africa attractive to investors. These include; (1) many sub – Sahara Africa countries undertook economic reform programmes resulting in reduced deficits, lower inflation rates, hence an enhanced business climate and strengthening of their economic performance (Brambila-Macias and Massa, 2010). (2), sub – Sahara Africa became relatively stable politically and a number of countries embarked on democratic transitions (Alfaro et al, 2004). (3), the natural resources endowment of some countries also attracted investors. In addition, external factors such as debt relief and the commodities boom added to the attractiveness of SSA.

Portfolio equity inflows are now important source of finance in many sub – Sahara African countries. Figure 3.4 shows trends of portfolio equity inflows and foreign direct investment (FDI) in sub – Sahara Africa. Portfolio equity flows have increased in the last decade; it was around 0.30 percent of GDP in 1993 and rose to almost 2.77 percent of GDP in 1999. It declined drastically in 2000 through to 2002 but begun to increase in the last quarter of 2002 and reached about US$ 17 billion (about 2.21 percent of GDP) in 2006 of which most (about 89%) went to South Africa in 2006. In 2007, however, portfolio equity inflows experienced a major fall of 40% due to the global financial crisis, and reversed in the latter part of 2008 through mid – 2010 (Hou et al, 2013).

Foreign Direct Investment (FDI), according to United Nations Conference on Trade and Development (UNCTAD) implies that the investor exercises a substantial degree of control on the management of enterprise resident in another economy. FDI is very important for both developed and developing countries across the world because it comes with advantages such
us economic growth and development especially in capital scarce countries, marketing expertise and financial resources to augment the domestic savings effort, managerial skills and results in increased employment. Aside from these, FDI facilitates exports to markets therefore strengthening the export capabilities of the domestic economy (Otieno et al 2013). FDI also provides the much needed foreign exchange to help bridge the balance of payments or trade deficit gap.

Africa continues to attract considerable FDI inflows and the latest figures indicate that the continent is the world’s second most attractive region for FDI. In 2014, only North America ranked ahead of Africa in terms of investment attractiveness (Ernst and Young, 2014). By the late 1990s, FDI rose to become the largest source of external capital for sub – Sahara Africa and other developing countries (World Investment Report 2000). Net FDI flows to the region rose from US$38.2 billion in 2005 to the highest level of US$72.2 billion in 2008 before falling to US$ 47.6 billion in 2010 but rose to US$ 57 billion in 2013, driven by
international and regional market-seeking investments as well as infrastructure investments, according to UNCTAD’s World Investment Report 2014.

3.7 Conclusion

In this chapter we discussed the performance and the nature of the economies in the region. In doing so, we divided the economic history of Sub-Saharan Africa into four sub-periods (1960 – 1980, 1980 – 2000, 2000 – 2007 and 2008 – present) as suggested by Olamosu and Wynne (2015). Aside from this, the chapter discussed the background to exchange rate policies and regimes in Sub-Saharan Africa. Finally, we discussed trends of some selected development indicators within the region that are relevant to the study. These include trade performance and the financial system of the region.
4.1 Introduction

This chapter of the study discusses the methodology, including the estimation technique, the statistical programme and data used to study the effect of real exchange rate depreciation on output in the Sub-Saharan African region. The chapter first discusses the theoretical framework used in the analysis the effect real exchange rate depreciation and output. This is followed by a description of the empirical model. In addition, we explain the variables used in the analysis. The chapter concludes with diagnostic tests that are perform to ensure that the model specification and the results of the study are reliable.

4.2 Theoretical framework

A review of literature reveals that various methods of estimation have been used in analyzing the effect of real exchange rate devaluation or depreciation on output. Some authors have used the fixed-effects estimation technique (Mustafa, 2000; Upadhyaya et al, 2013), theoretical rational expectation model (Kandil, 2004), Vector Auto Regression (VAR) (Melander, 2009; Ayen, 2014; Berument and Pasaogullari, 2003), the generalized method of moment (GMM) technique (Eme and Johnson, 2010), a two-step Engle and Granger (1987) error-correction model (Galebotswe and Andrias, 2011), smooth transition regression (STR) model (Miteza, 2006) and auto-regressive distributive lag model (ARDL) (Nawaz, 2012).

However, literature suggests that the choice of method of estimation used in a study depends on the variables and the objective of the study. Nevertheless it is very important to use a good theoretical framework to explicitly understand the fundamental mechanism by which the variables of interest affects any particular outcome (Khondker et al., 2012). The framework by Rhodd (1993), based on a simple three-market (goods market, money market and the
foreign exchange market) Keynesian model is used by this study to derive a reduced form equation for the empirical estimation. Rhodd (1993) represented the goods market by:

\[ Y = C + I + G + X - M \]  

(1)

where: \( Y \) represent output, \( C \) represents spending on the consumption of the household sector, \( I \) represents spending on the private sector investment, \( G \) represents spending on the public sector consumption, \( X \) represents the exports of goods and services, \( M \) represents the imports of goods and services. Using the savings – investment framework, savings equals investment in equilibrium.

\[ S = I \]  

(2)

But investment is the sum of domestic investment \( (I_d) \) and foreign investment or net export \((I_f)\)

\[ S = I_d + I_f \]  

(3)

Saving \( (S) \) is a positive function of output \( (Y) \) and domestic interest rate \( (r) \)

\[ S = s(Y, r); \frac{\partial S}{\partial Y} > 0; \frac{\partial I_f}{\partial r} > 0 \]  

(4)

Domestic investment \( (I_d) \), is a positive function of output and a negative function of domestic interest rate.

\[ I_d = I_d(Y, r); \frac{\partial I_d}{\partial Y} > 0; \frac{\partial I_d}{\partial r} < 0 \]  

(5)

Foreign investment or net export \( (I_f) \), define as the net build-up of claims against the rest of the world or \((X-M)\) (Khondker et al., 2012) is a negative function of output and a positive function of the exchange rate \( (e) \)

\[ I_f = I_f(Y, e); \frac{\partial I_f}{\partial Y} < 0; \frac{\partial I_f}{\partial e} > 0 \]  

(6)

Now, in the money market, the money demand and money supply must be equal for
equilibrium to be achieved. Money supply depends on monetary policy stance, whereas the money demand is dependent on income and interest rate.

\[ M_s = M_d \]  

\[ Md = L(Y, r), \quad \frac{\partial Y}{\partial e} > 0; \quad \frac{\partial Md}{\partial r} < 0 \]  

The third market in the model is the foreign exchange market. Activities in this market is greatly influenced by the balance of payments position of a country. The balance of payments is determined among others by trade flows and financial flows. The former are determined by output or income (Y) while the latter by the interest rate (r). According to Rhodd (1993), rising income worsens the trade balance. Therefore the relationship between the trade balance and income (output) is negative. Even though capital flows can improve the trade balance in the short-run, the long run outcome is unknown because of loan repayment and repatriation of dividends and interest (Khondker et al., 2012).

The equilibrium in the three markets can be written in linear forms as follows:

\[ S_0 + S_1 Y + S_2 r - I_{d_1} - I_{d_2} Y - I_{d_1} r - I_{f_1} Y - I_{f_2} e = 0 \] 

\[ L_0 + L_1 Y + L_2 r = M_s \] 

\[ T_0 + T_1 Y + T_2 e + F_0 + F_1 Y + F_2 r - B = 0 \]

Equations (9) – (11) can be presented in matrix form as:

\[
\begin{pmatrix}
S1 - I_d1 - I_f1 & S2 - I_f2 & 0 \\
L_1 & L_2 & 0 \\
T_1 + F_1 & F_2 & -1
\end{pmatrix}
\begin{pmatrix}
Y \\
r \\
B
\end{pmatrix}
= \begin{pmatrix}
-S0 + Id0 + If0 + If2 e \\
M_s - L0 \\
T0 - T2e - F0
\end{pmatrix}
\]

Solving for Y from equation (12) using the Cramer’s rule

\[
Y = \frac{(L_2 S_0 - L_2 Id - L_2 If - L_2 If 2 e - Mss_2 + If 2 Ms) - (S_2 L_0 + If 2 Ms)}{(S1 - Id1 - If1)(L2)(-1) - (-1)(L2)(S2 - If 2)}
\]

Equation (13) shows that output (Y) is depends on the activities in all the three markets (the
goods market, the money market and the foreign exchange market).

Note: let $D = (S1 - Id1 - If1)(L2)(-1) - (-1)(L2)(S2 - If2) > 0$

$$\frac{\partial Y}{\partial e} = - L2 I f 2 / D > 0$$

(L2 < 0, I f 2 > 0, D > 0)

The econometric estimation method adopted in the current study is the Generalized Methods of Moment (GMM) dynamic panel technique. This technique avoids some assumptions such as specifying a particular distribution for the errors. Unlike maximum likelihood estimation (MLE), GMM estimation can be done without full information of the distribution of the data. GMM estimation required only specified moments obtained from an underlying model. In cases where the distribution of the data is known, MLE can be computationally very onerous whereas GMM can be computationally very easy (Hall, 2005).

The GMM technique was first presented by Arellano and Bond (1991). It was based on the analysis of Hausman and Taylor in 1981 and Bhargava and Sargan in 1983. Arellano and Bond (1991) stated that “the fundamental identification condition for this model is the strict exogeneity of some of the explanatory variables (or the availability of strictly exogenous instrumental variables) condition on the unobservable individual effects”. The difficulty in looking for strictly exogenous variables that are realistically considered a priori as being uncorrelated with the individual effects limit the application of the Hausman and Taylor model (Obeng – Adu, 2013). Hence the Hausman and Taylor version of the GMM have seen some amount of transformation. Arellano and Bover (1995) further advance the GMM model by stating valid instruments for the models in levels, adding to those existing for models in first differences or deviations from individual means.

