REER MISALIGNMENT AND ECONOMIC GROWTH IN THE CAEMC REGION

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By

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ABSTRACT

The CFA Franc real exchange rate is frequently suspected to be overvalued as a result of recent prolonged appreciation of the Euro (the anchor currency). This situation is popularly associated with lose of competitiveness and several studies have tried to establish the relationship between growth and misaligned or overvalued real exchange rates. This study used a panel data cointegration techniques to evaluate the growth effects of real effective exchange rate misalignments for the Central African Economic and Monetary Community (CAEMC) using time series data from 1999-2010. To achieve this objective, the Real Effective Equilibrium Exchange Rate for the CFA Franc was first estimated using the Behavioural Equilibrium Exchange Rate (BEER) from which the misalignment was derived. Subsequently, a dynamic panel growth model was estimated using a Generalised Least Squares (GLS) Method, in which among the traditional determinants of growth, our measure of misalignment was included. Moderate and transitory misalignments were found for the six CAEMC member countries except for the Congo Republic were a sustained overvaluation was observed. The growth analysis indicates a positive and significant impact of real exchange rate misalignment to economic growth of the CAEMC member countries.

Keywords: Real exchange rate misalignment, growth, BEER, CAEMC and panel data analysis.

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GLOSSARY OF TERMS

ADF: Augmented Dickey-Fuller

ADI: African Development Indicators

AFD: French Development Agency

AID: Aid

BCAS: Bank of Central African States

BEAC : Banque des Etats de l'Afrique Centrale

BEER: Behavioural Equilibrium Exchange Rate

CAEMC: Central African Economic and Monetary Community

CEMAC : 'Communauté Economique Et Monétaire de l'Afrique Centrale'

CFA: 'Communauté Financière Africaine'

CHEER: Capital Enhanced Measures of the Equilibrium Exchange Rate

CPI: Consumer Price Index

DEER: Desired Equilibrium Exchange Rate

DOLS: Dynamic Ordinary Least Squares

EREER: Equilibrium Real Effective Exchange Rate

FEER: Fundamental Equilibrium Exchange Rate

FM-OLS: Fully Modified Ordinary Least Squares

GB: Government Balance

GDP: Gross Domestic Product

GLS: Generalised Least Squares

GMM: Generalised Method of Moment

GS: Government Spending

IEB: Internal-External Balance approach

IFS: International Financial Statistics

IMF: International Monetary Fund

INF: Inflation

IR: Interest Rate Differential

IRP: Interest Rate Parity

IV: Investments

LOG: logarithm

LOP: Law of One Price

MIS: Misalignment of the Real Exchange Rate

MS: Money Supply

NATREX: Natural Rate of Exchange

NBER: Nominal Bilateral Exchange Rate

NEER Nominal Effective Exchange Rate

NER Nominal Exchange Rate

NFA: Net Foreign Assets

OCA: Optimal Currency Area

ODA: Official Development Assistance

OLS: Ordinary Least Squares

OP: Openness

PEER: Permanent Equilibrium Exchange Rate

PG: Population Growth

PPP: Purchasing Power Parity

PV: Productivity

REER: Real Effective Exchange Rate

RER: Real Exchange Rate

TB: Trade Balance

TOT: Terms Of Trade

UIP: Uncovered Interest Rate Parity

UNCTADstat: United Nations Conference on Trade and Development Statistics

VECM: Vector-Error Correction Model

WAEMU: Western African Economic and Monetary Union

WB: World Bank

WDI: World Development Indicators

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REER MISALIGNMENT AND ECONOMIC GROWTH IN THE CAEMC REGION

1. INTRODUCTION

1.1. Research area and problem

Macroeconomic issues concerning the real exchange rate and its impact on monetary policy and sustainable economic growth remains a fundamental concern for researchers and policy makers. The Real Exchange Rate (RER) could be defined as an "economy-wide" relative price that has been linked to crucial macroeconomic phenomena and is viewed as a key indicator of external competitiveness. Therefore, a keen interest in estimating the equilibrium real exchange rates and their potential movement, in understanding its determinants and the factors behind implied misalignments of the actual rate from its equilibrium level should be paid by economists and policy makers. Both overvalued and undervalued currencies have their negative implications. There are a number of empirical supports for the view that an overvalued currency leads to lower economic growth (see Razin and Collins, 1997). Besides the loss of competitiveness associated with persistent overvaluation, it has been also linked with lower long-run economic growth, lower financial deepening and higher tendency to currency crises (see Aguirre and Calderón, 2006).

Although "equilibrium" exchange rate reflects the long term level the real exchange rate should ideally converge to in the long-run, there is little consensus in the literature on how to accurately estimate it. Economists have developed a number of methodologies for assessing the equilibrium exchange rate[1]. Each methodology involves conceptual simplifications and/or imprecise estimates of key parameters; and different methodologies sometimes generate noticeably different quantitative estimates of equilibrium exchange rate. The Real Exchange Rate (RER) measured by the relative price of tradables to nontradables, is considered to be an important indicator of economic performance, since it reflects the overall state of economic fundamentals as well as of macroeconomic and trade policies. It becomes thus, essential to determine the sustainable level reflecting the economic fundamentals and that will stimulate growth. Estimating the Equilibrium Exchange Rate will help establish the degree of the disequilibrium and adopt corrective measures. This practice is more important for fixed exchange rate regimes where market forces cannot resolve the choc (Gnimassoun, 2012).

[1] Section 2.3 present the most used approaches in determining the equilibrium real exchange rate.

Accordingly, the potential misalignment of the CFA Franc[2] is one of the most important monetary policy issues faced by Central African Economic and Monetary Community (CAEMC) especially for the persistent appreciation of the Euro for the last decade. The recent international financial crisis, the significant economic and financial challenges faced by most of the Euro zone member countries and the risk of leaving of the monetary union by some Euro member countries enhance some worries and raise number of questions on the stability of the Euro and its implications for the CFA Franc. Moreover, the high appreciation that the Euro had experienced between 2002 and 2010 have been widely suspected of weakening the competitiveness of the CFA Franc during that period not only because it is the anchor currency but also because the Euro zone is the largest trade partner representing more than 90% of the total trade of each CAEMC member country. The Euro has noted a 40% annual average appreciation against the US Dollar for the period 2002 – 2010 (Blaise Gnimassoun, 2012).

In addition, the lack of effective regional integration within the CAEMC and the significant discrepancies of the CAEMC economies constitute another challenge in designing and implementing adequate monetary policies for the region and maintaining the RER at a sustainable level. Coupled with weak institutional frameworks, the above issues undermine the capability of the CAEMC member countries to overcome external shocks like the appreciation of the Euro for instance. A fundamental issue arising from the above discussion is the sustainability of the parity. Would the CAEMC member countries be able to sustain a misaligned RER or is there any risk of resorting to a subsequent devaluation. Another vital question should be raised at this point: was the upholding of the nominal exchange rate between CFA Franc and the French Franc at the same fixed parity during the introduction of the Euro in 1999 in line with economic fundamentals of the CAEMC member countries and or was the CFA Franc Nominal exchange rate set at an overvalued (undervalued) level at the first place? How does the new currency impacts on the economic performance of the CAEMC? These are some concerns related to the CFA Reel Exchange Rate.

The link between RER misalignment and economic growth had not been particularly very apparent in the old macroeconomic literature; several researches had rather established correlation between RER misalignment and external competiveness. There is no gain saying that exchange rate misalignment has serious implications on economic fundamentals, but

[2] CFA is the common currency shared by former French colonies in Central and western Africa. It stands for "Cooperation Financière Africaine" for the CAEMC and "Communauté Financière Africaine" for the WAEMU.

what is particularly important is to know the nature and degree of the impact of the misalignment for efficient macroeconomic management. Misalignment is generally believed to be capable of reducing economic growth, export competitiveness, worsening terms of trade, lowering the flow of foreign investment, etc. There is however limited empirical studies linking RER misalignment and economic growth (especially in Sub-Saharan Africa), and the few studies that tried to investigate on that question focused on some developing countries in Latin American, Asian and Eastern Europe.

1.2. Research questions and scope

The main purpose of this research is to estimate the Equilibrium Exchange rate of the CFA Franc for the Central African Economic and Monetary Community member countries and evaluate how the resulting misalignment (if any) impacts on the economic growth in the CAEMC region.

The answer to the main question will provide us with an estimate of the equilibrium exchange rate for these countries and additional information to answer the following sub questions:

What is the degree of misalignment of the REER with the equilibrium REER?

What are the most significant determinants of the Real Effective Exchange Rate for the six countries of the CAEMC?

How significant is the real exchange rate misalignment (deviation from its equilibrium level) for the different countries of the CAEMC?

And does the CFA Franc real exchange rate misalignment affect on the economic growth of the CAEMC member countries?

This study is limited to one of the two regions forming the CFA zone namely the Central African Economic and Monetary Community (CAEMC). The six countries that constitute this region are: Cameroon, Chad, Central African Republic, Congo Republic, Equatorial Guinea and Gabon. The study period will cover the period starting from the introduction of the Euro in 1999 to 2010.

1.3. Purpose and Significance of the Research

During the early 1990s, the economies of the Franc Zone had faced severe financial and economic crisis characterized by a deterioration of terms of trade of about 40%, coupled with deflationary fiscal policies[3] significantly weakened their economic performance. Several analysts have attributed this crisis to the substantial overvaluation of the CFA Franc and the subsequent extended loss of competitiveness. This situation had lead to the inevitable nominal devaluation of the CFA franc by 50% against the French franc (the anchor currency) in January 1994.

The recent prolonged appreciation of the Euro[4] have raised concerns about its implications to the CFA Franc, the international competitiveness of the CFA zone member countries and accordingly to their economic development. A consistent fear of a second devaluation and a significant debate had been recently observed in the public opinion of this currency zone leading to a recent unfounded anticipation of devaluation of the CFA Franc in 2012. The fear of this event spread throughout the Franc Zone and has created a psychosis, renewing the debate on the devaluation already known in 1994.

This study proposes to empirically appraise these claims and investigate on the potential overvaluation of the CFA Franc and the subsequent impact of an exchange rate misalignment in general on the economies of the region. Issues related to the determinants of the real exchange rate, its evolution over time and its position relative to its equilibrium level play an important role in both academic and political works (several authors have addressed this question including Cassel (1916); Clark and MacDonald (1999); Edwadrs (1989); Hinkle and Montiel (1999) and Williamson (1985)).

However, the choice of the study period as from the introduction of the Euro is justified by the fact that the overvaluation of the real effective exchange rate in the CFA zone during the pre-devaluation period had been substantially established in the literature (see for instance Lendjoungou F. (2009); Yasser and Tsangarides (2006); and many other studies[5]). Various other authors analysed the reaction to the currency devaluation, investigated the behaviour of the CFA Franc in the post devaluation period and mainly recognised a sharp recovery at the

[3] The ratio of tax to GDP, declined from almost 15 percent of GDP in the early 1980s to only 11.5% in the early 1990s (C.S. Adam, D.L. Bevan and G. Chambas, 2000)

[4] The Euro had noted a 40% appreciation for the period 2002 – 2010 (B. Gnimassoun, 2012)

[5] Devarajan (1997) and Cottani et.al (1990), Cécile C., Issiaka C., and Olivier D., (2011)

wake of the devaluation (see Etta-Nkwelle and Jeong 2006). In the view to avoid repeating these previous works, this study chose to focus on the period after the introduction of the Euro in order to assess how the new currency impact on the CFA Franc real exchange rate. This will also allow investigating the claim of the adverse effect of the high appreciation of the Euro to the CFA Franc with more accuracy. In addition to estimating the equilibrium real exchange rate, this study proposes to further examine the impact of the real exchange rate on the economic growth of the CAEMC member countries.

1.4. Research Assumptions

As the data used in this study are mainly secondary data, it was assumed that they are accurate. This assumption was based on the reputations of the sources from which the data was collected. Also the research instruments were assumed reliable and produce valid results.

The study also assumed that the study period 1999 – 2012 (twelve years) is long enough to be characterised as a long term. The theoretical methodology used prescribes that the equilibrium real exchange rate is determined by the long term economic fundamentals. Furthermore, the estimation of the growth equation will be more accurate if the study consider a long term period.

Finally, the economies of CAEMC were assumed comparable enough to allow being included in the same panel. In this case we can expect the determinants of the exchange rate and economic growth to move in the same direction and same extent for all the countries allowing the panel to produce one estimating equation for all the countries.

After this introductory section, the remaining of this paper is organised as follows: section 2 will explore the literature review. In section 3, the theoretical as well as empirical methodology followed in the study will be presented. Then section 4 presents and analyses the research findings and subsequently, the research conclusions will be drawn in section 5. And ultimately, some recommendations for future research will be provided in section 6.

2. LITERATURE REVIEW

2.1. Background to area of study

Real equilibrium exchange rate has been a topic of interest to economists and policy makers for about a century and Balassa (1964) reemphasized the question and inspired more researchers to empirically investigate about various issues related to real exchange rate. Empirical studies on real exchange rate misalignment and its impact on growth have increasingly being published in the last decade.

The notion of real exchange rate equilibrium is normally associated with the combination of external and internal balance (Williamson, J., 1994). Estimating equilibrium exchange rate has been a vibrant topic in the international economics for several decades especially after the break down of the Bretton Woods systems and at the wake of the various currency crises[6] that occurred within fixed exchange rate regimes in developing countries during the 1990s. Accordingly, lot of works has been done to explain these currency crises and to tackle more related issues. Economic theories and literatures provide the foundation of the various models and tools used in estimating the equilibrium of an exchange rate, explain the origins of misalignments of the Real Exchange Rate (RER) and establish theoretically and empirically the link of the REER misalignment with economic performance, and growth.

Before any estimation of equilibrium exchange rate is being conducted, it is essential to classify some key concepts related to it and identify different possible measurements of equilibrium exchange rate. Studies on equilibrium exchange rates have dealt with a wide range of nominal, real, and effective exchange rates.

2.1.1. Nominal Exchange Rate

The nominal exchange rate is the rate observed on the foreign exchange market and could be defined as the amount of a national currency in foreign currency or vice versa. Depending on the monetary policy, the nominal exchange rate is determined by the law of demand and supply on the foreign exchange market for floating exchange rate regimes or prefixed for non floating currencies as it is the case with the CFA Franc. The nominal exchange rate can be quoted in two ways: direct or indirect quotation. The direct quotation means expressing the

[6] These crises include the 1994-95 Mexican crises, the 1997 Asian crisis, the 1998 Russian crisis and the 1999 Brazilian crisis.

exchange rate as units of foreign currency that can be exchanged with one unit of national currency. The indirect quotation in contrast expresses the exchange rate as units of national currency that must be provided for one unit of foreign currency.