Blundell and Bond (1998) imposed additional restrictions on the existing condition to make the usual first-differenced GMM estimator more accurate. This they believe will make it possible for the complete usage of every moment condition present in a system of first-
differenced and levels equations by the linear GMM estimator. The method by Arellano and Bover (1995) and Blundell and Bond (1998) is called the “System-GMM”. Their method assume that the first differences of the instrumental variables are uncorrelated with the fixed effects and so the addition of more instruments in the instruments matrix increases efficiency.

The ordinary least squares technique fundamentally assumes that the regressors are exogenous, $E [\varepsilon_{tx}] = 0$ (Greene, 2012). This means that, the error term and the regressors should not be correlated. For certain statistical and economic causes, this assumption may inappropriate at times. For example, it would be inappropriate to use this assumption where there is a lagged regressand in the model and autocorrelation in the error term. In addition, wrong measurements and endogeneity of the regressors can also make it difficult for this assumption to be applicable (Verbeek, 2004). Because of these reasons, one can argue that the OLS estimator is biased or inconsistent. Hence it is necessary to think through an alternative estimator than can overcome these difficulties.

The GMM dynamic panel model is very useful because it aim at solving almost all the difficulties identified above and more particularly, especially when you are analyzing a panel data set, hence its adoption by this study. According to Edison et al. (2002), the reason for the adoption of the GMM dynamic panel estimation technique is as a result of the following advantages it has over the other estimation methods: (i) GMM controls for endogeneity of the weakly exogenous variables that may be as a result of potential reverse causality or simultaneity in the model; (ii) it controls for country-fixed effects which is mostly captured in the error term of other estimation techniques; (iii) the GMM uses both the time-series and cross-sectional aspects of the data set which rises the degree of freedom; (iv) the use of panel data rises the sample size which leads to a fall in estimation biases and enhances the robustness of the model. The distinctive element of the GMM estimators is that, it uses both internal instruments; the lags of the endogenous variables and classical instrumental variables. To facilitate our data analysis process, I employed Stata 13.0 statistical package.
4.3 Empirical Model

The empirical specification used for this study follows closely the analytical framework discussed in the previous section. In line with the appropriate empirical literature, this study uses a regression model which is diverse in nature. The existence of several theories and mechanisms through which devaluation affects output justify the choice of this framework (Kamin and Klau, 1998). Monetary and fiscal variables, especially the level of government spending and the growth rate of money supply, affect economic activity in many countries across the world including those in sub-Saharan Africa (Edwards 1986; Khan and Knight 1981). As a result, money supply and government expenditure are included as monetary and fiscal policy variables that explain changes in aggregate output levels.

Following Edwards (1986), Kamin and Klau (1998) and Upadhyaya and Upadhyay (1999) two methods are adopted to study the effect on output of changes in the exchange rate. The first approach examines how changes in the real exchange rate affect output. This is consistent with the notion that changes in the nominal exchange rate affects output levels only if it changes the real exchange rate (Upadhyaya et al, 2013). This method takes into consideration the effect of changes in the real exchange rates only and neglects the effects of the changes in the nominal exchange rates and foreign-to-domestic price ratios which resulted in the movement in the real exchange rate (Upadhyaya et al, 2013). Note that if the proportionate change in the price level is the same as the proportionate change in the nominal exchange rate, the real exchange rate will not change and therefore does not affect output level.

Hence, this approach pays no attention to any possible asymmetric effect on output levels of the initial change in the nominal exchange rate and the effect of a gradual increase in the price level. To capture these effects, we include the nominal exchange rate and the relative price in a second model. This will allow to find out whether or not any effect of output came separately from the relative price ratio or the nominal exchange rate. Consequently the following semi
log empirical models were formulated. Equation (15) captures the former scenario while equation (16) represents the latter scenario.

\[
\log Y_{it} = \beta_0 + \beta_1 \log Y_{it-1} + \beta_2 G_{it} + \beta_3 BM_{it} + \beta_4 RER_{it} + \beta_5 RER_{it-1} + \beta_6 RER_{it-2} \\
+ \beta_7 \log Nres_{it} + \beta_8 Openness + \beta_9 TOT_{it} + \alpha + \pi_1 \ldots (15)
\]

\[
\log Y_{it} = u_0 + u_1 \log Y_{it-1} + u_2 G_{it} + u_3 BM_{it} + u_4 \log E_{it} + u_5 \log E_{it-1} + u_6 \log E_{it-2} \\
+ u_7 \log RPR_{it} + u_8 \log RPR_{it-1} + u_9 \log RPR_{it-2} + u_{10} Nres_{it} + u_{11} Openness_{it} \\
+ u_{12} TOT_{it} + \alpha + \pi_2 \ldots (16)
\]

where

Y = real output

G = fiscal policy (government expenditure)

BM = monetary policy (broad money)

RER = real exchange rate

E = nominal exchange rate

Nres = Natural resources extraction

Openness = Trade openness

ToT = terms of trade

RPR = relative price ratio

\( \alpha \) = parameter that captures country specific effects

\( \pi \) = error term

Output can be affected by movements in both the nominal and the real exchange rates in the present period and with a lag (Edwards, 1986). In addition to this view, Upadhyaya et al. (2013) state that devaluations can have varied effects at different times. For instance, Edwards
(1986) finds that the contemporaneous effect of currency depreciations is negative but positive and neutral in the medium and long runs respectively. Therefore the above models include the lagged values of real exchange rate, the nominal exchange rate, and the relative price ratios to capture their medium and long runs effects on output.

To eliminate the country specific effects (α), equations (15) and (16) have been transformed by taking the first difference to obtain:

\[ Δ\log Y_{it} = β_0 + β_1 Δ\log Y_{it-1} + β_2 ΔG_{it} + β_3 ΔBM_{it} + β_4 Δ\log RER_{it} + β_5 Δ\log RER_{it-1} + β_6 Δ\log RER_{it-2} + β_7 ΔNres_{it} + β_8 Δ\text{Openness}_{it} + β_9 Δ\text{TOT}_{it} + \pi_1 \] 

\[ Δ\log Y_{it} = u_0 + u_1 Δ\log Y_{it-1} + u_2 ΔG_{it} + u_3 ΔBM_{it} + u_4 Δ\log E_{it} + u_5 Δ\log E_{it-1} + u_6 Δ\log E_{it-2} + u_7 Δ\log RPR_{it} + u_8 Δ\log RPR_{it-1} + u_9 Δ\log RPR_{it-2} + u_{10} Δ\text{Nres}_{it} + u_{11} Δ\text{Openness}_{it} + u_{12} Δ\text{TOT}_{it} + \pi_2 \] 

The estimations are based on panel data from 35 sub-Saharan African countries from 1984 to 2013. All the variable are derived from World Development Indicators. These 35 countries were selected for this study based on availability of data.

Even though devaluation can be expansionary through the substitution effect, it can also reduce real income especially in the short term. This is because, exchange rate devaluations move income from wage recipients who have a high propensity to consume to profit recipients who have a low propensity to consume. Since the losers from this movements exceed winners, it can be very costly near elections. According to Steinberg and Walter (2013) extensive evidence has shown that exchange rates are affected by the electoral cycle. This argument suggests that devaluations are politically costly.

Like tax, devaluation is costly to the politician because it is mostly seen as a sign of incompetence by the voters and for this reason, incumbent government postpone devaluation.
which can result in currency overvaluation before election (Ghezzi, 2000). According to Frieden et al. (2006), politicians may wish to manipulate the exchange rate for the purpose of winning elections. They stated that, exchange-rate based stabilization programmes are usually implemented when elections are pending and there is a lot of evidence that devaluations are often delayed until after an election to preserve the purchasing power of the electorates.

According to Stein and Streb (1999), governments mostly do not have motivations to manipulate exchange rates near elections. However when they do, they always postpone devaluations until after elections. Edwards (1993) studies the timing of 39 large devaluations (15% and above) in democratic regimes, finds that devaluations were carried out early on in the term in office. In addition, Sibley (1997) found strong evidence that major political events like elections and change in government affect the path of nominal and real exchange rates.

Political business cycles and nominal exchange rate policies are also relevant in sub- Sahara Africa. This is because of the importance of exchange rates in determining inflation and prices in typical African economies (Block et al., 2003). Results of studies on Sub – Sahara Africa regarding devaluation and election cycles are not different. For instance, similar to the results of Frieden et al. (2006) for Latin America, Block et al., (2003) found out that there is clear evidence that incumbent leaders in African defer devaluation policies until after elections. Edwards (1993) suggests that governments are incline to follow the classic rule of “devalue immediately and blame it on your predecessors.”

Aside from the effect of election cycles on exchange rates, business cycles also affect economic growth and output levels. Studies such as Duesenberry, 1958; Gali and Hammour, 1992; Döpke, 2004; Fatás, 2002; among others suggest that business cycle affects productivity and growth and variables related to long – term growth. Therefore, following the approach of Edison et al. (2002) we averaged the data over a 3-year (non- overlappging) interval to average out the political economy effect on the exchange rate especially during election years in most sub – Sahara African countries. This will also remove business-cycle effects. The 3-year non-

4.4. Definition and Measurement of Variables Used in the Regression Models

In above equations, aggregate output (Y) is measured by real GDP. The control variables used in the above equations include fiscal policy variable, monetary policy variable, the real and the nominal exchange rates, the relative price, openness, natural resources and the terms of trade. Their definitions and measurements are as follows:

*Government expenditure (G)* is the proxy for fiscal policy and is measured by government consumption expenditure as a percentage of GDP. The primary economic effect of any change in government expenditure is felt by particular groups. Discussions of fiscal policy generally focus on the effect of changes in government budget on the overall performance of the economy. According to Keynesian school of thought, expansionary policy will increase output in the economy because of an increase in aggregate demand. For instance, a fiscal expansion, increases aggregate demand by one of two channels. First, if the government keeps taxes constant but increases its purchases, it increases demand directly. Second, if the government increases transfer payments or cuts taxes, the disposable income of households will rise, and they will spend more on consumption leading to increase in aggregate demand. This in turn increases output.

Apart from increasing or changing aggregate demand, fiscal policy also changes the composition of aggregate demand. When the government runs a deficit, it borrows so that it can meet some of its expenses thereby competing with private borrowers. Holding other things constant, expansionary fiscal policy will raise interest rate and “crowd out” some private investment, which reduces the fraction of output composed of private investment (Weil, 2008). In an open economy, fiscal policy also affects the exchange rate and the trade balance. In the
case of a fiscal expansion, the increase in interest rates as a result of government borrowing attracts foreign capital. The accumulation of external debt that results from persistent government deficits can lead foreigners to distrust domestic assets and which can cause a depreciation of the domestic currency rate. We therefore expect a positive relationship between government expenditure and the level output.

*Broad Money (BM)* represent the monetary policy variable. It is measured as broad money as a percentage of gross domestic product (GDP) of the sample country. Monetary policy has significant effects on aggregate demand, and hence on both output and prices. There are a number of ways through which monetary policy actions get transmitted to the real economy (Ireland, 2005). One of the channels which is mostly focused on is the interest rate channel. Expansionary monetary policy, for example, decreases the cost of borrowing and consumers can borrow at a cheaper cost to purchase goods and services such as houses or cars which they would usually finance through personal savings and businesses are more likely to invest in new buildings, new equipment, software among others (Mathai, 2012). This increases the level of economic activity. Another channel through which changes in monetary policy affects output is the balance sheet channel. A decrease in interest rates also tends to increase the net worth of businesses and individuals which makes it easier for them to qualify for loans at any interest rate, thus rising spending resulting in increased demand and output. The third channel is the lending channel. A fall in the interest rates makes banks more profitable in general and thus making them willing to lend more. The loans advance to businesses and individuals are spent on new investments and the purchase of goods and services. This increases aggregate demand hence output. Finally, changes in monetary policy affects output through the exchange rate channel. Normally, lower interest rates results in the depreciation of the domestic currency as foreign investors seek higher returns elsewhere and decrease their demand for the currency (Mathai, 2012). Through the exchange rate channel, exports are
increased as they become cheaper and imports become expensive which results in high output. Hence monetary policy is expected to directly relate to output.

*Natural Resource Extraction (Nres):* This is measured as total natural resource revenues as a percentage of GDP for sample countries. Natural resources are an important source of national wealth around the world. As a matter of fact classical economic theory predict that abundant natural resources should be good for the growth of any economy (Kronenberg, 2004). This is partly because economic theory in the 19th and early 20th century often considered land as a key factor of production, and land is a natural resource. Now, due to innovation and research, the productivity of natural resources have increased. For resource-rich developing countries, resource fortunes provides important prospects to stimulate economic development and expand output levels and raise living standards of the citizens (Gupta et al., 2015). This is because proper use of these resource will create employment for people engage in its extraction and processing. This increases economic activity and expand output. For this reasons natural resource extraction is expected to have a positive relationship with output.

*Trade Openness (openness):* The Organization for Economic Cooperation and Development (OECD) defines trade openness as the summation of total exports and total imports of a country as a percentage of its GDP. This is the measure used in this study. Growth theory suggests that “a country’s openness to world trade improves domestic technology, and hence an open economy grows faster than a closed economy through its impact on technological enhancement” (Harrison, 1996). He further emphasized that openness to trade makes it easy to access imported inputs, which compresses of new technology. The importation of inputs and essential goods and services facilitate production and promote economic growth. For instance, the import of medical supplies, capital equipment and expertise have the potential of helping a country to efficiently produce goods and services which ultimately enhances economic growth and the welfare of its citizens. However, too much importation without a corresponding rise in exports will result in a reduction of a country’s net foreign assets and
ultimately worsen its current account balance (Obeng – Adu, 2013). Trade openness also ensure that the size of the market faced by domestic producers increases. This in turn increases the return to innovation, and enables a country’s specialization in research intensive production.

Terms of trade (TOT): Terms of trade of a country is one of the mostly used as a control variable in studies of this nature. For example, Atkins (2000), Edwards (1986), Rhodd (1993), Upadhyaya and Upadhyay (1999) and Yiheyis (2006) among others include external terms of trade in their studies. It is measured as the percentage ratio of the export unit value indexes to the import unit value indexes, measured relative to the base year 2000. For a small open economy like most in sub – Sahara Africa, the terms of trade is exogenous and must be controlled for explicitly in the analysis. This is to prevent the indicator of external competitiveness (the real exchange rate) from capturing some of its unaccounted for effects (Khondker et al., 2012). Often, the terms of trade is considered to be the real exchange rate. But, for many countries, their terms of trade and real exchange rate move quite differently (Khondker et al., 2012). And so, the different effect of terms of trade cannot be captured by the real exchange rate. Hence the need to include it in my empirical model. The effect of a change in the terms of trade on output depends on the magnitude of price elasticities of exports and imports. The direction of the effect can be positive or negative.

The nominal official exchange rate \(E\) is measured as the price of the United States dollar in terms of the domestic currency; a rise in the nominal exchange rate represents nominal depreciation against the United States dollar. The real exchange rate \(RER\) is measured as the foreign to domestic price ratio \((P^*/P)\) multiplied by the nominal exchange rate. That is \(EP^*/P\), with an increase in RER representing a real depreciation. The domestic price level \(P\) is measured as the consumer price index where data is available for the period under study for a sample country, if not the GDP deflator was used. The foreign price level \(P^*\) is measured as world price index. The relative price ratio \(RPR\) is measured as \(P^*/P\).
4.5. Diagnostic Tests

The following diagnostic tests are carried out to ascertain the appropriateness of the variables and models used in the analysis which will in turn ensure that the estimated results are reliable.

The findings of the tests are reported in the next chapter

4.5.1. Pre-estimation Tests

4.5.1.1. Unit-root Test

The estimation of equations (1) and (2) with variables that are not stationary (example output), can produce spurious results. According to Granger and Newbold (1974), the normal t and F tests become bias and have the tendency to reject the hypothesis of no relationship between these variables even when there is none in the case of spurious results. The unit-root test is therefore important in order to avoid biases in the estimated relations and prevent spurious regressions (Greene, 2012). To ensure the stationarity of the panel data, we conducted the Augmented Dickey-Fuller (ADF) test for unit-root for every variable, both level and first difference. The unit-root test is carried out with the null hypothesis that all panels contain unit-roots. The Akaike Information Criterion (AIC) is used to select the optimum lags for the tests. As a robustness check, I also carried out the PPerron unit-root test to check the robustness of the results from the ADF test.

4.5.1.2. Hausman Specification Test

One of the reasons for using the GMM technique is the presence of time-invariant country characteristics (fixed effects). The econometric modeling of panel data usually applies two principle methods, fixed- and random-effects estimators. In the random effect model, the time – invariant, unobservable factors are treated as part of the error term thereby assuming that their correlation with the regressors is zero (Frondel and Vance, 2010). Given that this condition is satisfied, then the random-effects estimator is of greater efficiency than the fixed-
effects estimator. However, the violation of this assumption implies biased estimates. In the fixed-effects model on the other hand, the time-invariant, unobservable factors for each observation unit are either explicitly captured by dummy variables or eliminated via time-demeaning (Frondel and Vance, 2010). To choose the appropriate model between the two I used the Hausman specification test. The null hypothesis for the Hausman specification test states that, there is no correlation between regressors and individual effects. If the calculated P-value is greater than 0.05, we fail to reject the null hypothesis, that is we accept the null hypothesis. However, if the calculated p-value is less than 0.05, we reject the null hypothesis for the alternative hypothesis and conclude that there is correlation between regressors and individual effects.

4.5.1.3. Breusch and Pagan Lagrange Multiplier Test for Random Effects (LM Test)

The Breusch-Pagan Lagrange multiplier test is a conducted to ascertain the presence or otherwise of heteroskedasticity in the Random effects model. Since the property of homoskedasticity is one of the basic assumptions of the OLS estimator is the assumption of homoskedasticity which states that the variance of the error terms must be constant over the fitted values in the model. This assumption is crucial for the computation of appropriate standards errors and its corresponding t-tests. It is therefore important to test for homoskedasticity in the random effect estimator, which happens to be a transformed and more efficient OLS estimator. The Breusch-Pagan LM test follows a chi – squared distribution with degrees of freedom equal to the number of independent variables and conducted with the null hypothesis of homoskedasticity (Greene, 2012). We compare the estimated p-value with the conventional 0.05 significance level to decide whether to reject or accept the hull hypothesis. If the estimated p-value is greater than 0.05, we fail to reject the null hypothesis and conclude that, the error terms show the property of homoscedasticity or the pooled regression is more appropriate than the random effect model. The implication is that, the estimated standard
errors and their associated t-tests are appropriate. However, if the estimated p-value is less than 0.05, we reject the null hypothesis and conclude that, the error terms are heteroskedastic.