2.1.2. Reel Exchange Rate

The prevailing definition recurring in the modern literature describes the RER as the domestic relative price of nontradable goods to tradable goods. The definition of the nominal exchange rate does not reflect the differences in purchasing power between currencies. To account for this, one must consider the real exchange rate that allows him to compare the prices of goods between two countries. The real exchange rate (RER) is the nominal exchange rate between two currencies deflated with prices. Several RER calculations methods can be considered: the RER based on relative consumer prices, from international terms of trade, or on the basis of the internal terms of trade. Thus, we have the following three definitions of the RER:

$RER = e * \frac{p}{p^*}$: Relative consumer prices;

$RER = \frac{P_T}{P_T^*}$: International terms of trade;

$RER = \frac{P_T}{P_{NT}}$: Internal terms of trade;

Where: P, P_T, P_{NT} respectively mean domestic consumer prices, prices of tradables and prices of nontradables. An asterisk (*) denote for foreign country.

2.1.3. Reel Effective Exchange Rate

The real effective exchange rate is calculated as the weighted average of the bilateral exchange rates of a National currency against those of its trading partners. Indeed, during the same period, a currency may appreciate relative to some currencies and depreciate against some others. In addition, for a country, different currencies have not the same weight since the dimension of trade with the countries using these currencies differs. Thus, the effective exchange rate is a weighted average (by the trade weight of each country in the foreign trade of the country concerned) of bilateral exchange rates. It is also possible to determine an

effective exchange rate (REER) as weighted average of bilateral RER (between two currencies). The following equations though define the REER7:

$\text{NEER} = \prod_{i=1}^{n}(\text{NBER}_i)^{\alpha_i}$: Nominal Effective Exchange Rate

$\text{REER} = \text{NEER} * \prod_{i=1}^{n}(\frac{\text{CPI}}{\text{CPI}_i})^{\alpha_i}$: Reel Effective Exchange Rate

Where: NBER is the Nominal Bilateral Exchange Rate, α_i is the trade weight with country i.

2.1.4. Exchange Rate Misalignment

Exchange rate misalignment can be defined as the deviation of the real exchange rate from its long term equilibrium level determined by economic fundamentals for a sustained time period. This is in accordance with Edwards' (1989, p6) definition who defined exchange rate misalignment as a "sustained deviation of the actual RER from its long-run equilibrium level." 8 An exchange rate is labelled "undervalued" when it is more depreciated than the equilibrium rate and "overvalued" when it is more appreciated than the equilibrium rate (Razin and Collins 1997). Edwards (1989) further defined Equilibrium RER as "… the relative price of tradable to nontradable that, for given (equilibrium or sustainable) values of other relevant variables such as trade taxes, international prices, capital and aid flows, and technology, results in the simultaneous attainment of internal and external equilibrium" Edwards (1989, p9). REER appreciation signifies a loss of competitiveness.

2.2. Theoretical Foundation of Equilibrium Exchange Rate

2.2.1. Purchasing Power Parity (PPP) Theory

According to the PPP theory, the bilateral exchange rate between two currencies is determined by the relative internal purchasing power of the two currencies. It ensures that purchasing power between the two currencies are equal. The PPP theory holds that with a certain amount of money in a given currency area, an economic agent must be able to purchase the same basket of goods in the area and outside the area, once the currency is converted. This is the fundamental assumption of the PPP theory known as Law of One Price 'LOP'.

[7] Appendix A provide a more detailed methodology applied in computing the REER: I followed the methodology used by the "BEAC"
[8] Cited in Thandinkosi N., 2010

Absolute PPP

Absolute PPP is the transposition at the macro level of the law of one price for individual goods. It states that the general price level must be the same in every country when it is expressed in the same currency, or that the real exchange rate must be equal to one:

$e^* = e * \frac{P}{P^*} = 1.$ Where: e, e^*, p and P^* represent nominal and reel exchange rate, domestic and foreign price levels respectively.

This condition is necessary to prevent the arbitrage between domestic goods and foreign goods which is assumed to prevail within perfectly competitive markets.

If P* < eP, demand of foreign goods increases requiring the purchase of foreign currency, which increases the supply of domestic currency against foreign currency on the foreign exchange market thus provoking a depreciation of the national currency and reducing the price of national assets expressed in foreign currency. Conversely, if P * > eP, arbitration is favourable to domestic goods and generates an increase in the exchange rate e. At equilibrium, any arbitrage opportunity disappears and the foreign price level is aligned with the level of domestic prices expressed in foreign currency. The purchasing power of a unit of currency is the same in the country (1 / P) and abroad (e / P *).

Assumptions of absolute PPP are quite restrictive: it implies the no transaction costs, the exchange rate is determined only by trade flows, and the goods and services produced in different countries are assumed perfectly homogeneous and finally, all goods and services are traded internationally.

Relative PPP

This version allows the prices to differ but in proportion of one another and rather focuses on exchange rate variations. It modifies the law of one price and explains situations where foreign and domestic prices are proportionally equal. $P^* = k * Pe$. Where: k represents the constant gap between the prices.

Changes in the nominal exchange rate allow the LOP to maintain the real exchange rate constant k at a value which is not necessarily unity. Thus, at dates t and t +1, the above relation requires the following condition to be satisfied:

$\frac{e_{t+1}-e_t}{e_t} = \frac{\pi - \pi^*}{1+\pi^*} \approx \pi - \pi^*$ Where: $\pi = \frac{P_{t+1}-P_t}{P_t}$ and $\pi^* = \frac{P^*_{t+1}-P^*_t}{P^*_t}$ are domestic and foreign inflation rates.

Therefore, a country with an inflation rate higher than that of its main trading partners should see its currency depreciate at a rate equal to the inflation differential. Conversely, domestic inflation that is lower than foreign is associated with an appreciation of the domestic currency. Despite the modification of the assumption that the real exchange rate is equal to unity, the relative PPP remains restrictive as other assumptions remain unchanged.

Indeed, the existence of transaction costs, non-tradable goods, non-commercial transactions that may affect exchange rates as well as differences in the demand behaviour are limitations to the relative PPP.

2.2.2. Interest Rate Parity Theory

The Interest Rate Parity Theory (IRP) establishes a link between the interest rates differential, exchange rates and the forward rate. Depending on whether or not economic agents are covered against the risk engendered by the unanticipated change in the exchange rate, there are two versions of the IRP.

2.2.2.1. Uncovered Interest Rate Parity (UIP)

UIP establishes an equilibrium relationship between the spot exchange rate, the forward rate and the domestic and foreign interest rates. According to this theory, assets denominated in a currency which is expected to depreciate should get the corresponding country's interest rate rises to offset the capital loss associated with this anticipated depreciation.

Let X equals to capital expressed in national currency, e_t the exchange rate at time t, i_t and i^*_t the domestic and foreign interest rate respectively, e^a_{t+h}, is the anticipated exchange rate on t for date t + h. After h periods, investment capital X on domestic and foreign markets respectively become: $X(1+i_t)^h$ and $X(1+i^*_t)^{h\frac{e^a_{t+h}}{e_t}}$

As long as there is a difference between investment returns on the domestic capital market and the foreign capital market, capital transfers offer potential gains. Any possibility of arbitration will be eliminated at equilibrium by equalizing investment returns on the domestic and foreign investments.

For h = 1, it is shown that: $\mathrm{Log}(e^{a}_{t+1}) - \mathrm{Log}(e_t) = \mathrm{Log}(i_t) - \mathrm{Log}(i^{*}_t)$

The spot nominal exchange rate is influenced by the interest rates differential and expectations about the exchange rate. For a given level of the anticipated exchange rate an increase in the domestic interest rate raises the yield of securities denominated in national currency. The arbitration in favour of national securities created an excess demand for domestic currency on the foreign exchange market, and the readjustment for equilibrium results in an appreciation of the domestic currency. Conversely, an increase in the foreign interest rate leads to a depreciation of the domestic currency. For a given interest rate levels, a reduction in the anticipated exchange rate favours the arbitration for foreign assets. On the foreign exchange market, the resulting increased demand for foreign currency will be translated into a reduction of the spot rate thus restoring the UIP condition.

2.2.2.2. Covered Interest Rate Parity (CIP)

The CIP accounts for the exchange rate risk. Thus, in order to hedge against unanticipated changes in the exchange rate, traders consider the forward rate and not on anticipated exchange rate. The difference in relative terms, between the spot rate e and the forward rate f: $\frac{f-e}{e}$ is called premium if it is positive and discount if it is negative. On the foreign exchange market, the following equilibrium condition eliminates any arbitrage opportunity:

$$i = i^{*} - \frac{f-e}{e}.$$

Therefore, according to the CIP theory, the domestic interest rate equals the foreign interest rate, decreased by the forward premium, or increased by the forward discount of the domestic currency. In sum, differences in interest rates are compensated by a premium or a discount on the exchange rate since arbitrageurs make the forward exchange rate fluctuate so that any arbitrage opportunity created by these differences in interest rates disappears.

2.2.3. The Balassa-samuelson Effect

Balassa (1964) and Samuelson (1964) challenged the PPP LOP and invalidate some of its assumptions. They argued that the law of PPP might not be verified due to the existence of non-tradables. Their theory had been significantly valued in the exchange rate literature and is referred to as the "Balassa-Samuelson effect". It is also called the productivity differential approach. The basic assumptions underlying the Balassa-Samuelson model firstly assumes that PPP holds within the tradables (open); sector recognise the significance of the

nontradable (sheltered) sector and highlight some constant returns to scale in production. Moreover, capital is internationally mobile as opposite to labour which does not move internationally but is mobile between the traded and nontraded sectors (Driver and Westaway, 2003). This theory also assumes that wages depend on productivity in both open and sheltered sectors.

The Balassa-Samuelson effect assumes that labour is the only factor of production. Labour productivity in the tradable sector increases faster in high-growth economies (developing countries) than in the same sector of low growth countries (developed economies). The productivity of nontradable sector grows at weaker rates in both countries. According to the authors, this effect is due to differences in productivity between the two sectors and the relative level of development of the country compared to the rest of the world. An increase in productivity in the tradable sector leads to a real exchange rate appreciation. This justifies the fact that developing countries are experiencing an appreciation trend of their real exchange rate.

2.3. Measuring the Equilibrium Real Effective Exchange Rate and Misalignment

To estimate the equilibrium exchange rate and assess its misalignment with the Real Exchange Rate, economists established a wide range of methodologies. MacDonald (2000) critically discussed different approaches one can use to approximate an equilibrium exchange rate. He described the different methods and noted the advantages and limitations of each of them. Similarly, a more recent study by Siregar (2011) reviewed the literature and explored the most used 'theoretical and empirical models of equilibrium exchange rate'.

2.3.1. The Purchasing Power Parity (PPP)

The most traditional and popular approach in assessing the equilibrium exchange rate in the literature is the Purchasing Power Parity (PPP). The works of Cassel (1916, 1918) established the foundation of this theory. The PPP approach determines the long-term nominal exchange rate which makes equal the Foreign and domestic price levels. The fundamental notion of the PPP theory claims that foreign and domestic price levels determine the equilibrium exchange rate: $E^{PPP} = \frac{P}{P^*}$: (Siregar, 2011).

However, a number of limitations and critics of this approach were emphasized over the years. The fundamental assumptions (known as Law of One Price 'LOP') of the PPP hardly

hold, especially in developing countries where weak financial institutions prevail (trade impediments, capital and price controls etc). A fundamental limitation of the PPP approach was stated by Balassa-Samuelson (1964) who revealed that the PPP fails to account for the disparity in the relative productivities of tradable versus non-tradable goods of the domestic and foreign economies. This criticism is then known as the Balassa effect. Égert (2003) related the limitations of the PPP to differences in consumption and production patterns, existence of non-tradable goods, imperfect competition, and pricing to market.

Although these numerous critics associated with the PPP approach, some supports were established in the works of Dornbush (1976); Frenkel (1981) and Krugman (1978). Zafar (2005) used the PPP to estimate the degree of misalignment of the CFA Franc from the introduction of the Euro in 1999 to 2004 for both Central African and the West African unions. He found that both regions had lost export competitiveness due to an appreciation of the CFA Franc REER and the volatility of the Euro bilateral exchange rate.

The establishment of the limitations of the PPP has renewed the interest of academics to account for the issues raised in their analysis and to explore alternative ways of estimating equilibrium exchange rate. As a result, various approaches have been developed. Some of which have combined the PPP with some other hypothesis (Monetary Extension of PPP and the Capital Enhanced Measures of the Equilibrium Exchange Rate – CHEERS).

2.3.2. The Monetary Approach

The Monetary approach to Equilibrium Exchange Rate is attempting to correct some shortcomings of the PPP and thus is its direct extension. It theoretically links the nominal exchange rate to some macroeconomic fundamentals and assumes a money market equilibrium condition whereby price is flexible and is determined by the differential of the supply of money, incomes and nominal interest rates in the domestic and foreign economies. As simply put by Siregar (2011), this approach expresses the nominal exchange rate as function of the excess money supply, output and nominal interest rate in the local economy relative to their levels in the foreign economy. Nevertheless, academics have naturally expressed diverge views in support of that approach. Some have established some empirical evidence on the significance of that approach and used it in their works and obtained convincing results. Husted and MacDonald (2000) for instance based their analysis on the monetary model and estimated the misalignment of East Asian Currency at the eve of the 1997 crisis. Similarly Chinn (1998) included a relative productivity term in the model to

assess seven East Asian currencies for the period 1974 to 1997 and concluded that five of these currencies are overvalued. On the other hand, Cushman (2000) demonstrated that the monetary model did not hold for the US-Canadian exchange rate. Before then, Meese and Rogoff (1983) found the monetary model very weak and as they put it, underperformed if compared to 'a naïve random walk model'.

2.3.3. The Capital Enhanced Measures of the Equilibrium Exchange Rate (CHEERS)

Another variant of the PPP is the Capital Enhanced Measures of the Equilibrium Exchange Rate (CHEERS) which combines the PPP with the UIP condition in estimating an Equilibrium Exchange Rate and explaining the persistence in real exchange rates. This approach expands the PPP theory and accounts for the concern that the real exchange rate may be away from the PPP determined equilibrium as a consequence of non-zero interest rate differentials. As formulated by MacDonald (2000), the basic suggestion of this approach is that "there is long term persistence in both the real exchange rate and the interest rate differential". This approach assumes that, PPP will hold in the very long term when interest rate differentials are zero, the real exchange rate will thus be constant (Driver and Westaway, 2004). Various empirical works have been realised in support and extension of the CHEERS (Juselius (1991); Juselius and MacDonald (2000); Johansen and Juselius (1992); MacDonald and Marsh (1997)). MacDonald (2000) highlighted the merits of this approach in that robust measures of equilibrium may be derived from the CHEERS statistical expression.