4.5.2. Post-estimation Tests

We followed literature by conducting two main diagnostic tests as part of the estimations to ensure that the GMM estimator are accurate. There are the Sargan test to examine and report the valid of the internal instruments employed in the system GMM technique and the Autocorrelation test to test for serial correlation of the error term.

4.5.2.1 Sargan Test

The Sargan test is a test used to check for over-identifying restrictions in a statistical model (Verbeek, 2004). The hypothesis which is being tested with the Sargan test is that the instrumental variables are not correlated with some set of residuals and so they are appropriate instruments. The calculated probability value (p-value) is compared to the conventional significance level of 0.05 to decide whether the null hypothesis should be rejected or accepted. If the calculated P-value is greater than 0.05, we fail to reject the null hypothesis, that is we accept the null hypothesis. However, if the calculated p-value is less than 0.05, we reject the null hypothesis for the alternative hypothesis. If the null hypothesis is accepted, the instruments are judged to have passed the test and are seen to be valid instruments by this criterion. The higher the p-value of the Sargan statistic the better, suggesting that the instruments as a group are exogenous.

4.5.2.2 Autocorrelation Test

The test for autocorrelation in the model as the error terms may be correlated is also conducted. The test is conducted for the differenced residuals with a null hypothesis of no autocorrelation. Usually, the autocorrelation test for the first order autoregressive process [AR (1)] rejects the null hypothesis. But this does not mean that the model specification is wrong. The autocorrelation test for the second order autoregressive process [AR (2)] in first difference
is of utmost importance, because it will detect autocorrelation at levels (Edison et al, 2002). In the case of the null hypothesis means that the model is wrongly specified. Like the decision rule for the Sargan test, if the calculated P-value is greater than 0.05, we fail to reject the null hypothesis, that is we accept the null hypothesis. However, if the calculated p-value is less than 0.05, we reject the null hypothesis for the alternative hypothesis. If the null hypothesis is accepted, it suggests no autocorrelation in the model. However, if we reject the null hypothesis, it suggests the presence of autocorrelation.

4.6. Conclusion

In summary, this chapter describes the theoretical framework which underpins the model adopted by this study to examine the effect of devaluation or depreciation on output. The model was developed based on a simple three-market (goods market, money market and the foreign exchange market) Keynesian model. This chapter also explained the estimation technique used to obtain our results (GMM) and why it is appropriate for this study. In addition, the chapter gives a brief description of the variables used in the estimation process (real output, broad money, government expenditure, the nominal exchange rate, real exchange rate, the relative price ratio, trade openness, natural resource and terms of trade) and the sources from which the data are drawn and described the various statistical tests to ensure that the results are accurate.
5.1 Introduction

This chapter focuses on the estimation of the empirical models and the analysis of the results to achieve the objectives of the study, which are: (1) to examine empirically whether real depreciation is expansionary or contractionary in Sub-Saharan Africa (2) to find out whether the effect of real depreciation on output change overtime, (3) to find out the effect on output of changes in the nominal exchange rate overtime and (4) to find out whether any change on output emanates from changes in the relative price ratio. The chapter analyzed two sets of results. The first one seeks to establish the effect of real exchange rate depreciation on output in Sub-Saharan Africa and also to find out if this relationship changes overtime (objectives one and two). The second model seeks to ascertain the independent effects on output of changes in the nominal exchange rate and changes in the relative price ratio (objectives three and four). The estimations of these models were done using the GMM dynamic panel technique. Finally, the necessary pre and post estimation test were conducted. The results of these tests except the stationarity test are presented in the appendix.

5.2 Descriptive Statistics

As mentioned already the estimations are based on panel data from 35 sub-Saharan African countries from 1984 to 2013 which is averaged over a 3-year fixed-length interval. Summary statistics of the panel dataset is presented in Table 5.1. The mean values are reported in column three of table 5.1. The mean is a measure of central tendency of the variables. It basically tells us the average value of the variables. It can be seen that openness has the largest mean while government expenditure has the smallest. The minimum and the maximum values are also reported in columns five and six respectively. The standard deviation measures dispersion from the mean. A small standard deviation implies that most of the observations for the
variable are very close to the mean. However a high one implies that the observations are spread out from the mean. This means that the higher the standard deviation the greater the

Table 5.1: Summary Statistics of Panel data of Sub-Saharan Africa

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>AlogRGDP</td>
<td>0.0652316</td>
<td>1.002236</td>
<td>-4.67927</td>
<td>13.55334</td>
</tr>
<tr>
<td>AGOVEXP</td>
<td>-0.0161787</td>
<td>5.134928</td>
<td>-23.8336</td>
<td>27.83061</td>
</tr>
<tr>
<td>ABM</td>
<td>0.3486552</td>
<td>7.862415</td>
<td>-50.6748</td>
<td>23.43603</td>
</tr>
<tr>
<td>ANRES</td>
<td>-0.0197429</td>
<td>8.087065</td>
<td>-56.7657</td>
<td>31.70479</td>
</tr>
<tr>
<td>AOPENNESS</td>
<td>0.7737228</td>
<td>20.89981</td>
<td>-103.505</td>
<td>124.9485</td>
</tr>
<tr>
<td>ATOT</td>
<td>0.215741</td>
<td>35.96163</td>
<td>-166.348</td>
<td>272.2982</td>
</tr>
<tr>
<td>AlogRER</td>
<td>0.0556343</td>
<td>3.297954</td>
<td>-31.07989</td>
<td>12.66277</td>
</tr>
<tr>
<td>AlogE</td>
<td>0.0574946</td>
<td>2.759251</td>
<td>-30.38398</td>
<td>10.526</td>
</tr>
<tr>
<td>AlogRPR</td>
<td>-0.3464894</td>
<td>1.330903</td>
<td>-6.052158</td>
<td>4.206407</td>
</tr>
</tbody>
</table>

Source: Author's calculation

fluctuations in the variable. This tells us that the nominal exchange rates in the region have been unstable within the period under study. This has serious implications for the price levels, interest rates and output.

5.3 Unit root test

To avoid obtaining spurious results, we test the stationarity of the data. Spurious results can lead to a situation where variables that are not related are inferred to be leading to wrong conclusions about the relationship between/among variables. So to ensure that the panel data is stationary, we carried out the Augmented Dickey-Fuller (ADF) unit-root test for every variable, both level and first difference. As a robust check on the Augmented Dickey-Fuller test results, we also conducted the Phillips – Perron (PP) unit root test. The results show that all the variables are stationary in level for the two tests except real output. However, the test
in first difference shows that all the variables are stationary for the two testing techniques.

The results are present in Table 5.2 below.

### Table 5.2: Panel Unit Root Test

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>Augmented Dickey – Fuller (ADF)</th>
<th>Phillips- Perron</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LEVEL</td>
<td>FD</td>
</tr>
<tr>
<td>RGDP</td>
<td>1.1994</td>
<td>-6.2244***</td>
</tr>
<tr>
<td>EXCHANGERATE</td>
<td>-8.0856***</td>
<td>-10.1223***</td>
</tr>
<tr>
<td>GOVEXP</td>
<td>-6.8451***</td>
<td>-8.8316***</td>
</tr>
<tr>
<td>BM</td>
<td>-2.85944**</td>
<td>-6.7843***</td>
</tr>
<tr>
<td>RPR</td>
<td>-4.6396***</td>
<td>-14.3397***</td>
</tr>
<tr>
<td>NATURAL RESOURCE EXT.</td>
<td>-7.2534***</td>
<td>-8.7954***</td>
</tr>
<tr>
<td>OPENNESS</td>
<td>-5.5835***</td>
<td>-8.1066***</td>
</tr>
</tbody>
</table>

*** p<0.01, ** p<0.05, * p<0.1

Source: Author’s calculation

### 5.4. Empirical results and analysis

To achieve the objectives of examining empirically whether real depreciation is expansionary or contractionary and if its effect on output change overtime, equation (17) was estimated. As already mentioned, the control variables in this equation include government expenditure (fiscal policy), broad money (monetary policy), natural resource, trade openness, terms of trade and the real exchange rate. The estimation was done using the system GMM estimation technique. The results are shown in table 5.3. But before the estimations were done, we conducted the unit root test to ensure that our data set is stationary and the model. We also carried out the Breusch and Pagan Lagrange Multiplier test for random effect and the Hausman specification to see whether or not fixed effect is appropriate. The result show that the fixed effect is appropriate therefore it is not incorrect to employ the System GMM dynamic panel estimation model. Finally, we tested for endogeneity using the Durbin and Wu-
Hausman tests before estimating the empirical models for which we obtained results and analysed.

**Table 5.3. System GMM dynamic panel estimation result for equation (17)**

<table>
<thead>
<tr>
<th>Independent variables</th>
<th>Coefficient</th>
<th>P-Value</th>
<th>Standard Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>ΔlogRGDP_{t-1}</td>
<td>0.229</td>
<td>0.038</td>
<td>0.110</td>
</tr>
<tr>
<td>ΔGOVEXP</td>
<td>0.000655</td>
<td>0.827</td>
<td>0.00300</td>
</tr>
<tr>
<td>ΔBM</td>
<td>0.00280</td>
<td>0.029</td>
<td>0.00128</td>
</tr>
<tr>
<td>ΔNRES</td>
<td>0.00583</td>
<td>0.002</td>
<td>0.00189</td>
</tr>
<tr>
<td>ΔOPENNESS</td>
<td>-0.00251</td>
<td>0.007</td>
<td>0.000923</td>
</tr>
<tr>
<td>ΔTOT</td>
<td>0.000859</td>
<td>0.050</td>
<td>0.000438</td>
</tr>
<tr>
<td>ΔlogRER</td>
<td>-0.0167</td>
<td>0.001</td>
<td>0.00508</td>
</tr>
<tr>
<td>ΔlogRER_{t-1}</td>
<td>0.000565</td>
<td>0.887</td>
<td>0.00397</td>
</tr>
<tr>
<td>ΔlogRER_{t-2}</td>
<td>0.00306</td>
<td>0.124</td>
<td>0.00199</td>
</tr>
</tbody>
</table>

| Observations          | 179         |
| Number of country     | 35          |
| Sargan test p-value   | 0.252       |
| AR (1) p-value        | 0.000       |
| AR (2) p-value        | 0.755       |

The results suggest that previous level of output affect its current level positively. The coefficient of ΔlogRGDP_{t-1} is 0.229 and statistically significant at 5% level. This relationship can be explain by the fact that high output level last year means that economic resources will be available for production in the following year. For example high output means high income. This makes savings possible and provide resources for investment in the next period. Also high incomes means that economic agents, in this case households will demand more goods and services which increases aggregate demand which in turn increase output.
Similarly, fiscal policy (government expenditure) shows a positive relationship with output however it is statistically insignificant. This finding is similar to the findings of Yiheyis (2006) and Constant (2012) when examining the effect of devaluation on aggregate output for 20 African countries and the effect of devaluation on output growth in the Franc Zone respectively. Wan (2012), Alawin (2013) and Upadhyaya et al. (2013) among others have also arrived at the same conclusion regarding fiscal in their respective studies. According to Tareq et al. (2009), fiscal policy can crowd – out private consumption and investment when fiscal balance reduce public savings and increases interest rates. In addition, they suggested that the crowding – out effect of fiscal policy in sub – Sahara Africa may be bigger than that of emerging markets and advanced economies because they have limited size of domestic financial market and less access to international capital. Crowding out effect refers to the phenomenon of a reduction in private investment and private consumption as a result of a rise in the interest rates due to fiscal stimulation (Balcerzak and Rogalska, 2014). In theory, expansionary fiscal policy will increase aggregate demand and lead to higher output. This can be done through higher government spending and/or lower taxes. Reduction in taxes should increase disposable income of consumers resulting in higher levels of consumer spending. This will increase aggregate demand and output. However Expansionary fiscal policy will lead to an increase in the size of a government’s budget deficit. This is mostly finance by borrowing which pushes the interest rate up. Since both private consumption and investment are negative functions of the interest rate they will fall (Balcerzak and Rogalska, 2014). It means the phenomenon of crowding out of private investment and consumption expenditure has been observe as a result of fiscal stimulus.

As expected, monetary policy affects real output positively and it is statistically significant at 5% level. Its coefficient is 0.00280 indicating that a rise in broad money by one dollar (US$1) will cause real output to rise by 0.28 percent. Studies such as Miteza (2006), Mustafa (2000) and Yiheyis (2006) also found out that expansionary monetary policy leads to higher output.
This conclusion underscores the important role monetary policy plays in sub-Saharan African economies. One important channel through which monetary policy affects economic activity and output is the real interest rate. This is because it reduces real interest rate which increase demand for goods and services by households. Lower interest rates also lead to lower cost of borrowing which encourage firms to borrow and invest to meet the demand for their goods and services. The rise in household expenditure and business investment spending leads to a high aggregate demand hence a high output level.

The result also shows that natural resource extraction has a direct relationship with output and it is statistically significant at 1% level. This suggest that the region benefits from these natural resources. The result confirms the claim by African Development Bank that natural resources are central to the livelihood of many people in the sub-region. This is mostly because during the last decade the prices of these resources have gone up on the international market due to high demand (Collier and Laroche, 2015). Aside from this, many new discoveries were made. This requires new business investment spending to extract them. Consequently, more jobs were created for economic agents to earn more income which lead to consumption expenditure by consumers. The increase in business investment spending and consumption expenditure results in a high aggregate demand, hence high output.

According to Cashin and Pattillo (2000), a common feature of Sub-Saharan African countries that export commodities is that the movement in their terms of trade is an important determinant of macroeconomic performance and has an significant effect on real output. Similar to the results of Yiheyis (2006) we found out that this effect is positive and it is statistically significant at 5 percent level. This suggests that a favourable terms of trade results in a higher output level. A unit increase in the terms of trade either from a fall in import value index or an increase in the export value index will results in 0.054 percent increase in real output. The effect of terms of trade on output show by this study is contrary to the findings of Mustafa (2000), Upadhyaya et al. (2013) and Pal (2014).
found out that terms of trade has a negative effect on output in South – East Asian countries. The same conclusion was drawn by Mustafa (2000) when studying the impact on output due to devaluation of 18 Less Developed Countries (LDCs).

The result also show that trade openness is negatively related to real output. Its coefficient is -0.00106 and it is statistically significant at 1 percent level. This result does not mean that sub – Sahara Africa countries does not enjoy the advantages such as access to international market, exchanging of knowledge with other countries and assimilation of new technologies which come with opening up to trade with other countries. The negative impact of trade openness can be explain by export instability or variability and the high dependence of sub – Sahara Countries on imports. For instance Gyimah- Brempong (1991) found that export variability have a statistically significant negative impact on growth for twenty-three sub-Saharan African countries and Fosu (1992) also found that the same negative impact for thirty-five African countries but his result was not statistically significant. This result suggest that sub – Sahara African countries are not doing well with regard to export and there is the need to diversify and add value to their exports. According to the Keynesian theory of demand, imports rises the aggregate demand for foreign countries and contracts aggregate demand and output in the domestic economy. This is because income which could have been spent in demanding domestic goods is being spent in demanding foreign goods.

The variable of concern in this model; the real exchange rate has a negative coefficient which is statistically significant at 1 percent level but its lags have positive coefficients and are not significant statistically. This result suggests that real devaluation or depreciation contracts output in the short run. However it has no effect on output in the medium run through to the long run. This is similar to the findings of studies such as Krugman and Taylor (1978), Edwards (1986), Agénor (1991), Yiheyis (2006), Mustafa (2000), Kamin and Rogers (2000) Kandil (2004) and Upadhyaya et al (2013) which have also concluded that real devaluation reduce output in the short run, but is contrary to the predictions of exported led growth theories.
which argues that devaluation will encourage export and in turn increase output. But according to Narayan and Narayan (2007), any increase in output following a depreciation can be offset by a decline in the demand for nontradeable goods. This is possibly due to the following two reasons: The first reason is well documented by Diaz-Alejandro (1963), Cooper (1971) and Krugman and Taylor (1978). They argued that, in the presence of a trade deficit, a devaluation or depreciation increases the real value of the deficit in domestic currency; thus causing a reduction in aggregate demand. This conclusion was also drawn by Cooper (1971) and Lizondo and Montiel (1989). According to them, real devaluation increases the domestic currency value of foreign liabilities, such as foreign debts, in real terms which means that servicing them will require a cut in spending which contracts aggregate demand and real output.

This argument is also emphasized by Yiheyis (2006) that devaluation increases the debt service charge on a given level of debt stock denominated in foreign currency and thus reduces the level of real income from a given output level. Also, an increase in the debt servicing charges reduces the available foreign exchange resources and also weakens the creditworthiness position, therefore limiting access to international credit for investment, hence output falls. This reason may hold for sub-Saharan Africa since most of the countries in the region run trade deficits and huge foreign liabilities/debts. Countries in the region have generally adopted a development strategies that rely heavily on foreign financing from both official and private sources. This has led to a situation where the external debt stock of the region has built up over decades to a level that is generally seen as unsustainable (Khan and Ajayi, 2000. Therefore one of the reasons why real exchange rate devaluation or depreciation may contract real output is that most sub-Saharan African countries run trade deficit and have huge foreign liabilities.

A second explanation why any output increase following devaluation could be offset is based on the works of Copelman and Werner (1996) and Kamin and Rogers (2000). According to
them, prices do not adjust immediately to their new steady-state levels after devaluation. This means that inflation rate, the expected rate of depreciation and the nominal interest rate may increase temporarily. They argued that, this may cause panic which may harm investor confidence resulting in decline in the demand for bank deposits. In addition, devaluation in most cases causes capital outflow and acts as a caveat on foreign borrowings, which can induce a decrease in consumer and investor spending in the domestic economy (Narayan and Narayan, 2007). Studies have shown that devaluation/depreciation and expected devaluation/depreciation are among the major causes of capital flights in sub-Saharan Africa (Rojas-Suarez, 1990; Ali and Walters, 2011 and Khan and Ajayi, 2000). This is because no investor wants to hold assets that will lose, for example, 20 percent or 25 percent overnight. Studies also suggest that the social cost of capital flight in terms of lost output is high in sub-Saharan Africa (Ndikumana and Boyce, 2008). In order to achieve objectives three, equation (18) was estimated to see whether any of the effects comes separately from changes in the nominal exchange rate or the relative price ratio. As already stated in chapter four, in equation (18) we decompose the real exchange rate into nominal exchange rate and the relative price ratio (the ratio of foreign price to domestic price). The explanatory variables in this model are the same as those of equation (17) except the real exchange rate which is decomposed into the nominal exchange rate and the relative price. The results of this estimation is presented in Table 5.5. The variables of interest for this estimation are the nominal exchange rate or relative price ratio. The result presented in Table 5.5 is similar to that of Table 5.4 for the other control variables (fiscal and monetary policy variables, natural extraction, openness and terms of trade). It however shows that the coefficient of nominal exchange rate is negative and statistically significant. This means that in the short run nominal devaluation or depreciation reduces output. Since the economy of sub-Saharan Africa is dependent on imports as shown
Table 5.4. System GMM dynamic panel estimation result for equation (18)
Dependent variable: Real GDP (rgdp)