2.3.4. The Fundamental Equilibrium Exchange Rate (FEER)

The Fundamental Equilibrium Exchange Rate (FEER) also known as the macroeconomic approach is another methodology pioneered by Williamson (1983, 1994) and determines the equilibrium exchange rate based on macro-economic fundamentals. It is a variant of the Internal-External Balance approach (IEB). The underlying idea is to determine an equilibrium exchange rate which would simultaneously allow an achievement of internal and external equilibrium in an economy. "In accordance with the Williamson's definition, the FEER is the real effective exchange rate that simultaneously secures internal and external balance for a country or for a number of countries." (MacDonald (2005, p)). Williamson described some basic features of the FEER and stated for instance that internal balance is achieved when the economy is operating at a low inflation environment and full employment; and external balance is characterised by a "sustainable balance of payment position over a medium-term horizon" which ensure the sustainability of both net flows of resources and external debt.

This approach is particularly appropriate in assessing whether a real exchange rate movement reflect a misalignment or whether changes in key economic fundamentals had forced the equilibrium to shift from its initial level (Abdih and Tsangarides, 2006) Despites the various advantages associated with this methodology notably the ease to interpret its results, various critics highlighted some shortcomings of the models.

Nevertheless, several empirical studies have based their analysis on the FEER in estimating the equilibrium exchange rate. Abdih and Tsangarides (2006) used the FEER approach to determine the misalignment of the CFA Franc (annual data from 1975 to 2005). They concluded that in the long run, the real exchange rate behaviour is affected by changes in some economic fundamentals namely: the terms-of-trade, government consumption, investment, openness and productivity. They further established that in both the West African and Central African regions, the CFA Franc were overvalued before the 1994 devaluation and came back in line in 2005 with the equilibrium REER though leaving no statistically significant misalignment. Coudert and Couharde (2005) found significant undervaluation of the Chinese Renminbi in 2002 and 2003 using the FEER. They also addressed the issue of "Balassa effect" and found a lack of such an effect in China.

2.3.5. The Behavioural Equilibrium Exchange Rate

The Behavioural Equilibrium Exchange Rate is based on the concept of the uncovered interest rate parity (UIP) and was established by works of MacDonald (1997) and Clark and MacDonald (1998). This approach does not only estimate the equilibrium exchange rate, analyses a number of macroeconomic fundamentals but explains at the same time the correlation of a set of economic variables and the REER. This approach has gained popularity in the last decade and arguably is the most used methodology in estimating the equilibrium REER in recent years. Etta-Nkwelle and Augustine (2008) examined the behaviour of the Reel Effective Exchange Rate of the WAEMU and found evidence that the WAEMU' CFA Franc was overvalued at the wake of the 1994 devaluation (ranging from 12 percent in 1995 to 25 percent in 2006). They further classified the WEEMU countries by the size of the economy; agricultural exports dominance and diversification and concluded that: (a) misalignment were more significant in agricultural economies (were agriculture dominates exports) than non agricultural economies; (b) medium-sized economies observed more REER misalignment than small-sized economies and (c) diversified economies had less overvalued

REER than non-diversified economies. Atsushi (2006) used the BEER to assess if the Botswana's currency were misaligned during the period 1985–2004 and established that the pula was undervalued in the later 1980s but overvalued in recent years though providing evidence that the 2004 devaluation was rational and empirically justified. Similarly, Baffe, Elbadawi and O'Connell (1999) used a variant of the BEER (the Equilibrium Real Exchange Rate) and found that in Burkina Faso the CFA Franc was undervalued in 1993 while it was overvalued in Cote d'Ivoire although both countries use the same CFA Franc.

MacDonald and Dias (2007) estimated the Behavioural Equilibrium Exchange Rate for ten Industrialized and emerging economies that rank amongst the fifteen contributor economies to global imbalance for the 1988 to 2006 period. Accordingly, they suggested some necessary exchange rate adjustments.

2.3.6. The Permanent Equilibrium Exchange Rate (PEER)

Another commonly used exchange rate misalignment measurement is the Permanent Equilibrium Exchange Rate (PEER), which is similar to the BEER and suggests that real exchange rate should be decomposed into temporary and permanent factors. Only the later component should be considered as measure of equilibrium (MacDonald, 2000). As the misalignment reported by the BEER could be reflecting transitory factors and random errors, this is an attempt to correcting one shortcoming of the BEER (the short term feature). It is an extension of the BEER, which advocates that the equilibrium exchange rate is mainly impelled by the long-term sustainable levels of identified economic fundamentals (Siregar, 2011). Many models and techniques have been developed to decompose non-stationary series into the temporary/stationary and the permanent component (Gonzalo and Granger, 1995 and Stock and Watson, 1998)). To strengthen the BEER, some studies combine it with the PEER to capture the time component of the misalignment in the model. Maeso-Fernandez, et.al. (2002) combined the BEER and the PEER to analyse the medium-term determinants of the Euro effective exchange rate for the period of 1975 to 1998 and found that real interest rates and productivity differentials; the relative fiscal stance and the real price of oil significantly impact on the Euro effective exchange rate. They also compared the reported estimates using both methods and found no significant different. Nevertheless, they suggested that although both methodologies revealed the same answers, the PEER was smoother than the BEER.

2.3.7. The Natural Rate of Exchange (NATREX)

The Natural Rate of Exchange (NATREX) introduced by Stein (1994), Stein and Allen, and Stein and Paladino (1998) excludes speculative and cyclical factors and suggests that the sustainable capital account should equals to savings minus desired investment. In accordance with Stein's definition, the NATREX is "the rate that would prevail if speculative and cyclical factors could be removed while unemployment is at its natural rate" [Stein, 1994, p135]. Similarly, Stein 1994 considered productivity and social thrift as the main fundamentals affecting savings and investment, the current account and thus the NATREX (Siregar, 2011 And Stein, 1994), argued that ultimately the NATREX rate will converge to a 'static long-run rate'

2.4. Reel Effective Exchange Rate misalignment and economic growth: The literature

The impact of exchange rate misalignment on economic growth has been theoretically and empirically established in the literature for several decades (see Cottani, et al. (1990); Edwards (1988); Meade (1951) and Razin &Collins (1997)). Various studies have examined the effects of exchange rate misalignment on economic stability and performance of countries and predominantly adhere to the view that exchange rate matters for economic development. As real exchange rate have not been considered as a significant variable in most of the growth models, a key issue however is to identify transmission channels through which it affects growth and to appreciate its policy implications. The most dominant channels recurring in the literature corroborate with the view of Levy-Yeyati and Sturzenegger, (2009); the "capital accumulation channel" and the "total factor productivity (TFP) growth channel.

In a popular paper, as traditional neoclassic growth models do not consider exchange rate as a key determinant of economic growth. Eichengreen (2007) explored this question and demonstrated the role exchange rate plays in the growth process. He addressed different ways exchange rate levels, misalignments and volatility may affect economic development. A central channel highlighted in this paper is the "export-led growth". The author argues that, exchange rate could promote the export sector by giving more incentive to shift resources into manufacturing for export thus increasing national income. This will in turn boost up domestic saving therefore financing higher levels of investment, which he presumes will

accordingly foster growth.9 In the same way, Razmi, Rapetti and Skott (2012) more recently suggested that the existence of (hidden) unemployment and the reliance on foreign capital goods provide some explanations on how the real Exchange rate impacts on the developing countries' economies.

Exchange rate volatility is another issue raised by Eichengreen, (2007) which he argues negatively affect economic growth. This view is also support by several works (Aghion et al. (2009); Diallo (2011) and Razin and Collins (1997)). A key suggestion of Eichengreen's (2007) work is that a stable and appropriate real exchange rate should be perceived as a growth "facilitating condition". He argues that keeping the real exchange rate at appropriate levels and avoiding excessive volatility is significant for an economy's growth and development. He further recognised however that there are also more significant fundamentals explaining that link (see Eichengreen, 2007).

Accordingly, several works have attempted to examine the relationship between exchange rate misalignment and growth and mostly found a negative correlation (Dollar, 1992; Ghura & Greenes, 1993). However, it has been evidenced that the nature of the misalignment as whether it is an overvaluation or undervaluation is fundamental. Studies suggest that overvalued currencies hinder economic growth whereas undervaluation can foster growth. This is evidenced for instance by the work of Béreau, Villavicencio and Mignon, (2009), who in their attempt of establishing the link between real exchange rate and economic growth suggested that the effect of misaligned RER on economic growth depends on the sign of the misalignment. They found a negative relationship between overvalued currencies and growth as opposed to undervaluation which is positively correlated with economic growth. They considered a wide sample of countries in their analysis including both developed and developing economies and annual data from 1980 to 2007. Their results were based on a nonlinear model they estimated relying on the Panel Smooth Transition Regression (PSTR) model.

Similarly, MacDonald and Vieira, (2010) assessed the impact of real exchange rate misalignment on long run growth for a set of ninety countries. They first measured the RER misalignment using a panel data model for the 1980 to 2004 period. Their growth analysis were based on a two-step System GMM panel growth model and shows that overvalued real exchange rate hinders long-run growth whereas undervalued real exchange rate produce the

[9] Asian countries and more recently China have succeeded with that growth model ….

opposite effect enhancing economic growth. They also fund the relationship to be stronger for developing and emerging countries meaning that the growth path of these countries are more significantly affected by real exchange rate misalignment than developed economies. According to the authors' estimates, if real exchange rate misalignment increases by 10%, annual per capita GDP growth will accordingly experience a 0.3% increase.

Likewise, a more popular study on real exchange rate misalignment and growth by Rodrik (2008) found similar results. He investigated this relationship for a large sample of 184 countries using a time series data from 1950 to 2004. The author defines a misalignment (under or – overvaluation) index as a measure of domestic price levels adjusted for the Balassa-Samuelson effect. Rodrik (2008) established that undervalued exchange rate stimulates economic growth and overvalued currencies hinder growth. He joins the view of Eichengreen, (2007) and argues that this is accomplished by enhancing the tradable sector (especially the industry) shifting resources from nontradable to tradable sector. Rodrik (2008) explained why the relative price of tradables and the tradable sector size significantly affect growth and discussed the corresponding mechanisms. He argued that undervaluation improves the productivity of the tradable sector thus helping to overcome a set of institutional weaknesses and market failures prevailing more particularly in low income developing countries. This argument is contrasted in Berg and Miao's (2010) work with the "Washington Consensus" (WC) view suggesting that real exchange rate misalignment is associated with macroeconomic imbalances which are in turn considered harmful for growth. The authors confirmed Rodrik's findings and conclusions, highlighted an identification problem and prescribed some adjustments to the WC viewpoint.

Gala and Lucinda (2006) incorporated an overvaluation index in their analysis and estimated a growth regression. Their model adjusted the exchange rate estimates for the Balassa – Samuelson effect using a variant of PPP. The authors stressed that the productivity differential may significantly explain the relationship between real exchange rate levels and per capita real income growth rates. They considered 58 developing countries for the 1960 to 1999 period into their panel data analysis and concluded that exchange rate levels affect real GDP per capita growth rates. They specifically related real exchange rate overvaluations to growth and advocated that overvaluation has a negative impact on growth. This is in line with the earlier work of Ghura, (1993) who investigated the link between real exchange rate misalignment and economic performance for 33 sub-Saharan African countries and found a

negative relationship. Ghura's work also studied the effect of the variability of real exchange rate on real income growth, exports, imports and investment and confirmed Edwards's (1990) who found that real exchange rate variability adversely affect real income growth and investment during the period of floating exchange rates. A more recent empirical paper by Diallo, (2011), also reinforced that view. They considered a panel of 42 developing countries and concluded that real exchange rate misalignment and volatility negatively affect exports.

Sallenave (2009) provided answers to the implications of the real effective exchange rate misalignments to the G20 countries' growth question. Before investigating this relationship for the 1980-2006 periods, they used the BEER approach to estimate the real effective equilibrium exchange rates and thus the misalignment. A dynamic panel growth model was estimated to this end. Their study found a hampering effect of exchange rate misalignment on the G20 economies' growth and argued that the misalignment could be significantly controlled by efficient exchange rate policy and growth could be enhanced thereof. The authors equally noted significant differences between developed and emerging economies forming the G20 in terms of the misalignment magnitude and the speed of adjustment towards equilibrium. On one hand, real effective exchange rates were found closer to the estimated equilibrium level in developed economies than in emerging countries and the later group of countries tends to recover and its real exchange rate converge to equilibrium faster than the former group on the other hand.

2.5. Some Empirical studies on the CFA zone

Number of study were interested in estimating the equilibrium real exchange rate and examining the behaviour of the CFA Franc real exchange rate especially during and after the high overvaluation period preceding the 1994 devaluation and the prolonged appreciation of the Euro period. Accordingly, Zakar (2005) evaluated the impact of the appreciating Euro on the CFA zone. He first estimated the degree of misalignment of the CFA franc since the introduction of the euro in 1999 using relative purchasing power parity for both the CAEMC and the WAEMU regions. A monthly panel dataset from January 1999 to December 2004 was constructed in the process of determining the equilibrium exchange rate. He evidenced that the high appreciation and volatility of the Euro explain the appreciation of the CFA Franc in both the regions (by approximately 8 percent in WAEMU and 7 percent in CAEMC). The author concludes that a strong euro would result in an appreciated REER in

the CFA zone and noted that the low inflation targeting policies adopted by the two regional central banks contributed to a lessening of the degree of appreciation.

Abdih and Tsangarides, (2006) assessed the deviation from the long-run equilibrium paths of the real effective exchange rates of the two regions of the CFA zone. They based their analysis on the FEER method and the Johensen cointegration approach to make out the significant real exchange rate determinants. The fundamentals explaining the behaviour of the REER for both the CAEMC and WAEMU regions are the terms of trade, government consumption, and productivity. These three determinants positively correlated with the real exchange rate. However, investment and trade openness are also significant but present negative coefficients. The estimated equilibrium real exchange rate revealed that the 1994 devaluation was necessary as the real exchange rates were completely out of line with the long term equilibrium level determined by their economic fundamentals. Amazingly, the authors found that real effective exchange rates were broadly in line with their long-run equilibrium levels for both the regions at end-2005. The results further indicates that the speed of adjustment of the REER back to the equilibrium level following a shock is two time higher in the WAEMU than in the CAEMU.

As the overvaluation of the CFA Franc was had been sufficiently established during the pre-devaluation period, Etta-Nkwelle and Jeong, (2006) proposed to investigate the post-devaluation period for potential overvaluations. In the process of achieving this objective, they used the Hodrick-Prescot filter to decompose the considered macroeconomic variables into permanent and transitory components. Although the significant recovery towards the equilibrium level, the results indicate that the CFA Franc real exchange rate still overvalued in 2004 (25% against 85% for the pre-devaluation period). More interesting observations were underlined by the authors. They suggested that the extent of overvaluation is more pronounce in agricultural countries. 10 Conversely, medium sized economies are less overvalued than small sized economies and Oil producing countries observe less exchange rate overvaluation than nonoil producing countries.