<table>
<thead>
<tr>
<th>Independent variables</th>
<th>Coefficient</th>
<th>P-Value</th>
<th>Standard Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>ΔlogRGDP$_{t-1}$</td>
<td>0.292</td>
<td>0.000</td>
<td>0.0689</td>
</tr>
<tr>
<td>ΔGOVEXP</td>
<td>0.000474</td>
<td>0.825</td>
<td>0.00214</td>
</tr>
<tr>
<td>ΔBM</td>
<td>0.00147</td>
<td>0.031</td>
<td>0.000683</td>
</tr>
<tr>
<td>ΔNRES</td>
<td>0.00319</td>
<td>0.018</td>
<td>0.00135</td>
</tr>
<tr>
<td>ΔOPENNESS</td>
<td>-0.00115</td>
<td>0.064</td>
<td>0.000622</td>
</tr>
<tr>
<td>ΔTOT</td>
<td>0.000276</td>
<td>0.409</td>
<td>0.000334</td>
</tr>
<tr>
<td>ΔlogE</td>
<td>-0.0366</td>
<td>0.000</td>
<td>0.00939</td>
</tr>
<tr>
<td>ΔlogE$_{t-1}$</td>
<td>0.0100</td>
<td>0.249</td>
<td>0.00869</td>
</tr>
<tr>
<td>ΔlogE$_{t-2}$</td>
<td>-0.00246</td>
<td>0.270</td>
<td>0.00223</td>
</tr>
<tr>
<td>ΔlogRPR</td>
<td>0.0177</td>
<td>0.031</td>
<td>0.00822</td>
</tr>
<tr>
<td>ΔlogRPR$_{t-1}$</td>
<td>0.0171</td>
<td>0.020</td>
<td>0.00733</td>
</tr>
<tr>
<td>ΔlogRPR$_{t-2}$</td>
<td>0.00559</td>
<td>0.342</td>
<td>0.00589</td>
</tr>
</tbody>
</table>

Observations 181  Number of country 35  Sargan test p-value 0.637  AR (1) p-value 0.000  AR (2) p-value 0.504

by the outcome on the trade openness variable, devaluation leads to inflation which reduces spending because of low purchasing power.

However, the relative price ratio and its lags have expansionary effect on real output and are statistically significant except for the second lag. So the negative effect of real exchange rate on output is dominated by nominal devaluation.
To sum up, these findings suggest that real devaluation or depreciation is contractionary on real output in the short run but has no effect in the medium run and the long run. Following the findings of Hutchison and Noy (2002), we can infer from our results that exchange rates are overvalued in the region. Also, the results suggest that the contractionary effect comes from the nominal exchange rate and not the relative price ratio.

5.5 Conclusion

This chapter of the study analyses the panel dataset of 35 sub – Sahara African countries to examine the relationship between real exchange rate devaluation or depreciation and real output in the region and if the direction of the relationship between them change overtime. After this we decompose the real exchange rate into nominal exchange rate and the relative price ratio to see if any changes in output comes separately from them. But before the estimations were done, we conducted the unit root test to ensure that our data set is stationary and the model. We also carried out the Breusch and Pagan Lagrange Multiplier test for random effect and the Hausman specification to see whether or not fixed effect is appropriate. The result show that the fixed effect is appropriate therefore it is not incorrect to employ the System GMM dynamic panel estimation model. Finally, we tested for endogeneity using the Durbin and Wu-Hausman tests before estimating the empirical models for which we obtained results and analysed. Our results showed that in sub- Sahara Africa devaluations are contractionary and it is from the nominal exchange rate not the relative price ratio.
6.1. Introduction

This chapter concludes the study. It deals with the summary of what the study is about (the objectives of the study) and how the study was carried out to achieve these objectives. This chapter also presents the conclusions about the relationship between real exchange rate depreciation or devaluation and output based on the results of the study. Also, on the basis of the results and the conclusions we provide some recommendations for policy and further research in this chapter. Finally, we provided some limitations of the study.

6.2. Summary and Conclusions

Countries in sub-Saharan Africa are making every effort necessary to develop and providing their citizens with an improved standard of living. These efforts include opening up their economies more to the rest of the world through international trade, capital flows and cooperation. Therefore, the issue of exchange rate becomes very important in the management of the economies of these countries, especially the issues of exchange rates devaluation or depreciation and its effect on output. As such, many studies have been conducted to examine the effect of depreciation on output. The literature especially on sub-Saharan Africa provides very little guidance on the nature of this relationship partly because the topic within the African context have been under researched. Hence the need to undertake this study to provide us with knowledge about the recent trends with reference to the depreciation and output dynamics.

Specifically, this study sought to examine the effect of real exchange rate devaluation or depreciation on real output in Sub-Saharan Africa and whether the effect changes overtime. In other words, the study sought to examine whether real exchange rate devaluation or depreciation is expansionary or contractionary. Aside from these, we also investigated where
the effects come from. That is, we decompose the real exchange rate effect into the relative price and the nominal exchange rate effect to ascertain their different impact on real output.

The study used panel data drawn from 35 countries in sub – Sahara African for the period 1984 to 2013. Edwards (1993), Stein and Streb (1999), Ghezzi et al (2000), (Block et al., 2003) and Frieden et al. (2006) among others have argued that devaluation/depreciation is costly to the politician because it is mostly seen as a sign of incompetence by the electorates and for this reason, incumbent governments postpone devaluation leading to currency overvaluation before elections. For example, Block et al., (2003) observes that there is clear evidence that incumbent leaders in Africa defer devaluation policies until after elections. Aside this, Duesenberry (1950), Gali and Hammour (1992), Döpke (2004) and Fatás (2000) also suggest that business cycles affect productivity, growth and output levels. Therefore, we followed the approach of Edison et al. (2002) and averaged the data over a 3-year (non-overlapping) interval to average out the political economy effect on the exchange rate especially during election years and also to eliminate business-cycle fluctuations. The 3-year non-overlapping periods were obtained as 1984-1986, 1987-1989, 1990-1992, 1993-1995, 1996-1998, 1999-2001, 2002-2004, 2005-2007, 2007-2010 and 2011-2013, such that there are ten observations per country.

The system GMM estimation technique was used to estimate the empirical models. We estimated two models. One with the real exchange rate and the second with the real exchange rate decomposed into, relative price ratio and the nominal exchange rate. The other variables included in the regression are government expenditure, broad money, natural resource extraction, terms of trade and trade openness. The results of the study shows that government expenditure, broad money, natural resource extraction and terms of trade all have positive effect on real output. Trade openness is negatively related to output. The main variable for the study, the real exchange rate has a negative relationship with real output but its lags have positive relationship. This suggests that real devaluation or depreciation contracts output in
the short run but expands it in the medium through to the long run. The results also suggest that the contractionary effect comes from the nominal exchange rate and not the relative price ratio. Finally, these findings suggest that exchange rates tend to be overvalued in the region.

6.3 Recommendations

Based on the findings and conclusions, the study recommends the following:

First, the contractionary effect of real exchange rate devaluation or depreciation on real output implies exchange rate overvaluation. This can lead to issues of exchange rate misalignment and distortions in the economy. It also leads to discrimination against exports because it makes exports noncompetitive in the foreign market. Studies have shown that countries that try to keep their currencies overvalued significantly put a constraint on their medium to long term growth. Therefore it is important for sub-Saharan African countries to implement policies to keep the exchange rate at its equilibrium value. Also, these policies should aim at making exchange rates competitive in the region. Secondly, our results show that trade openness negatively affect real output and suggest that African countries essentially open their economies more to import rather than to encourage exports. This has resulted in a situation where most sub-Saharan African countries having import bills and trade deficits. Appropriate economic policies must be put in place to reverse this trend. Import bills must be reduced and exports encouraged. In addition, countries in the sub region must diversified their exports and ensure that value addition to the tradable goods is make key to polices directed at export promotion.

Thirdly, based on the results of this study we recommend that natural resources regions in the sub region be well managed to benefit its people. Natural resources dominate many economies in the region and are essential to the livelihoods of the majority of the poor especially in the rural areas. Natural resources also provide the export base for almost all the countries in the region. If properly managed, natural resource can be main catalyst for economic growth and
development leading to the transformation to factory production from cottage industry. That is, proper management of natural resources can transform many countries in the region to ones with large manufacturing base from those which rely heavily on exports of primary commodities. For this reason it must be seen as a key variable and manage properly in the effort to develop the economies in the region.

Finally, future studies on the effect on real output of real exchange rate devaluation or depreciation in sub-Saharan Africa should examine the effect of changes in the real exchange rate on the various channels through which changes in the real exchange rate can affect output.

6.3. Limitations of the Study

Most researchers especially in Africa are confronted with the problem of data. The current study on the effects real exchange rate devaluation/depreciation in sub-Saharan Africa is constrained by the same problem. In some cases, data on some variables are not available which can lead to the problem of omitted variables. In cases where data is available on these variables, the observations for some years were not available. This resulted in a situation where only 35 countries out of the 48 in the region were examined.
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APPENDIX A

Table 1A: Test for correlation among variables

<table>
<thead>
<tr>
<th></th>
<th>rgdp</th>
<th>goexp</th>
<th>bmgdp</th>
<th>nres</th>
<th>open</th>
<th>tot</th>
<th>Exch.rate</th>
<th>rer</th>
<th>rpr</th>
</tr>
</thead>
<tbody>
<tr>
<td>rgdp</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>goexp</td>
<td>-0.0311</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>bm</td>
<td>0.2177</td>
<td>0.3974</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>nres</td>
<td>0.005</td>
<td>-0.1193</td>
<td>-0.2508</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>open</td>
<td>-0.1168</td>
<td>0.517</td>
<td>0.3696</td>
<td>0.0274</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>tot</td>
<td>0.0381</td>
<td>-0.1504</td>
<td>-0.1403</td>
<td>0.2005</td>
<td>-0.1137</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exch.rate</td>
<td>-0.0878</td>
<td>-0.1661</td>
<td>-0.1113</td>
<td>0.0597</td>
<td>-0.1521</td>
<td>-0.0526</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>rer</td>
<td>-0.0033</td>
<td>-0.0254</td>
<td>-0.0013</td>
<td>0.0696</td>
<td>0.0072</td>
<td>-0.082</td>
<td>0.0888</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>rpr</td>
<td>0.0067</td>
<td>0.0104</td>
<td>0.0298</td>
<td>0.0319</td>
<td>0.0491</td>
<td>-0.1354</td>
<td>0.0073</td>
<td>0.9095</td>
<td>1</td>
</tr>
</tbody>
</table>

Source: Author’s calculation

APPENDIX B

Table 1B: Breusch and Pagan Lagrangian multiplier test for random effects for equation (17)

Breusch and Pagan Lagrangian multiplier test for random effects

\[ dlrgdp[\text{country},t] = Xb + u[\text{country}] + e[\text{country},t] \]

Estimated results:

\[
\begin{array}{c|cc}
\text{Var} & \text{sd} = \sqrt{\text{Var}} \\
\hline
\text{dlrgdp} & 0.0109328 & 0.1045601 \\
\text{e} & 0.0073346 & 0.0856425 \\
\text{u} & 0 & 0 \\
\end{array}
\]

Test: \[ \text{Var}(u) = 0 \]

\[ \text{chibar2(01)} = 0.00 \]

\[ \text{Prob} > \text{chibar2} = 1.0000 \]

Source: Author’s calculation
Table 2B: Random and Fixed effects for equation (17)

Dependent variable: Real GDP (rgdp)

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>RANDOM EFFECT</th>
<th>FIXED EFFECT</th>
</tr>
</thead>
<tbody>
<tr>
<td>ΔlogRGDP_{t-1}</td>
<td>0.387***</td>
<td>0.167**</td>
</tr>
<tr>
<td></td>
<td>(0.0592)</td>
<td>(0.0740)</td>
</tr>
<tr>
<td>ΔGOVEXP</td>
<td>0.000728</td>
<td>0.000556</td>
</tr>
<tr>
<td></td>
<td>(0.00205)</td>
<td>(0.00240)</td>
</tr>
<tr>
<td>ΔBM</td>
<td>0.00218***</td>
<td>0.00231**</td>
</tr>
<tr>
<td></td>
<td>(0.000816)</td>
<td>(0.000906)</td>
</tr>
<tr>
<td>ΔNRES</td>
<td>0.00234*</td>
<td>0.00336**</td>
</tr>
<tr>
<td></td>
<td>(0.00126)</td>
<td>(0.00131)</td>
</tr>
<tr>
<td>ΔOPENNESS</td>
<td>-0.000967*</td>
<td>-0.00107*</td>
</tr>
<tr>
<td></td>
<td>(0.000546)</td>
<td>(0.000568)</td>
</tr>
<tr>
<td>ΔTOT</td>
<td>0.00034</td>
<td>0.000349</td>
</tr>
<tr>
<td></td>
<td>(0.000321)</td>
<td>(0.000359)</td>
</tr>
<tr>
<td>ΔlogRER</td>
<td>-0.00925**</td>
<td>-0.0135**</td>
</tr>
<tr>
<td></td>
<td>(0.00462)</td>
<td>(0.00549)</td>
</tr>
<tr>
<td>ΔlogRER_{t-1}</td>
<td>-0.00134</td>
<td>-0.00363</td>
</tr>
<tr>
<td></td>
<td>(0.00407)</td>
<td>(0.00478)</td>
</tr>
<tr>
<td>ΔlogRER_{t-2}</td>
<td>0.00199</td>
<td>0.00165</td>
</tr>
<tr>
<td></td>
<td>(0.00196)</td>
<td>(0.00200)</td>
</tr>
<tr>
<td>Constant</td>
<td>0.0691***</td>
<td>0.0966***</td>
</tr>
<tr>
<td></td>
<td>(0.0102)</td>
<td>(0.0122)</td>
</tr>
</tbody>
</table>

Observations 188 188
Number of country 35 35
R-Squared 0.19 0.22

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Source: Author’s calculation
Table 3B: Hausman Specification Test Results for equation (17)

<table>
<thead>
<tr>
<th>Coefficients</th>
<th>(b)fe</th>
<th>(B)re</th>
<th>(b-B) Difference</th>
<th>sqrt(diag(V_b-V_B)) S.E.</th>
</tr>
</thead>
<tbody>
<tr>
<td>ΔlogRGDP_{t-1}</td>
<td>0.1670581</td>
<td>0.3866196</td>
<td>-0.2195615</td>
<td>0.0443422</td>
</tr>
<tr>
<td>ΔGOVEXP</td>
<td>0.0005563</td>
<td>0.0007282</td>
<td>-0.0001719</td>
<td>0.0012396</td>
</tr>
<tr>
<td>ΔBM</td>
<td>0.0023088</td>
<td>0.0021786</td>
<td>0.0001302</td>
<td>0.0003947</td>
</tr>
<tr>
<td>ΔNRES</td>
<td>0.0033576</td>
<td>0.0023447</td>
<td>0.0010129</td>
<td>0.0003646</td>
</tr>
<tr>
<td>ΔOPENNESS</td>
<td>-0.0010719</td>
<td>-0.000967</td>
<td>-0.0001048</td>
<td>0.0001581</td>
</tr>
<tr>
<td>ΔTOT</td>
<td>0.0003488</td>
<td>0.0003338</td>
<td>0.000015</td>
<td>0.0001613</td>
</tr>
<tr>
<td>ΔlogRER</td>
<td>-0.0134591</td>
<td>-0.0092519</td>
<td>-0.0042072</td>
<td>0.0029654</td>
</tr>
<tr>
<td>ΔlogRER_{t-1}</td>
<td>-0.0036268</td>
<td>-0.0013435</td>
<td>-0.0022833</td>
<td>0.0025071</td>
</tr>
<tr>
<td>ΔlogRER_{t-2}</td>
<td>0.001647</td>
<td>0.0019931</td>
<td>-0.0003461</td>
<td>0.000363</td>
</tr>
</tbody>
</table>

Source: Author’s calculation

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

\[ \chi^2(8) = (b-B)'[(V_b-V_B)^{-1}](b-B) \]
\[ = 27.65 \]
\[ \text{Prob} > \chi^2 = 0.0011 \]
(V_b-V_B is not positive definite)

Table 4B: Endogeneity test for equation (17)

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>DURBIN (SCORE) (Χ2)</th>
<th>WU-HAUSMAN</th>
</tr>
</thead>
<tbody>
<tr>
<td>ΔlogRGDP_{t-1}</td>
<td>5.44474</td>
<td>0.0196</td>
</tr>
<tr>
<td>ΔGOVEXP</td>
<td>0.669908</td>
<td>0.4131</td>
</tr>
<tr>
<td>ΔBM</td>
<td>4.13925</td>
<td>0.0419</td>
</tr>
<tr>
<td>ΔNRES</td>
<td>3.94765</td>
<td>0.0469</td>
</tr>
<tr>
<td>ΔOPENNESS</td>
<td>3.39378</td>
<td>0.0654</td>
</tr>
<tr>
<td>ΔTOT</td>
<td>5.35193</td>
<td>0.0207</td>
</tr>
<tr>
<td>ΔlogRER</td>
<td>18.4053</td>
<td>0.0000</td>
</tr>
<tr>
<td>ΔlogRER_{t-1}</td>
<td>1.72393</td>
<td>0.1892</td>
</tr>
<tr>
<td>ΔlogRER_{t-2}</td>
<td>0.124638</td>
<td>0.7241</td>
</tr>
</tbody>
</table>

Source: Author’s calculation
Table 5B: Arellano-Bond test for zero autocorrelation in first-differenced errors for equation (17)

<table>
<thead>
<tr>
<th>ORDER</th>
<th>Z-VALUE</th>
<th>PROBABILITY VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>AR (1)</td>
<td>-3.52</td>
<td>0.000</td>
</tr>
<tr>
<td>AR (2)</td>
<td>-0.31</td>
<td>0.755</td>
</tr>
</tbody>
</table>

Source: Author’s calculation

Table 6B: Sargan test of over identifying restrictions for equation (17)

<table>
<thead>
<tr>
<th>CHI2 STATISTIC ((\chi^2))</th>
<th>PROBABILITY VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>62.64</td>
<td>0.252</td>
</tr>
</tbody>
</table>

Source: Author’s calculation

APPENDIX C

Table 1C: Breusch and Pagan Lagrangian multiplier test for random effects for equation (18)

Breusch and Pagan Lagrangian multiplier test for random effects

dlrgdp[country,t] = Xb + u[country] + e[country,t]