Lendjoungou, (2009) analysed the real exchange rate and the competiveness in the CAEMC from 1979 to 2008 using the FEER. The author determined the equilibrium real exchange rate from the estimated short and long term parameters using the Engle and Granger (1987) two-stage co-integration technique. The estimated equilibrium equation identified terms of trade,

[10] Countries in which agriculture is dominant and represents a significant share in the economic activity

public spending, trade openness and productivity as the most significant real exchange rate determinants. These estimations are consistent with those of Abdih and Tsangarides, (2006) who found investment statistically significant in addition to these determinants. The results also indicate that the CFA Franc was highly overvalued in the years preceding the 1994 devaluation and accordingly significant loss of competitiveness. However, he found no evidence of recent overvaluation in the real exchange rate.

More recently, Couharde, Coulibaly and Damette, (2011) studied the misalignment of the CFA Franc and the adjustment process of the REER back to its equilibrium for the period of 1985-2007. The authors interestingly proposed to investigate if the appreciation experienced by the CFA Franc during the 2000s had caused the RER to overvalue in 2007 on a scale comparable to that observed before the 1994 devaluation? They found no evidence to conclude with an affirmative answer to this question. One originality of this paper lies of the estimation of a panel smooth transition error correction model in order to take into account nonlinearities the REER misalignment adjustment process back to the equilibrium level. The results indicate that the speed of adjustment towards the equilibrium level substantially differs from the two regions. Conversely to results highlighted in the work of Abdih and Tsangarides, (2006), this study suggests that the seed of adjustment of the misaligned real effective exchange rate in the CAEMC was higher than that of the WAEMU indicated a more sustained misalignment in the later region. This study had also highlighted substantial heterogeneity between the countries of the CFA zone.

Similar results were found in the work of Gnimassoun (2012) who examined the behaviour of the CFA Franc before and after the devaluation. Using the BEER approach, the author applied the Pedroni (1995, 1997) panel cointegration technique to estimate the equilibrium exchange rate of the CFA Franc. The estimated equilibrium model validate terms of trade, productivity and investment as significant determinants of the real exchange rate. In line with the previous studies, he also observed highly overvalued real exchange rate during the pre-devaluation period and noted that the devaluation had help readjust back to equilibrium levels, regain competitiveness and boost economic activities of the CFA zone. However, the introduction of the Euro and its appreciation since 2002 had increasingly reducing the competitiveness of the CFA zone products. Indeed, the author investigated if the misalignment of the CFA Franc was explained by misalignment of the anchor currency and effectively found evidence that except for the period of high appreciation, the misalignment

of the anchor currency plaid a significant role. The results also unlined a "Dutch disease" in the CFA zone.11

2.6. Literature review Conclusion

The above discussions reviewed some key concepts related to equilibrium exchange rate, estimating misalignment and its implications on economic growth with the support of some exchange rate explanatory theories and empirical evidence in the literature. Although all the described theoretical and empirical approaches seek to provide exchange rate misalignment measurement and explications, each has its particularities and is more appropriate for a particular set of studies and countries. One measure of exchange rate may capture movements of the exchange rate associated with shocks from the local economy, while other measurements incorporate both internal and external factors. Therefore a choice of a good assessment technique is vital for the consistency and robustness of a study. The literature on exchange rate misalignment and economic growth has increasingly gained attention and numerous studies have attempted to investigate the impact of the exchange rate misalignment and variability on exports, external competitiveness, economic performance and economic growth. Most studies exploring this question focus on Asian, Latin American, and eastern European emerging countries. These studies established the significance of the real Exchange rate misalignment in explaining economic growth and generally underline a negative relation with exchange rate overvaluation and growth but a mixed view on the impact of an undervaluation and economic performance. However, the literature review process highlighted a limited attention on the CAEMC region. Nevertheless, some studies have considered a number of Sub-Saharan African economies including countries form the Franc zone12 especially from the WAEMU but they mostly focused on estimating the equilibrium real exchange rate and its determinants. This study fits in to fill to gap and in addition to estimating the real exchange rate misalignment for the CAEMC, extend the existing literature by studying its impact on economic growth of the region.

[11] We talk about Dutch disease when international official aid causes the recipient country's currency to appreciate.

[12] CFA Franc zone is comprised with two monetary unions CAEMC : Cameroon, Chad, Central African Republic, Congo Republic, Equatorial Guinea and Gabon on one hand and WAEMU : Benin, Burkina Faso, Côte d'Ivoire, Guinea-Bissau, Mali, Niger, Senegal, and Togo on the other hand and the Comoros Republic

3. RESEARCH METHODOLOGY

3.1. Research Approach and Strategy

In order to achieve its objective, this research has used a deductive approach, a quantitative Strategy and an explanatory research design.

A deductive research approach can be defined as a process of using theory to explain observations. Leedy and Ormrod (2010) suggested that a deductive reasoning is extremely valuable for generating research hypotheses and testing theories. Looking at the research questions this study aim to answer, this is the appropriate approach to use. The equilibrium real exchange rate and the subsequent misalignment on one hand and the growth equation on the other hand are estimated using some economic theories.

A quantitative research strategy was adopted for this study since its main purpose is to first investigate the relationship between real exchange rate and its determinants identified in the literature and second establish the link between exchange rate misalignment and economic growth. A quantitative data analysis approach is described as one that uses statistical analysis to analyse sample data and produces results that could predictably be used to other sample sets Leedy and Ormrod (2010).

The research questions this study intends to answer justify the choice of an Explanatory research design. In order to achieve its goals, this study was organised in four steps: firstly, the Real Effective Exchange Rate was calculated for the six countries of the CAEMC region using nominal bilateral exchange rates, CPIs and extensive trade information (imports by origins, exports by products, trade weights, total imports, total exports). Secondly, using the BEER approach, the Equilibrium Exchange Rate determined by economic fundamentals was estimated. The Dynamic Ordinary Least Squared model was employed in estimating the model. Thirdly, the exchange rate misalignment was derived from the previous calculation as the difference between the estimated equilibrium REER and the observed REER. And finally, this measure of misalignment was included as an explanatory variable in the estimation of an economic growth model.

3.2. Data Collection, Frequency, research instruments and Choice of Data

3.2.1. Data Collection and Frequency and research instruments

In order to evaluate the impact of the REER misalignment to the economic growth of the CAEMC member countries, we first need to estimate the equilibrium exchange rate and eventually the misalignment. The main source of data for this study was the World Development Indicators (WDI) 2012. However, the International Financial Statistics (IFS), the United Nations Conference on Trade and Development Statistics (UNCTADstat) and the African Development Indicators (ADI) databases were also used.13 Annual dataset over the period 1998 – 2010 were pooled for the six CAEMC (and for their respective trading partners for some data). The time span was purposely chosen to just take into account the period from the introduction of the Euro and thus capture the effects of the Euro and its consequent appreciation on the CFA Franc REER and competitiveness since its introduction.

As research instruments, this study have used Stata SE 11 software for the estimations and Microsoft Office Excel for data processing and REER calculations.

3.2.2. Choice of Data and determinants of the Real Exchange Rate

For the Equilibrium exchange rate estimation (the first estimation), the dependent variable (the REER) and the explanatory variables are described below. The Real Effective Exchange Rate is widely defined in the literature as the relative price of tradables to non-tradables. It is generally calculated as a weighted average of real bilateral exchange rates between the national currency and that of its trade partners. This study has used the methodology followed by the Bank of Central African States (BCAS) which itself is based on the methodology applied by the French Development Agency (AFD). Appendix A presents this methodology in more details.

This study has considered a wide range of determinant variables identified in the literature that are likely to affect the REER of the CFA Franc. Following the work of Ronald MacDonald and Preethike Dias (2007) who estimated the equilibrium exchange rate for ten

[13]Sources of data: WDI: CPI, GDP, GDP Per Capita, Gross fixed capital formation, inflation rate, NFA, General government final consumption expenditure (% of GDP), Net ODA and official aid received, Money and quasi money (M2), Population growth (annual %)).
IFS: PPI, lending interest rate, REER
UNCTADstat : imports, exports, terms of trade index, trade Openness and exchange rate cross rates
ADI: Global Government Budgetary Balance

countries using the BEER approach and also that of Etta-Nkwelle, Augustine (2009) who examined the behaviour of the WAEMU in the wake of the 1994 devaluation of the CFA Franc, this study included the following variables into the model estimator:

Terms of Trade index (TOT) was collected from the UNCTADstat database and defined as exports price index divided by imports price index. An increase of the terms of trade might cause both exports (and imports) to increase subsequently improving (or worsening) the current account. Depending on the price elasticity of the demand, terms of trade could have a positive or negative effect on the real exchange rate.

Productivity (PV) was calculated as the ratio of domestic consumer price index of country i to the geometric average of the producer price index of its ten top trading partners. It is also defined as the Balassa-Samuelson effect. According to this theory, an increase in productivity spurs demand in the non-tradable sector thus provoking an appreciation of the real exchange rate.

Interest Rate Differential (IR) was calculated by taking the difference between the lending interest rate of a particular country of the CAEMC region and the geometric average of the lending interest rate of the top ten trading partners of each country.

Net Foreign Assets (NFA) are defined as the difference between foreign assets held by domestic residents and foreign investors' holdings of domestic assets.14 Its effect on the real exchange rate is quite ambiguous. An increase in NFA could induce to an appreciation for net debtor countries. However, it could also have a positive relationship with currency depreciation in some countries following an undervalued currency growth strategy (Yan and Yang, 2012).

Trade Openness (OP) was also collected from the UNCTADstat database and defined as the total trade (sum of imports and exports) to GDP. It is positively correlated with the real exchange rate. Greater liberalization of trade reduces the domestic prices and stimulates demand for tradable goods. The real exchange rate will depreciate in order to shift the demand from non-tradable to tradable goods.15

[14] Ho-don Yan and Cheng-lang Yang (2012)
[15] Ho-don Yan and Cheng-lang Yang (2012)

Domestic Investments (IV) is expressed as the gross fixed capital formation to GDP. An increase in domestic investment might stimulate the productivity of the tradable sector hence decreasing the price of tradables. However, its relationship with real exchange rate is unclear; it can thus be positive or negative.

Government Spending (GS) is the General government final consumption expenditure as percentage of GDP and is used to capture the effect of fiscal policies. Depending on whether public spending are more oriented in domestically produced or imported goods and services, this variable could positively or negatively impact on the real exchange rate.

The Trade Balance (TB) was measures by taking the difference between Exports and Imports expressed in proportion of GDP.

Official Development Assistance - aid inflows (ODA) represents the Net official development assistance and official aid received by each country

For the economic growth estimation, this study have considered some of the above described variables (investment, net foreign assets, trade openness and government spending) but also included additional variables recurring in the literature as growth explanatory variables. Money Supply (MS) represented by Money and Quasi Money (M2), Governmeent Balance (GB) representing the global government budgetary balance and annual Population Growth (PG).

3.3. Sampling

Bryman and Bell (2007) defined sampling as a process of selecting research participants amongst an entire population. In the case of this study, research participants describe countries that are considered in study. A non-probability Purposive sampling technique was use for this study. The countries included were intentionally selected to limit the study specifically to the CAEMC (Cameroon, Central African Republic, Chad, Congo Republic, Equatorial Guinea and Gabon). The study period (1999 to 2010) was deliberately chosen as well. This was intended to show how the introduction of the Euro (in 1999), and its high appreciation (from 2002 to 2010) explain the behaviour of the CFA Franc and impact on the economic growth of the CAEMC.

3.4. Data Analysis Methods

To implement the proposed methodology, a quantitative data analysis was used in this study. The theoretical methodology and empirical approach for both the equilibrium exchange rate and economic growth equation estimations are described in more details in this section.

3.4.1. Theoretical Methodology

3.4.1.1. Measuring the equilibrium Real Effective Exchange Rate and misalignment

The methodological approach this study chose to follow is the Behavioural Equilibrium Exchange Rate methodology introduced by Clark and MacDonald (1998). The authors based their approach on the concept of the uncovered interest rate parity (UIP) and brought in a risk premium parameter:

$$q_t = q^e_{t+k} - \left(r^e_{t,t+k} - r^{*e}_{t,t+k}\right) - \lambda_t. \quad (1)$$

Where: q_t is the observed real exchange rate in period t; q^e_{t+k} is the real exchange rate expected in t for k; $r^e_{t,t+k} = i_t - \Delta p^e_{t,t+k}$ is the domestic ex ante real interest rate; $r^{*e}_{t,t+k} = i^*_t - \Delta p^{*e}_{t,t+k}$ is the foreign ex ante real interest rate; λ_t is the risk premium; an asterisk (*) denotes a foreign magnitude. MacDonald and Dias (2007) interpreted q^e_{t+k} as the 'long-run' or systematic component of the real exchange rate and replaced it by $\bar{q}_t$ to come up with the following equation:

$$q_t = \bar{q}_t - \left(r^e_{t,t+k} - r^{*e}_{t,t+k}\right) - \lambda_t \quad (2)$$

As the current account must equal zero at the equilibrium (3) and that the larger the steady state Surplus, the more depreciated the real exchange rate will be (4),

$$ca_t = tb_t + r^*_t nfa_t = 0 \quad (3)$$

$$q_t = -\propto tb_t + \beta X_t \quad (4)$$

We can use (3) in (4) to rewrite the real exchange rate:

$$q_t = -\propto nfa_t + \beta X_t \quad (5)$$

Where nfa_t denotes net foreign assets; X_t symbolize other factors determining the real exchange rate.

We can also express the real exchange rate as a function of economic fundamentals (x) and the short term variable (z) into a generalized equation:

$$q_t = q_t(\bar{x}_t \bar{z}_t) \quad (6)$$

The following equation summarises the relationship this study aim to estimate:

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$$q_t = \beta_1 tb + \beta_2 tot + \beta_3 pv + \beta_4 ir + \beta_5 nfa + \beta_6 op + \beta_7 iv + \beta_8 gs + \beta_9 oda + \varepsilon. \ 16 \quad (7)$$

3.4.1.2. Reel Effective Exchange Rate misalignment and economic growth

To establish the impact of the misalignment to the economic growth, the study will add the estimated RER misalignment measure to the set of explanatory variables usually considered in empirical economic growth models. The theoretical growth model takes the following form:

$$(Y_{i,t} - Y_{i,t-1} = \alpha Y_{i,t-1} + \beta X_{i,t} + \mu_t + \eta_i + \varepsilon_{it}) \quad (9)$$

Where $Y_{i,t}$ represents GDP per Capita for country (i) at period t, $Y_{i,t-1}$ GDP per Capita for country (i) at period t-1, $X_{i,t}$ a vector of variables representing growth determinants, η_i unobserved country-specific factors and μ_t is a period specific effect.