Estimated results:

<table>
<thead>
<tr>
<th></th>
<th>Var</th>
<th>sd = sqrt(Var)</th>
</tr>
</thead>
<tbody>
<tr>
<td>dlrgdp</td>
<td>0.0110985</td>
<td>0.1053496</td>
</tr>
<tr>
<td>e</td>
<td>0.0058842</td>
<td>0.0767088</td>
</tr>
<tr>
<td>u</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Test: \(\text{Var}(u) = 0\)

\[\text{chibar2(01)} = 0.00\]

\[\text{Prob} > \text{chibar2} = 1.0000\]

Source: Author’s calculation
Table 2C: Random and Fixed effects for equation (18)

Dependent variable: Real GDP (rgdp)

<table>
<thead>
<tr>
<th>DEPENDENT VARIABLES</th>
<th>RAMDOM EFFECT</th>
<th>FIXED EFFECT</th>
</tr>
</thead>
<tbody>
<tr>
<td>ΔlogRGDP&lt;sub&gt;t-1&lt;/sub&gt;</td>
<td>0.375***</td>
<td>0.148**</td>
</tr>
<tr>
<td></td>
<td>(0.0559)</td>
<td>(0.0690)</td>
</tr>
<tr>
<td>ΔGOVEXP</td>
<td>-0.000551</td>
<td>-0.00225</td>
</tr>
<tr>
<td></td>
<td>(0.00196)</td>
<td>(0.00222)</td>
</tr>
<tr>
<td>ΔBM</td>
<td>0.00145*</td>
<td>0.00114</td>
</tr>
<tr>
<td></td>
<td>(0.000763)</td>
<td>(0.000835)</td>
</tr>
<tr>
<td>ΔNRES</td>
<td>0.00147</td>
<td>0.00291**</td>
</tr>
<tr>
<td></td>
<td>(0.00118)</td>
<td>(0.00120)</td>
</tr>
<tr>
<td>ΔOPENNESS</td>
<td>-0.000565</td>
<td>-0.000764</td>
</tr>
<tr>
<td></td>
<td>(0.000512)</td>
<td>(0.000515)</td>
</tr>
<tr>
<td>ΔTOT</td>
<td>0.000266</td>
<td>5.79e-05</td>
</tr>
<tr>
<td></td>
<td>(0.000305)</td>
<td>(0.000337)</td>
</tr>
<tr>
<td>ΔlogE</td>
<td>-0.0368***</td>
<td>-0.0400***</td>
</tr>
<tr>
<td></td>
<td>(0.00831)</td>
<td>(0.00893)</td>
</tr>
<tr>
<td>ΔlogE&lt;sub&gt;t-1&lt;/sub&gt;</td>
<td>0.0140*</td>
<td>-0.00116</td>
</tr>
<tr>
<td></td>
<td>(0.00805)</td>
<td>(0.00858)</td>
</tr>
<tr>
<td>ΔlogE&lt;sub&gt;t-2&lt;/sub&gt;</td>
<td>-0.00178</td>
<td>-0.00150</td>
</tr>
<tr>
<td></td>
<td>(0.00232)</td>
<td>(0.00228)</td>
</tr>
<tr>
<td>ΔlogRPR</td>
<td>0.0122*</td>
<td>0.00900</td>
</tr>
<tr>
<td></td>
<td>(0.00712)</td>
<td>(0.00775)</td>
</tr>
<tr>
<td>ΔlogRPR&lt;sub&gt;t-1&lt;/sub&gt;</td>
<td>0.00642</td>
<td>0.00417</td>
</tr>
<tr>
<td></td>
<td>(0.00669)</td>
<td>(0.00770)</td>
</tr>
<tr>
<td>ΔlogRPR&lt;sub&gt;t-2&lt;/sub&gt;</td>
<td>-0.00370</td>
<td>-0.00449</td>
</tr>
<tr>
<td></td>
<td>(0.00530)</td>
<td>(0.00586)</td>
</tr>
<tr>
<td>Constant</td>
<td>0.0744***</td>
<td>0.111***</td>
</tr>
<tr>
<td></td>
<td>(0.00983)</td>
<td>(0.0121)</td>
</tr>
</tbody>
</table>

Observations 185 185
Number of country 35 35
R-squared (overall) 0.342 0.396

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Source: Author’s calculation
Table 3C: Hausman Specification Test Results for equation (18)

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>Coefficients (b) fe</th>
<th>Coefficients (B) re</th>
<th>(b-B) Difference</th>
<th>sqrt(diag(V_b-V_B)) S.E.</th>
</tr>
</thead>
<tbody>
<tr>
<td>ΔlogRGDPt-1</td>
<td>0.1480064</td>
<td>0.3745331</td>
<td>-0.2265267</td>
<td>0.0404387</td>
</tr>
<tr>
<td>ΔGOVEXP</td>
<td>-0.0022481</td>
<td>-0.000551</td>
<td>-0.0016971</td>
<td>0.0010488</td>
</tr>
<tr>
<td>ΔMS</td>
<td>0.0011396</td>
<td>0.0014486</td>
<td>-0.000309</td>
<td>0.0003375</td>
</tr>
<tr>
<td>ΔNRES</td>
<td>0.0029071</td>
<td>0.0014678</td>
<td>0.0014392</td>
<td>0.0002468</td>
</tr>
<tr>
<td>ΔOPENNESS</td>
<td>-0.0007638</td>
<td>-0.0005649</td>
<td>-0.0001989</td>
<td>0.0000555</td>
</tr>
<tr>
<td>ΔTOT</td>
<td>0.0000579</td>
<td>0.0002656</td>
<td>-0.0002076</td>
<td>0.0001424</td>
</tr>
<tr>
<td>ΔlogE</td>
<td>-0.0400043</td>
<td>-0.0368403</td>
<td>-0.003164</td>
<td>0.0032691</td>
</tr>
<tr>
<td>ΔlogEt-1</td>
<td>-0.0011566</td>
<td>0.0139983</td>
<td>-0.0151549</td>
<td>0.0029544</td>
</tr>
<tr>
<td>ΔlogEt-2</td>
<td>-0.0014965</td>
<td>-0.0017786</td>
<td>0.0002821</td>
<td></td>
</tr>
<tr>
<td>ΔlogRPR</td>
<td>0.0090001</td>
<td>0.0121675</td>
<td>-0.0031673</td>
<td>0.0030522</td>
</tr>
<tr>
<td>ΔlogRPRt-1</td>
<td>0.0041732</td>
<td>0.0064216</td>
<td>-0.0022484</td>
<td>0.0038119</td>
</tr>
<tr>
<td>ΔlogRPRt-2</td>
<td>-0.004486</td>
<td>-0.0036997</td>
<td>-0.0007863</td>
<td>0.0024963</td>
</tr>
</tbody>
</table>

Source: Author’s calculation

b = consistent under Ho and Ha; obtained from xtreg

B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

\[ \text{chi}^2(11) = (b-B)'[(V_b-V_B)^{-1}](b-B) \]

= 39.15

Prob>chi2 = 0.0001

(V_b-V_B is not positive definite)

Table 4C: Endogeneity test for equation (18)

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>DURBIN (SCORE) (Χ2)</th>
<th>prob. value</th>
<th>WU-HAUSMAN</th>
</tr>
</thead>
<tbody>
<tr>
<td>ΔlogRGDPt-1</td>
<td>4.08401</td>
<td>0.0433</td>
<td>3.90532</td>
</tr>
<tr>
<td>ΔGOVEXP</td>
<td>0.048997</td>
<td>0.8248</td>
<td>0.046361</td>
</tr>
<tr>
<td>ΔBM</td>
<td>18.9784</td>
<td>0.0000</td>
<td>19.6618</td>
</tr>
<tr>
<td>ΔNRES</td>
<td>0.014558</td>
<td>0.9040</td>
<td>0.013772</td>
</tr>
<tr>
<td>ΔOPENNESS</td>
<td>0.043451</td>
<td>0.8349</td>
<td>0.040877</td>
</tr>
<tr>
<td>ΔTOT</td>
<td>0.464016</td>
<td>0.4958</td>
<td>0.445067</td>
</tr>
<tr>
<td>ΔlogE</td>
<td>1.92261</td>
<td>0.1656</td>
<td>1.83778</td>
</tr>
<tr>
<td>ΔlogEt-1</td>
<td>19.6031</td>
<td>0.0000</td>
<td>20.9783</td>
</tr>
<tr>
<td>(\Delta \log E_{t-2})</td>
<td>5.70164</td>
<td>0.0169</td>
<td>5.59675</td>
</tr>
<tr>
<td>----------------------</td>
<td>---------</td>
<td>-------</td>
<td>---------</td>
</tr>
</tbody>
</table>

Source: Author’s calculation

Table 5C: Arellano-Bond test for zero autocorrelation in first-differenced errors for equation (18)

<table>
<thead>
<tr>
<th>ORDER</th>
<th>Z-VALUE</th>
<th>PROBABILITY VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>AR (1)</td>
<td>-3.13</td>
<td>0.002</td>
</tr>
<tr>
<td>AR (2)</td>
<td>-0.67</td>
<td>0.504</td>
</tr>
</tbody>
</table>

Source: Author’s calculation

Table 6C: Sargan test of over identifying restrictions for equation (18)

<table>
<thead>
<tr>
<th>CHI2 STATISTIC ((\chi^2))</th>
<th>PROBABILITY VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>76.95</td>
<td>0.637</td>
</tr>
</tbody>
</table>

Source: Author’s calculation