The study envisages manipulating and integrating into the growth equation, the misalignment of the real exchange rate (MIS) aside with the determinants of growth established in the literature. The dependent variable is the GDP Per Capita (GDP Per Capita) growth. Following the neoclassic growth theory, the initial GDP Per Capita will be included as independent variable aside with Money supply (MS), terms of trade (TOT), trade openness (OP), Government Spending (GS), Government Balance (GB) and Population Growth (PG). The following equation summarises the proposed growth equation this study will try to estimate.17 The expected sign of the coefficients are in brackets.

(-) (+/-) (+/-) (+/-) (+) (+/-) (+/-)

$$gdppc_t = \beta_1 gdpc_{t-1} + \beta_2 mis + \beta_3 ms + \beta_5 nfa + \beta_6 op + \beta_7 gs + \beta_9 gb + \beta_{10} pg + \varepsilon \quad (10)$$

[16] All variables are in log except tb, nfa and inf. (-), (+) and (+/-) express the expected sign of the coefficient of the estimation is negative, positive and can be negative or positive respectively.
[17] All variables are in log except nfa and gb.

3.4.2. Econometric Approach

To estimate the equilibrium exchange and the growth equation, unit root tests and cointegration tests must be performed first. The study combined the Levin and Lin (1993) and Im, Pesaran and Shin (1997) tests to determine the integration order of the different variables. The Johansen (1995) and Westerlund (2007) cointegration tests were implemented to establish the long term relationship between the variables in the proposed models.

The Johansen (1995) econometric model is based on vector-error correction model (VECM). The suggestion of the VECM can be conveyed in the following equation:

$$\Delta y_i = \prod y_{t-1} + \sum_i^{k-1} \Gamma_i \Delta_{t-1} + \mu + \varepsilon_i \quad (8)$$

Where: y_i is a (n x 1) vector of the n variable; Γ is a [n x (k-1)] matrix of short-run coefficients; ε_i represents a (n x 1) vector of constants and $\prod$ denotes a (n x n) coefficient matrix.

Johansen's (1995) approach is to estimate the VECM using the maximum likelihood method, under various assumptions. The trend, intercept and the number of cointegrating vectors (r) represent different parameters of the test and then the likelihood ratio tests are conduct. Jahansen's (1995) approach performs the trace test and maximum eigenvalue test using the following equations:

$$\lambda_{trace} = -T \sum_{i=r+1}^{n} \ln(1 - \hat{\lambda}_i) \quad (11)$$

HO: there is r cointegrating vector

H1: there is n cointegrating vector (n > r)

$$\lambda_{max} = -T \ln(1 - \hat{\lambda}_i) \quad (12)$$

HO: there is r cointegrating vector

H1: there is r + 1 cointegrating vectors

On the other hand, Westerlund (2007) has developed four new cointegration tests that are based not on residuals, but the structural dynamics of relationships and therefore do not impose any restriction on the common factors. The idea is to test the null hypothesis of no

cointegration by checking if the error correction term in the error correction model built for this effect is significantly equal to zero.

The first two test the null hypothesis of no cointegration against the alternative hypothesis that the panel is cointegrated as a whole, while the last two are testing the alternative existence of at least one individual of the panel for whom variables are cointegrated. We also implemented this cointegration technique to test for the existence of a long-term relationship between the REER and its determinants in our panel on one hand and between the GDP Per capita growth and its explanatory variables on the other hand.

This study had also performed the Hausman (1987) specification test to in order to specify which of the fixed or random model our estimated equation is.

3.4.2.1. Estimating the equilibrium Real Effective Exchange Rate and misalignment

The first model was estimated using the Dynamic Ordinary Least Squares (DOLS) approach developed by Kao (1999) and Phillips and Moon (1999). The DOLS estimation technique entails including advanced and delayed values of x_{it} in the cointegration relationship in the view of eliminating the correlation between the explanatory variables and the error term:

$$y_{it} = \alpha_i + \beta x_{it} + \sum_{k=-\infty}^{+\infty} \delta_{ik} \Delta x_{it} + \varepsilon_{it}$$

The DOLS estimator is simply obtained by estimating the above model using Ordinary Least Squares (OLS) method. It has the same asymptotic distribution as Fully Modified Ordinary Least Squares (FM-OLS) estimator. This is a robust estimation method comparable to the FMOLS. According to Kao (1999), DOLS estimates are empirically more efficient than that of FM-OLS. It has the advantage of being easily calculable because it involves applying OLS to the model increased by a number of delays and advances on the first difference of the independent variables. The choice of the number of delays and advances is done by minimizing the Akaike information criterion for k varying from 0 to 2.

3.4.2.2. Estimating the economic growth model

For the second model, this study chose the Generalised Least Squares (GLS) estimator.

3.1. Research Reliability and Validity

As defined by Leedy and Ormrod (2010) reliability indicates the accuracy and consistency of results produced by a measurement instrument. Bryman and Bell (2007) associate the validity

of a research with the integrity and soundness of the findings. The research instruments (Stata and Excel) used for this study is popularly used in data analysis and widely recognised as reliable. In addition the input data used were secondary data collected from reliable sources and considered accurate. Furthermore, this study have used well established theoretical and empirical methodologies in performing the estimations, therefore, the research instruments can be assumed as reliable and the findings valid.

3.2. Limitations

As the study aim to capture the effects of the new anchor currency (Euro) on the behaviour of the CFA Franc real exchange rate, the main limitations identified for this study was its very short time span (1999 to 2010). Twelve years is quite short for an empirical study which claims to be robust. This study initially attempted to construct a quarterly dataset in order to enlarge the sample but dropped the idea because it realized that converting some annual variables into quarterly data would not make any theoretical sense. The limitation had been partially overcome by the econometric approach used in the estimations. The panel data technique studies the movements and patterns of variables for the entire panel unlike the time series approach which performs a country by country study.

Another noteworthy limitation of this study was the exclusion of the Western African Economic and Monetary Union (which is also part of the CFA zone) from the study sample. This was mainly attributed to the fact that there already exists a consistent literature addressing the equilibrium exchange rate and its misalignment topic for that region.

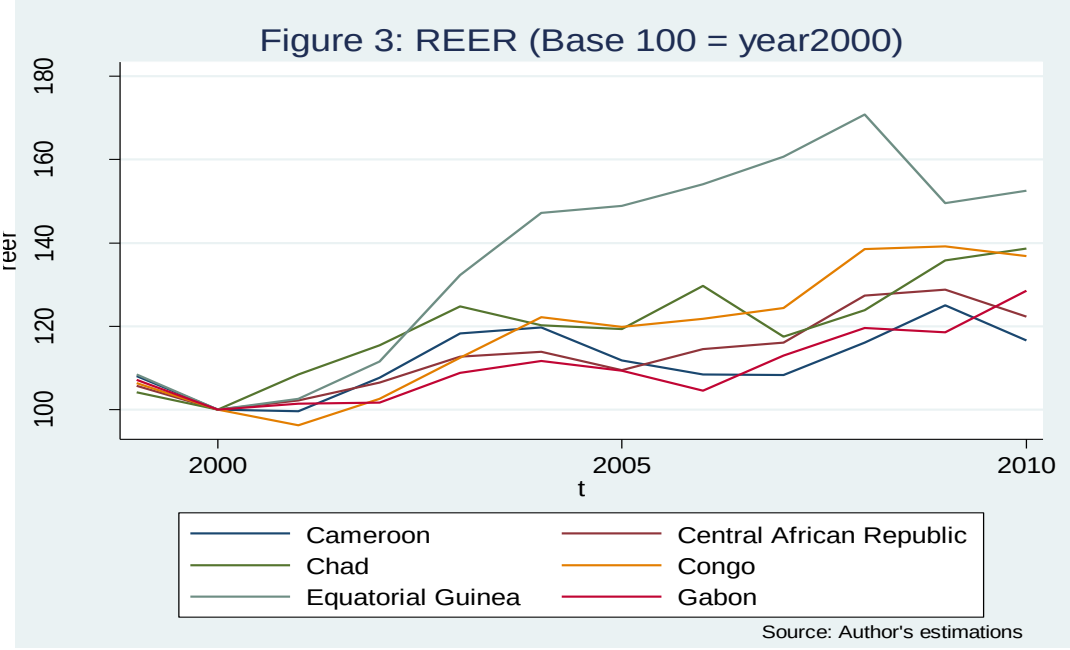
For the growth estimation, this study attempted to integrate more explanatory variables but could not get hold of some variables. Human capital, education and technology development for instance are popularly used in explaining GDP per capita growth but this study was not to find any of these data for the considered sample of countries.

4. RESEARCH FINDINGS, ANALYSIS AND DISCUSSION

The purpose of this study was to estimate the equilibrium exchange rate of the CFA Franc for the Central African Economic and Monetary Community member countries and evaluate how the resulting misalignment impacts on the economic growth in the CAEMC region. This section presents the outcomes of the study, analyses these findings and discusses relevant economic and monetary policy implications for the Central African Economic and Monetary Community region.

4.1. Research findings

In the process of achieving the its main purpose, the first step this study accomplished was to determine the Real Effective Exchange Rate for the CFA Franc. The results are presented in figure 3. Subsequently, the econometric approach followed by this paper first executes panel Unit Root tests in the panel data series and cointegration tests to determine the long term cointegration between the selected set of macroeconomic fundamentals. Then the regression equations will be estimated. The first estimation will establish the long term relationship that will be used for computing the real equilibrium exchange rates and the corresponding misalignments. The later estimated variable will then be considered as an independent variable and integrated in the second estimation: the growth equation.



4.1.1. Panel Data tests

4.1.1.1. Panel Unit root tests

Using a panel econometric approach to implement unit root tests presents substantial benefits for this study compared with relying on individual time series. First, this technique overcomes the limitation related to the very short time span of this study. Second, panel unit root and cointegration tests outperform their conventional time series counterparts (Carrera & Restout, 2008).[18] Hurlin and Mignon (2005) classified the unit root tests into two groups: the first generation of tests based on an assumption of independence between individuals and the second that incorporate various possible forms of inter-individual dependencies.

In accordance with the first group of tests, Consider a sample of N individuals observed over T periods and assume $\Delta y_{i,t} = \propto_i + \rho_i y_{i,t} + \varepsilon_{i,t}$. Where: the parameter $\propto_i$ represents individual specificity which is captured by a fixed effect. The null hypothesis of unit root is simply expressed as follows:

$$H_0 : \forall_i \rho_i = 0,\ \alpha_i = 0$$

But the alternative hypothesis can take many forms. Thus, Levin and Lin (1993) consider that the parameters ρ_i are identical from one individual to another while Im, Pesaran and Shin (1997) let go the assumption of homogeneity of ρ_i in the alternative hypothesis. Both the Levin and Lin and the Im, Pesaran and Shin tests considered in this study are based on the augmented Dickey-Fuller (ADF) test to each individual series.

With regards to the results of the unit root tests, the results are reported in the tables in appendix B. The Levin and Lin test presented in table 1 reveals that all variables used for estimating both the equilibrium exchange rate and the growth equation are stationary (at 10% significance level) except for logtot and gb which are integrated I(1). Variables tb, nfa, logs, logoda and logms are stationary only under "with trend" condition. Conversely, the variable loggdppc is only stationary when no trend is included in the model. The first differential of the variables was also tested to confirm the first order integration. As shown is table 2, all the variables are I(1) at 5% significance level.

The Im, Pesaran and Shin test reported pretty contrasting results in terms of the stationarity of the variables; Variables logir, nfa, logs, loggdppc, logms and logpg are not stationary (see

[18] Cited by Audrey Sallenave (2009)

table 3). However, except for logpg which is not I(1) all the variables are integrated in the first order I(1) as illustrated in table 4.

As the above established that the integrated order of each variable has the property of I(1), it is now appropriate to implement the cointegration test.

4.1.1.2. Cointegration tests

Considering on the above results, one can infer that there is at least one intra-individual cointegration relationship for at least one country thus justifying the cointegration test. It would not be the case if for each country there were no more than one variable I (1). Besides, having variables with different integration order in the sample is theoretically not an issue. Johansen (1995) inferred that there is little need to pre-test the variables in the system in order to determine their stationary property.[19] The author further argued that if a single variable is I(0) instead of I(1), the cointegration vector will capture this situation and its space is spanned by the only stationary variable in the model (Hjalmarsson and Österholm, 2007).

Nevertheless, as this study will perform two estimations, the equilibrium exchange rate and the growth equation, it is necessary to test for the long-run relationship between the variables of the two estimated regressions. The equilibrium real exchange rate estimated model included logtot, lodpv, loggs et logiv as determinants of the logreer, and the estimated growth relationship found loggdppc loggs gb logop logmis to be the significant variables. This study had first performed the Johansen cointegration test for the six countries of the CAEMC and then the Westerlund panel cointegration test. Appendix C presents the results of the cointegration tests.

Johansen Cointegration test:

In interpreting the results, this study compared for both the trace and maximum Eigenvalue tests, the test statistic and its critical value (5%). For instance, If the test statistic exceeds its critical value (5%), we can conclude that at least one cointegrating vector is present when the null is r = 0. In some cases, the trace test and the maximum Eigenvalue test revealed different results, this study considered the maximum Eigenvalue test following Johansen and Juselius' (1990) recommendation.

[19] Cited by Erik Hjalmarsson and Pär Österholm (2007)

As shown in tables 5 and 6, for both the first and second estimation, the Johansen Cointegration test found at least one cointegrating vector for all the six countries in the region. Indeed, two cointegrating vectors were found in the first estimation for Cameroon, Equatorial Guinea and Gabon and three cointegrating vectors were existent for the Central African Republic. For the second estimation, two cointegrating vectors were present for Congo republic, Equatorial Guinea and Gabon.

Westerlund Cointegration test:

The econometric approach this study chose to follow is the panel data analysis. The Johansen cointegration test was implemented at first place to overcome the inaccuracy of the Westerlund Cointegration test (designed for panel data) for this study most probably due to the very short time span. It is widely recognised that cointegration tests produce results that are highly erroneous and does not reflect the reality when the study data time set is short. As far as this study is concerned, for both the Equilibrium REER and the Growth equation estimations, the Westerlund test revealed no cointegration relationship in the respective models, for it fail to reject the null hypotheses of no cointegration. Yet the results are presented in tables 7 and 8.

For the matter of interest, several studies using various panel data cointegration tests fail to reject the null hypothesis of no cointegration even if the cointegration between variables is strongly suggested by economic theory (see for example Baltagi et al. (2000), Pesaran et al. (1999) and Rapach and Wohar (2004)).[20] One possible raison explaining this inconsistency lies in the fact that for both times series and panel data, cointegration tests based on residuals require the long-term parameters of variables to be equal to the short-term parameters of the differentiated variables.

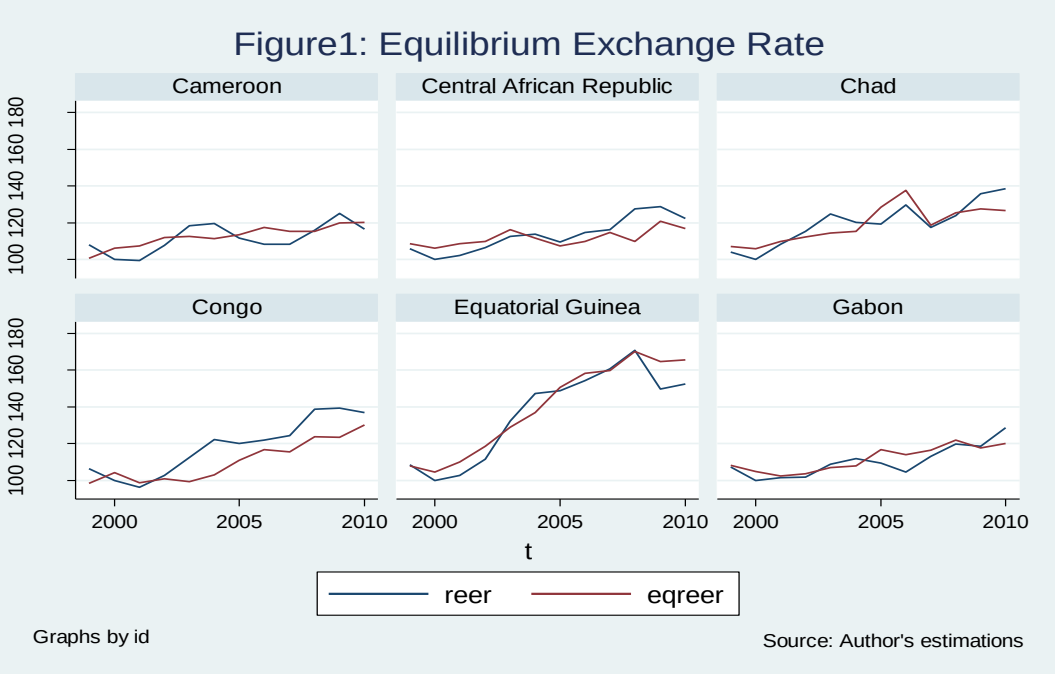
[20] Cited by westerlund, 2007

4.1.2. Estimating the Equilibrium REER and Misalignment

The equilibrium exchange rate is estimated using the Dynamic Ordinary Least Squares (DOLS). Its corresponding Stata command is (xtdolshm). This study have proposed six different models and retained model 5 including the following dependent variables. As presented in table 9, variables terms of trade and productivity (representing the Balasa-Samuelson effect) are significant at 1% and positively correlated with the REER as expected. This is consistent with the theory. On the other hand, government spending and government balance are also significant but with negative coefficients. Trade balance and interest rate differential were also included in the model but were not statistically significant. The results also show a significant positive constant terms for the model. Overall, this implies that the REER will appreciate in response to an increase in the terms of trade and the productivity. Conversely, an increase in government spending and domestic investments will depreciate the REER. The estimated model for the fundamental equilibrium real exchange rate is represented in the following equation:

$$\text{logeqreer} = 1.697782 + .255887 * \text{logtot} + .709048 * \text{logpv} + -.054442 * \text{loggs} + -.053918 * \text{logiv} + \varepsilon$$

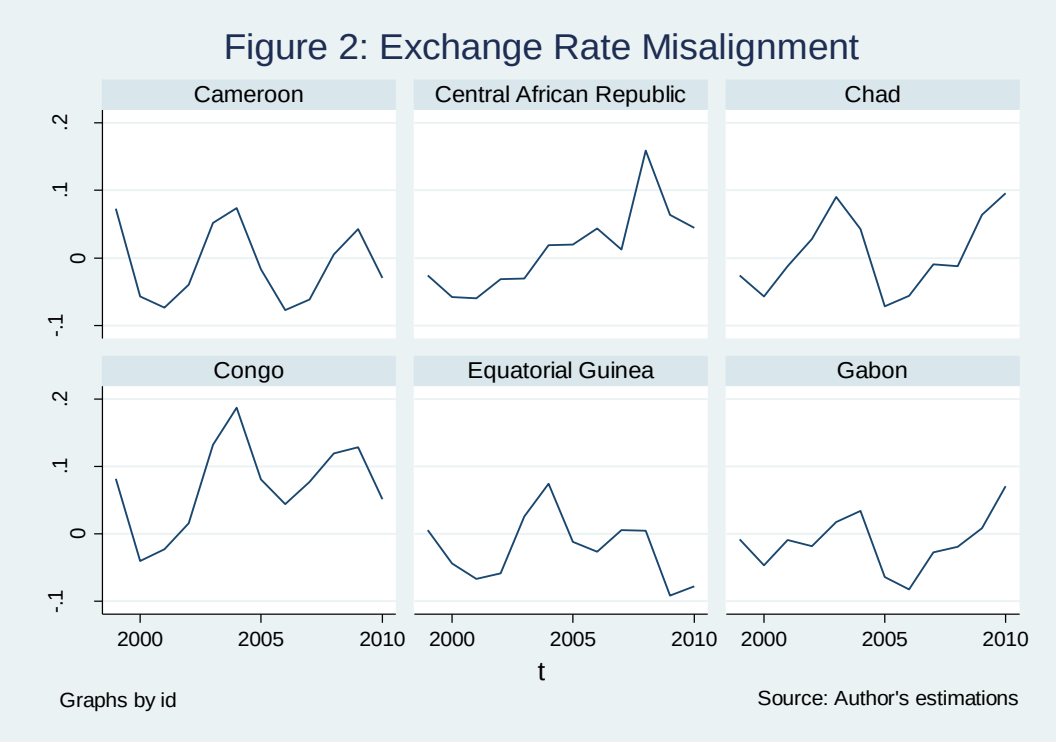
The equilibrium exchange rates were estimated for the whole panel using this equation. The misalignment was then derived from this equation by subtracting from the above estimated equilibrium rate, the observed REER. Figure 1 present the results of the estimated equilibrium exchange rate and the observed REER.



The corresponding misalignment shown in figure 2 was determined using the following equation: $\text{mis} = \frac{\text{eqreer}-\text{reer}}{\text{eqreer}}$

According to this definition of the misalignment, a negative signs (+) means undervaluation and a positive sign (-) means overvaluation. Different patterns can be observed for the different countries. The REER highly fluctuate around the equilibrium level for all the countries except for the Congo republic where a sustained overvaluation was observed. The overvaluation peaked in 2004 reaching 18.67% (the highest in the panel for the entire study period). This appreciating trend could arguably be explained by the political instability and civil war that the country had experienced in the early 2000s. It could also be impacted by the high appreciation of the Euro during that period.[21]

[21] The Euro has noted a 40% appreciation for the 2002 – 2010 period (Gnimassoun, 2012)



On the other hand, the Equatorial Guinea had experienced a depreciating trend in recent years signifying a gain of competitiveness. This could be attributed to the rise in the shares of oil in the total exports of the country coupled with the increase in oil prices. Conversely, the Central African Republic's REER had faced an appreciating trend from 2000 to 2008 crossing the equilibrium level around mid 2003 and had never adjusted back to the fundamental equilibrium level yet. However, it started recovering since 2008. The Cameroonian REER is fluctuating around the equilibrium experiencing short periods of both overvaluation and undervaluation. It is noteworthy highlighting that it is not very stable but does not move far away from the equilibrium; in other words, the misalignment is less pronounced as it is the case for Gabon's.

The opposite situation was noted for Gabon where the REER were undervalued almost for the entire study period. However, from 2004, an increasing trend is perceived for this country indicating loss of competitiveness. Still, the REER remained undervalued until 2009 when it became higher than the equilibrium level. A pretty similar observation is made for Chad where the REER appreciation trend was also observed for the same period.

4.1.3. Estimating the Panel Growth regression

The estimated the panel growth regression, this study applied the Generalised Least square (GLS) econometric method. The corresponding Stata command allows us estimating a model in the presence of AR(1) autocorrelation within panels and cross-sectional correlation and heteroskedasticity across panels (StataCorp, 2009). xtgls fits panel-data linear models by using feasible generalized least squares. The dependent variable characterising the economic growth in this model is the GDP per capita growth. The results of the estimation are shown in table 11 and indicate that our variable of interest (the misalignment) is significant at 1% for all the six proposed models. Moreover, the coefficient has the expected positive sign in the case of an undervaluation and very significant. It ranges from 1.1819 to 1.3643 with an average of 1.257 which is very significant. Although this result is consistent with those of MacDonald and Vieira, (2010), Rodrik (2008), Béreau, Villavicencio and Mignon (2009) and many other studies (Eichengreen (2008), Berg and Miao (2010), etc), the coefficients are quite high compared with these studies. However, even higher coefficients (ranging from 1.391 to 3.727) were found by Mbaye (2012) for a panel of 72 countries. In his study, the author empirically verified the "total factor productivity" growth channel.

The retained model for this study is portrayed in the following equation.

$$\text{loggdppc}_t = .9497427 * \text{loggdppc}_{t-1} + 1.242988 * \text{logmis} + \quad .0868058 * \text{logop} + \\ -.0529862 * \text{loggs} + .003462 * \text{gb}$$

This estimation infer that other things being equal a 10% real exchange rate depreciation contributes to an increase in GDP per capita growth of 0.12 points. This result is in line with the theoretical expectations and suggests that exchange rate undervaluation stimulate economic growth while overvaluation produces the opposite effect.

Coming back to the estimated model, the results illustrates that the initial GDP per capita is significant as expected and suggested by the neoclassical theory. However, the positive coefficient is in contradiction with "the conditional convergence hypothesis" one would have expected countries with lower GDP Per capita to grow faster but the results imply the opposite scenario. Mbaye (2012) had also found similar results for his GMM estimated model. Trade Openness and government balance are also significant and present positive coefficients. On the other hand, government spending is negatively correlated with growth

most likely indicating that some governments had invested in long term development ventures or in some social projects.

4.2. Research analysis and discussion

This study was interested in estimating the real exchange rate misalignment and investigating its subsequent impact on the economic growth of the CAEMC. Naturally, the findings could entail some policy implications. In essence, the CFA Franc real exchange rate was not significantly out of line with the economic fundamentals for the six countries with an average misalignment of 0.79%. However, the research finding highlighted a diverse extend of misalignment and pattern for the different member countries. This situation arguably reflects disparities in the foreign trade policies and practices within the CAEMC.

The pegged exchange rate regime prevailing in the CAEMC imposes some burdens on the economies of the member countries as it restricts the flexibility of the monetary authorities in adopting appropriate measures and leaves them vulnerable to potential external shocks. Second, this study had also noted that exportations are essentially oriented towards very low 'production value added' primary products. In addition, the CAEMC member countries are price takers with regards to these primarily products whose prices are determined by the global supply and demand. This situation is unfavourable for the competitiveness of the economies of the CAEMC. A more diversified export structure, transformation of locally produced goods before exportation and improvement of the Balasa-Samuelson effect (productivity) would help improve terms of trade (which is a significant determinant of the real exchange rate) and enhance the tradable sector.

The effect of the appreciation of the anchor currency on the CFA Franc constitutes another challenge for the CAEMC member countries. It had been noted that the appreciation of the Euro since 2002 was transmitted to that of the CFA Franc. This could be conveyed through the nominal peg but also through the significant trade weight between these countries and the Euro zone.[22] The appreciation of the CFA Franc could also be explained by the growing share of trade with Asian countries (especially China) since some Asian countries adopt monetary policies and interventions to keep their currencies undervalued against the US Dollar. Increasing trade with China for instance will cause the CFA Franc REER to appreciate. Furthermore, an increase in interregional and intra-regional trade and more

[22] The Euro zone is the largest trade partner representing more than 90% of the total trade of each CAEMC member country.

regional integration would however help limit the CFA Franc REER appreciation. An increase in interregional trade within the CAEMC in particular and the entire CFA zone would thus be significantly beneficial for the member countries. [23]

The growth analysis indicated that real exchange rate is significant variable in explaining economic growth in the CAEMC. It is thus, crucial for the member countries and their central bank (the BCAS) to pay highest attention to the evolution of the Real Effective Exchange Rate of the CFA Franc an insure it is not substantially out of line with its long term equilibrium level as determined by the economic fundamentals. In particular, the monetary authorities should manage to avoid persistent overvaluation of the CFA Franc real exchange rate since it is empirically established that it hampers economic growth. Policies towards depreciating the CFA Franc real exchange rate and maintaining it at undervalued level is highly recommended. As noted by Eichengreen (2007), maintaining the real exchange rate at competitive levels can be essential for 'jump-starting growth'. This study like many others (Berg and Miao (2010); Béreau, Villavicencio and Mignon (2009); Eichengreen (2007); Mbaye (2012); MacDonald and Vieira, (2010); and Rodrik (2008)) has associated real exchange rate undervaluation with economic growth. Eichengreen (2007), valued its role in the growth process as a 'facilitating condition' which in his view will facilitate efforts to capitalize on fundamentals directly affecting growth (education and training, saving and investment, technological development, etc.). A competitive real exchange rate will promote the tradable sector since domestically produced goods are competitive in foreign markets. This enhancement will shift resources form the law productivity non tradable sector to the tradable sector thus developing the manufacturing sector. Number of Asian countries especially China have benefited from the above illustrated scenario for decades.24

[23] The foreign trade analysis indicated insignificant interregional trade in the CAEMC relative to the total trade.
[24] Korea, Japan and Thailand had also adopted the Export-leads to growth strategy.

5. RESEARCH CONCLUSIONS

Real exchange rate is a key variable indicating international competitiveness of a currency. In a context of pegged exchange rate regime coupled with a high appreciation of the Euro (the anchor currency) in the recent past, one would have expected the CFA Franc real effective exchange rate to be overvalued. To empirically investigate this claim, this study proposed to estimate the equilibrium exchange rate and to determine the resulting misalignment and additionally examine the impact of the subsequent misalignment to the economic growth of the CAEMC member countries. In this process, the CFA Franc REER was first calculated (the observed REER). Using the DOLS econometric approach, the equilibrium real exchange rate was then estimated relying on the Behavioural Equilibrium Exchange Rate. Subsequently, a misalignment measure was derived from the above estimations as the difference between the estimated equilibrium real exchange rate and the observed REER.

The results of the first estimation revealed as the most significant determinants of the REER for the CAEMC member countries, terms of trade and the Balasa-Samuelson effect are positively correlated with the real exchange rate while government spending and investment present negative coefficients. The REER was moderately in line with the long term economic growth for all the countries (with an average misalignment of 0.79%) and tend to converge back towards the equilibrium level except for the Congo Republic where a sustained overvaluation was observed (reaching a maximum of 18.67% in 2004: the highest in the panel for the entire study period). To establish the effect of exchange rate misalignment on economic growth (measured by the GDP Per capita growth), the later determined misalignment indicator was included into a growth model as an explanatory variable.

The growth model was estimated using the Generalised Least Squares (GLS) econometric method and the results indicated that real exchange rate misalignment positively impact on the economic growth of the CAEMC implying that a more undervalued real exchange rate increases GDP per capita while the opposite effect is also true for an overvalued real exchange rate. Considering the average coefficient of the six estimated models (1.257), a 10% increase (depreciation) in the CFA Franc real exchange rate could result to a 0.12 points increase in annual per capita GDP growth. Although these results corroborate with those of many previous studies (Béreau, Villavicencio and Mignon (2009); MacDonald and Vieira (2010), Rodrik (2008) and many other studies (Berg and Miao (2010); Eichengreen (2008)

etc), the coefficients are quite high implying a higher effect on economic growth.[25] Also, the growth equation indicated that GDP per capita growth is determined by its initial level (as prescribed by the neoclassical theory), the real exchange rate misalignment, trade openness, government spending and government balance.

This study attempted to complement and extend the existing literature on the CFA Franc equilibrium exchange. An essential recommendation for the CAEMC economic and monetary authorities emerging from this study is to implement policies intended to maintain the CFA Franc real exchange rate in line with the long term equilibrium level as determined by its economic fundamentals. More particularly, in respect to the empirical suggestion of this study and many others, they should keep the real exchange rate at competitive level (undervalued) in order to smooth the economic growth progress. This could be achieved by increasing the productivity of the tradable sector (promoting exports), enhancing the manufacturing and domestic transformation of primarily products (thus reducing the weight of imports), and avoiding prolonged real exchange rate appreciation episodes. Also, they should effectively implement more regional integration. It was noted that economies of the CAEMC are highly dissimilar making it difficult to implement the same monetary for the entire region in the view of keeping the common currency competitive. One monetary policy could yield to different effects in different countries. A real political will in promoting regional integration and adopting more integrated foreign trade and economic policies will facilitate interregional trade, considerably enhance the competitiveness of the common currency and straighten the economies of the CAEMC enjoying significant growth potential.

[25] For instance, Ronald MacDonald and Flávio Vieira (2010) reported 0.3% points increase in GDP growth for a 10% increase in real exchange rate depreciation; Rodrik (2008) reported that for a 20% increase in undervaluation will boost growth by 0.4% points;

6. RECOMMENDATIONS FOR FUTURE RESEARCH

Throughout the research process, this study had gained awareness of important concepts and issues surrounding the research area and was thus inspired in addressing valuable potential research problems.

To address the limited time span considered by this study, additional effort in constructing quarterly or even monthly data would provide wider statistical dataset while sticking on the same study period. Since this study encountered difficulties on doing so, one could consider another appropriate methodology. For instance, one could follow the methodology used by Zafar (2005)

As this study was limited only to the CAEMC member countries, one could consider the same research questions for the entire CFA zone and get interested in drawing some comparative analysis of the two regions.

This study had estimated the CFA Franc equilibrium exchange rate and established the impact of the implied misalignment on the economic growth of the CAEMC region but did not examine how the misalignment translates to growth. Studying the channel trough which exchange rate misalignment affect economic growth, would constitute an interesting research question.

The CFA Franc is a pegged currency used by the monetary union. However, this study had noted discrepancies between the CAEMC member countries. This has drawn attention on the rationality of the CAEMC monetary union itself and raised the question on the adequacy of the CFA Franc currency union. In view of that, investigating if the CAEMC particularly and the CFA zone in general constitute an 'Optimal Currency Area' (OCA) would be a noteworthy research question. The Theory of Optimal Currency Area is widely used in assessing the adequacy of a currency union and was established by Mundell (1961).

One more interesting issue related to the CFA Franc exchange rate is the pegged monetary regime itself. This monetary regime was put in place during the colonial era just after second war two (in 1945) and since then was pegged to the French Franc and later to the Euro. Considering globalisation, improvements of trade conditions and considerable economic political development achieved by the CFA zone member countries, is this pegged regime still appropriate for the CFA zone? Is it not time to let the CFA Franc float? One could

implement a cost and benefits analyse of the CFA Franc exchange rate regime and investigate if the peg to the Euro is appropriate and the more rational regime or if the CFA zone member countries are ready to adopt more flexible exchange rate regime.

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8. Appendixes

8.1. Appendix A: REER Calculations Methodology (the BCAS' Methodology)

The Bank of Central African States (BCAS) develops an index of the overall real effective exchange rate expressed as the price ratio of each country and foreign prices, adjusted for changes in the nominal effective exchange rate. This index is derived from a double weighting according to the origin of imports (REER imports) and according to the share of the global market for major exporters of primary products (excluding oil) exported by the country (REER exports).

1. ***Calculating REER imports***

The index of the imports effective exchange rate (nominal and real) of country j in the CAEMC sub-region, reflecting its competitiveness in its own market, is built on a geometric average of bilateral nominal exchange rates, weighted according to the geographical origin of imports. Considering for each trading partner i in this country (selected from key suppliers) the nominal exchange rate (NER_{ji}) corresponding simply to the official exchange rate of the national currency against the currency observed in the market, expressed as base Index = 100 in 2000, we have:

1.1. ***The nominal effective exchange rate of the country's for imports ($NEER_j$)*** is equal to:

$\mathrm{NEER_j} = \prod_i [\mathrm{NEER_{ji}}]^{\propto_i}$ Where $\propto_i$ is a weighting of import flows regularly updated. $\propto_i = \frac{\mathrm{M_i}}{\sum_i \mathrm{m_i}}$ With $\sum_i \propto_i = 1$

1.2. The real effective exchange rate of the country's imports is:

$$\mathbf{REER_j^{imp}} = \prod_i [\mathbf{NER_{ji}} * \frac{\mathbf{P_j}}{\mathbf{P_i}}]^{\propto_i}$$

Where: P_i (respectively P_j) is the consumer price index in the supplier country i (resp. j CEMAC country) and $\propto_i$ the weighting of the overall flow of imports.

2. ***REER exports calculation***

The effective exchange rate index for exports is built on the basis of a double weighting taking into account both the share of the global market for major competitor countries exporting primary products (excluding oil) and the relative proportion of these same products in the exports of the country studied.

2.1. ***The nominal effective exchange rate for exports***:

For each product k, we calculate an index of nominal effective exchange rate of the national currency vis-à-vis the currencies of its five major competitors (i) in market k:

$\mathrm{NEER_j^k} = \prod_i [\mathrm{NER_{ji}}]^{\propto_i^k}$ Where: $\propto_i = \frac{\mathrm{X_i^k}}{\sum_i \mathrm{X_i^k}}$ represents the share of country i competitor in market k, $\mathrm{X_i^k}$country i's exports of product k, with $\sum_i \mathrm{X_i^k} = 1$

The nominal effective exchange rate for exports of country j is then obtained as the geometric mean of the nominal effective exchange rate by product, weighted by the relative share of the same products exported by the country.

$NEER_j = \prod_i [NER_{ji}]^{\beta_j^k}$ Where β_j^k is the share of each product k in total exports of primary products subject to competition for countries I, $\beta_j^k = \frac{M_j^k}{\sum_i M_j^k}$ with $\sum_j \beta_j^k = 1$

2.2. ***The real effective exchange rate of exports*** is calculated according to the same principle as above

For each product, ie on market k, the real effective exchange rate of the national currency against the currencies of major competitors in this market is equal to:

$REER_j^k = \prod_i [NER_{ji}^k * \frac{P_j}{P_i}]^{\propto_i^k}$ Where P_i and P_j are defined as above.

The real effective exchange rate for exports of country j is calculated as the geometric mean of the real effective exchange rate by product, weighted by the relative share of products exported by the same country:

$$\mathbf{REER_j^{exp} = \prod_k [NEER_j^k]^{\beta_j^k}}$$

Where β_j^k is defined as above.

3. ***Calculation of overall REER***

The overall real effective exchange rate index of each country is a geometric average of the REER imports and REER exports, weighted by the proportion of each aggregate (import and export) in total external trade.

$$\mathbf{REER_j = [NEER_J^{exp}]^{\lambda_{EXP}} * [NEER_j^{imp}]^{\lambda_{imp}}}$$

Where $\lambda_{EXP} = \frac{X_j}{X_j + M_j}$ and $\lambda_{imp} = \frac{M_j}{X_j + M_j}$

Source: Bank of the Central African States

8.2. Appendix B: Unit Root Tests

Table 1: Levin Lin and Chu (LLC) Unit Root test

Levin Lin and Chu (LLC) test						
	Without Trend			With Trend		
Variables	Unadjusted t	Adjusted t	P-value	Unadjusted t	Adjusted t	P-value
logreer	-4.7763	-3.5464	0.0002	-10.2542	-5.8321	0.0000
tb	-3.9077	-0.9580	0.1690	-5.8903	-2.2600	0.0119
logtot	-2.4027	-0.8065	0.2100	-5.6591	-1.0640	0.1437
logir	-6.5443	-2.8027	0.0025	-12.5922	-8.4338	0.0000

logpv	-3.7445	-2.7308	0.0032	-7.4487	-4.9123	0.0000
nfa	-1.4395	-0.3123	0.3774	-6.6556	-3.6578	0.0001
logop	-6.1047	-3.7688	0.0001	-6.0569	-2.6397	0.0041
loggs	-3.5553	0.2913	0.6146	-4.8975	-1.5299	0.0630
logiv	-8.6666	-4.6340	0.0000	-10.4636	-5.9957	0.0000
logoda	-3.4428	-0.6853	0.2466	-8.8521	-5.4272	0.0000
inf	-7.7886	-4.4539	0.0000	-9.5896	-4.5323	0.0000
loggdppc	-3.4806	-2.6340	0.0042	-6.4029	-1.1838	0.1182
logms	-0.1945	0.3380	0.6323	-6.8229	-4.2634	0.0000
gb	-4.5406	-0.3423	0.3661	-4.7748	-0.0753	0.4700
logpg	-8.7972	-8.7850	0.0000	-25.9851	-24.0521	0.0000

Table 2: Levin Lin and Chu (LLC) Unit Root test (First differential of Variables)

Levin Lin and Chu (LLC) test (First differential of Variables)						
	Without Trend			With Trend		
Variables	Unadjusted t	Adjusted t	P-Value	Unadjusted t	Adjusted t	P-value
logreer	-9.5231	-5.8088	0	-9.2984	-4.872	0
tb	-9.8593	-6.2541	0.0000	-10.5590	-5.6245	0.0000
logtot	-8.1526	-3.4487	0.0003	-7.5365	-0.8586	0.1953
logir	-6.4909	-1.6214	0.0525	-6.4057	-1.2883	0.0988
logpv	-9.9713	-6.9182	0.0000	-12.2535	-7.4831	0.0000
nfa	-5.5438	-2.1811	0.0146	-5.9254	-1.4495	0.0736
logop	-7.4469	-3.1639	0.0008	-8.4518	-2.8368	0.0023
loggs	-6.4071	-2.2397	0.0126	-7.6419	-3.0708	0.0011
logiv	-10.4836	-5.8175	0.0000	-10.7664	-5.1988	0.0000
logoda	-9.6634	-5.9572	0.0000	-11.4848	-5.9621	0.0000
inf	-11.6905	-7.0095	0.0000	-11.7371	-5.4179	0.0000
loggdppc	-7.4980	-4.8868	0.0000	-6.6688	-2.7585	0.0029
logms	-9.4780	-5.9605	0.0000	-10.4273	-5.0156	0.0000
gb	-8.2766	-5.0661	0.0000	-10.6122	-6.0562	0.0000
logpg	-9.3546	-7.7091	0.0000	-13.0894	-9.3846	0.0000

Table 3: Im Pesaran Shin Unit Root test

Im Pesaran Shin test				
	Without Trend		With Trend	
Variables	t-bar	P-value	t-bar	P-value
logreer	-0.7658	0.9654	-2.4385	0.0165
tb	-2.0965	0.0525	2.5479	0.0109
logtot	-1.5688	-0.1196	-2.8689	0.0088
logir	-1.4108	0.5264	-1.0264	0.8809
logpv	-1.8905	0.1625	-2.2188	0.0359
nfa	-0.4842	0.9971	-1.6445	0.2720
logop	-1.9668	0.1202	-2.2519	0.0262

loggs	-1.8020	0.1767	-1.7594	0.2339
logiv	-4.1453	0.0013	-4.4516	0.0013
logoda	-1.8382	0.2156	-3.2541	0.0013
inf	-3.3790	0.0003	-3.7639	0.0001
loggdppc	-0.6887	0.9818	-1.9965	0.1094
logms	-0.1775	0.9999	-1.7573	0.1821
gb	-2.2726	0.0520	-2.2883	0.0827
logpg	-1.2965	0.9659	-0.8559	0.6637

Table 4: Im Pesaran Shin Unit Root test (First differential of Variables)

Im Pesaran Shin test (First differential of Variables)				
	Without Trend		With Trend	
Variables	t-bar	P-value	t-bar	P-value
logreer	-3.0792	0.0019	-2.8884	0.0048
tb	-4.2142	0.0000	-4.2072	0.0000
logtot	-4.3387	0.0000	-4.6597	0.0000
logir	-2.8346	0.0024	-3.1564	0.0005
logpv	-3.5365	0.0002	-3.8633	0.0001
nfa	-2.8168	0.0035	-2.8758	0.0030
logop	-3.9295	0.0001	-4.0052	0.0002
loggs	-3.0631	0.0040	-3.1961	0.0009
logiv	-4.5110	0.0007	-4.5364	0.0016
logoda	-4.3195	0.0000	-4.4542	0.0000
inf	-5.1676	0.0000	-5.0371	0.0000
loggdppc	-2.8868	0.0032	-2.8007	0.0035
logms	-3.6263	0.0001	-3.6005	0.0001
gb	-3.6307	0.0002	-3.9440	0.0000
logpg	-1.5233	0.9705	-1.1731	0.9982

8.3. Appendix C: Cointegration Tests

Johansen Cointegration test

Table 5: Johansen Cointegration test: (Equilibrium Exchange Rate estimation)

Cameroon				
maximum rank	trace statistic	5% critical value	max statistic	5% critical value
0	126.9124	68.5200	54.2024	33.4600
1	72.7100*	47.2100	44.7416*	27.0700
2	27.9684	29.6800	19.1181	20.9700
3	8.8503	15.4100	6.9692	14.0700
4	1.8811	3.7600	1.8811	3.7600
5				

Central African Rep				
maximum rank	trace statistic	5% critical value	max statistic	5% critical value
0	126.1099	68.5200	52.8061	33.4600
1	73.3038	47.2100	35.1205*	27.0700
2	38.1833*	29.6800	23.3425	20.9700
3	14.8408	15.4100	12.5199	14.0700
4	2.3209	3.7600	2.3209	3.7600
5				

Chad				
maximum rank	trace statistic	5% critical value	max statistic	5% critical value
0	96.4096*	68.5200	50.8654*	33.4600
1	45.5442	47.2100	20.7950	27.0700
2	24.7491	29.6800	16.1040	20.9700
3	8.6451	15.4100	8.6105	14.0700
4	0.0346	3.7600	0.0346	3.7600
5				

Congo				
maximum rank	trace statistic	5% critical value	max statistic	5% critical value
0	134.0968	68.5200	83.0021*	33.4600
1	51.0947*	47.2100	21.9486	27.0700
2	29.1460	29.6800	15.1873	20.9700
3	13.9587	15.4100	11.8600	14.0700
4	2.0988	3.7600	2.0988	3.7600
5				

Equatorial Guinea				
maximum rank	trace statistic	5% critical value	max statistic	5% critical value
0	173.8591	68.5200	115.3388	33.4600
1	58.5203	47.2100	28.7460*	27.0700
2	29.7743*	29.6800	17.8954	20.9700
3	11.8789	15.4100	9.9669	14.0700
4	1.9120	3.7600	1.9120	3.7600
5				

				Gabon
maximum rank	trace statistic	5% critical value	max statistic	5% critical value
0	99.3861*	68.5200	54.0720	33.4600
1	45.3141	47.2100	30.0302*	27.0700
2	15.2839	29.6800	9.3217	20.9700
3	5.9622	15.4100	5.8618	14.0700
4	0.1005	3.7600	0.1005	3.7600
5				

Table 6: Johansen Cointegration test (Growth equation Estimation)

Cameroon				
maximum rank	trace statistic	5% critical value	max statistic	5% critical value
0	148.6418	68.52	97.4818*	33.46
1	51.16*	47.21	26.7108	27.07

2	24.4491	29.68	15.9871	20.97
3	8.462	15.41	5.8112	14.07
4	2.6508	3.76	2.6508	3.76
5				

Central African Rep				
maximum rank	trace statistic	5% critical value	max statistic	5% critical value
0	99.9052*	68.52	57.6493*	33.46
1	42.2559	47.21	19.7562	27.07
2	22.4997	29.68	13.1146	20.97
3	9.3852	15.41	8.931	14.07
4	0.4542	3.76	0.4542	3.76
5				

Chad				
maximum rank	trace statistic	5% critical value	max statistic	5% critical value
0	65.2232*	58.52	39.6952*	33.46
1	34.528	47.21	19.6831	27.07
2	14.8449	29.68	10.1467	20.97
3	4.6982	15.41	4.3726	14.07
4	0.3256	3.76	0.3256	3.76
5				

Congo				
maximum rank	trace statistic	5% critical value	max statistic	5% critical value
0	139.1372	68.52	73.0671	33.46
1	66.0702	47.21	35.6276*	27.07
2	30.4426*	29.68	17.5417	20.97
3	12.9009	15.41	11.2182	14.07
4	1.6827	3.76	1.6827	3.76
5				

Equatorial Guinea				
maximum rank	trace statistic	5% critical value	max statistic	5% critical value
0	120.4494	68.52	53.9075	33.46
1	66.5418*	47.21	49.5631*	27.07
2	16.9787	29.68	9.7808	20.97
3	7.1979	15.41	5.4	14.07
4	1.7979	3.76	1.7979	3.76
5				

Gabon				
maximum rank	trace statistic	5% critical value	max statistic	5% critical value
0	140.2998	68.52	70.2914	33.46
1	70.0084*	47.21	43.6355*	27.07
2	26.3729	29.68	18.747	20.97
3	7.6259	15.41	7.6171	14.07
4	0.0088	3.76	0.0088	3.76
5				

Westerlund Cointegration test

Table 7: Westerlund Cointegration test (Equilibrium exchange rate estimation)

Westerlund test (eqreer)			
Statistic	Value	Z-value	P-value
Gt	-1.700	1.385	0.917
Ga	-1.706	3.225	0.999
Pt	-1.158	3.356	1.000
Pa	-1.549	2.208	0.986

Table 8: Westerlund Cointegration test (Growth Equation estimation)

Westerlund test (growth)			
Statistic	Value	Z-value	P-value
Gt	-2.169	0.709	0.761
Ga	-0.454	3.997	1
Pt	-2.135	2.887	0.998
Pa	-0.36	2.89	0.998

8.4. Appendix D: Estimated Models

Table 9: Equilibrium REER estimation

logreer	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
tb	-0.0001684	-0.0001687			-0.0004	-0.0001191
logtot	.203584***	.204083***	.185807 ***	.189001***	0.2559***	.194653***
logir		0.0032045	0.0013625	0.0027409	-0.0349	-0.0059697
logpv	.852495***	.849150***	.879895***	.860389***	0.7090***	.8984405***
nfa	0.0000	0.0000	0.0000	0.0000		-0.000025**
logop				0.001065		0.0039721
loggs	-.0394227*	-.0403802**	-.0420155*	-.0371422*	-0.0544**	-.0410615**
logoda			0.0130687			0.0122048
logiv	-.032538***	-.0327723**	-.0302937*	-.030629**	-0.0539***	-.0302755**
cons	1.69778***	1.69645***	1.709515***	1.71970***	1.67151***	1.688468***

Note: *** p<0.01, ** p<0.05, * p<0.1

Table 10: DOLS estimator results for Model 5

DOLS estimator results for Model 5						
loreer	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
tb	-0.0004	0.0003	-1.2400	0.2140	-0.0009	0.0002
logtot	0.2559***	0.0377	6.7800	0.0000	0.1820	0.3298
logir	-0.0349	0.0464	-0.7500	0.4510	-0.1259	0.0560
logpv	0.7090***	0.1633	4.3400	0.0000	0.3889	1.0292
loggs	-0.0544**	0.0227	-2.4000	0.0160	-0.0989	-0.0100
logiv	-0.0539***	0.0149	-3.6200	0.0000	-0.0831	-0.0247

Note: *** p<0.01, ** p<0.05, * p<0.1

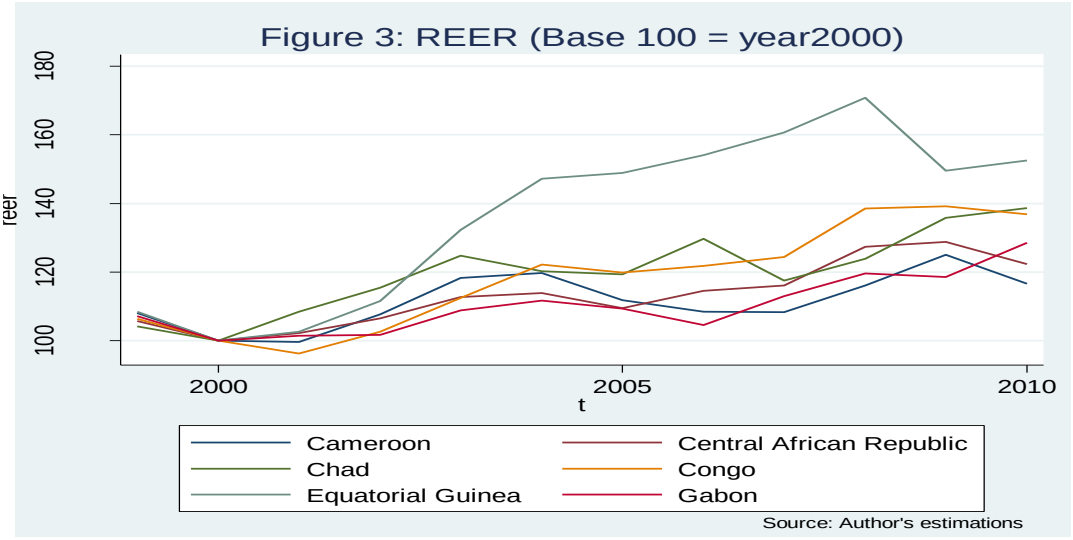
Table 11: Growth Equation estimation

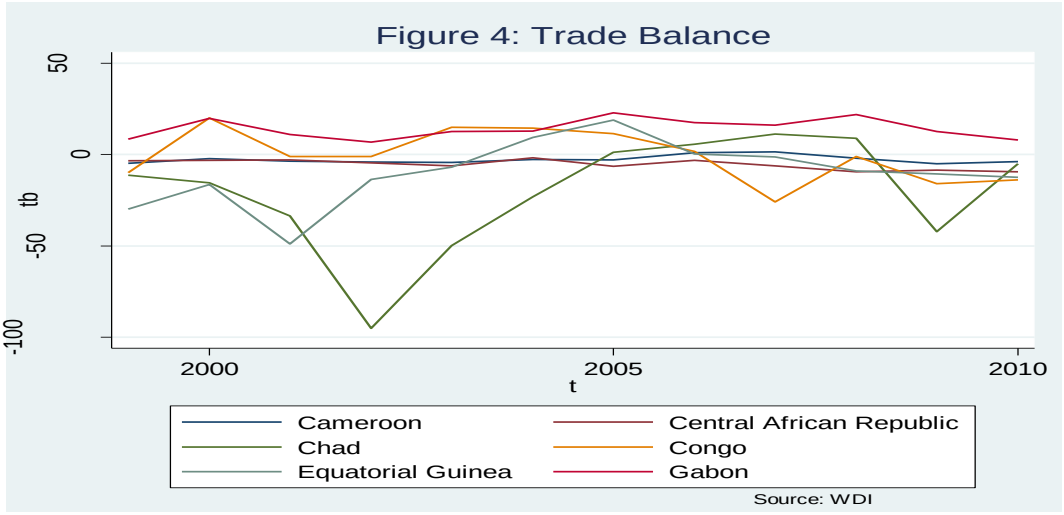
loggdppc	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
loggdppct_1	1.0146***	0.9456***	0.96934***	0.96164***	0.128528*	0.94974***
logmis	1.20138**	1.3643***	1.28720***	1.18191***	1.2646***	1.24298***
logms						
nfa					-.000028**	
logop		0.097829*	0.16864***	0.08068***	.072678**	0.086805***

loggs	-0.050761*	-.08669***	-0.053349**	-.057907**	-.0529862*
gb	0.004129***		0.00375***	.00378***	.003462***
logpg		-.1969058*			
logiv					
cons					

Note: *** p<0.01, ** p<0.05, * p<0.1

8.5. Appendix E: Descriptive Statistics





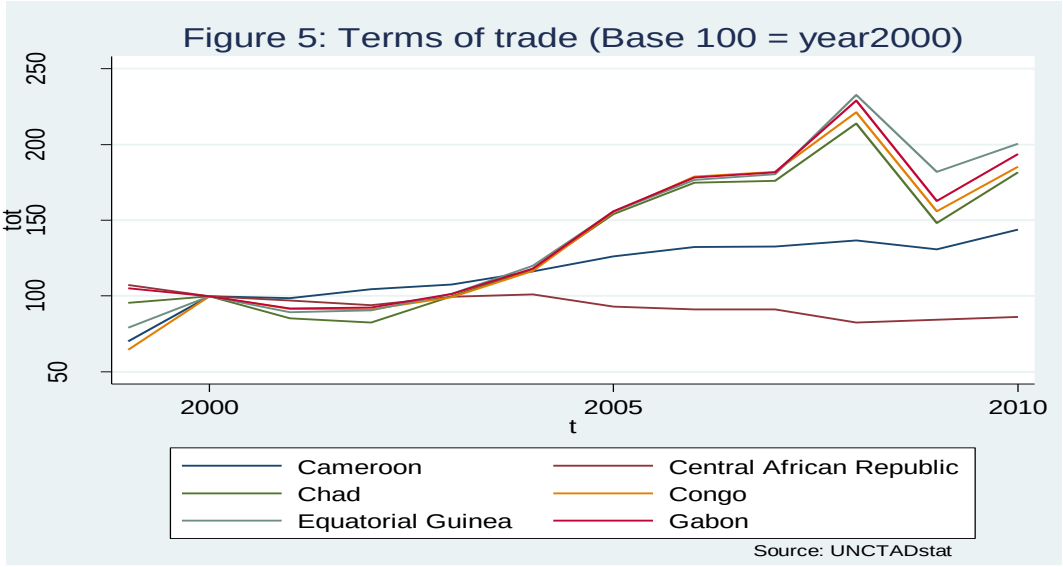


Figure 5: Terms of trade (Base 100 = year2000)
tot
50
100
150
200
250
2000
2005
2010
t
Cameroon
Central African Republic
Chad
Congo
Equatorial Guinea
Gabon
Source: UNCTADstat

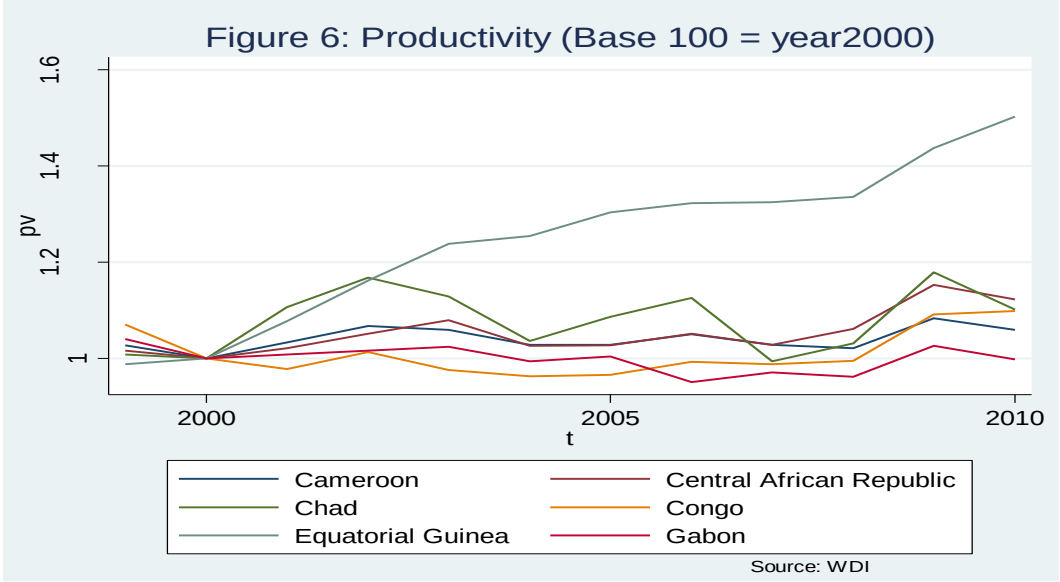


Figure 6: Productivity (Base 100 = year2000)
pv
1
1.2
1.4
1.6
2000
2005
2010
t
Cameroon
Central African Republic
Chad
Congo
Equatorial Guinea
Gabon
Source: WDI

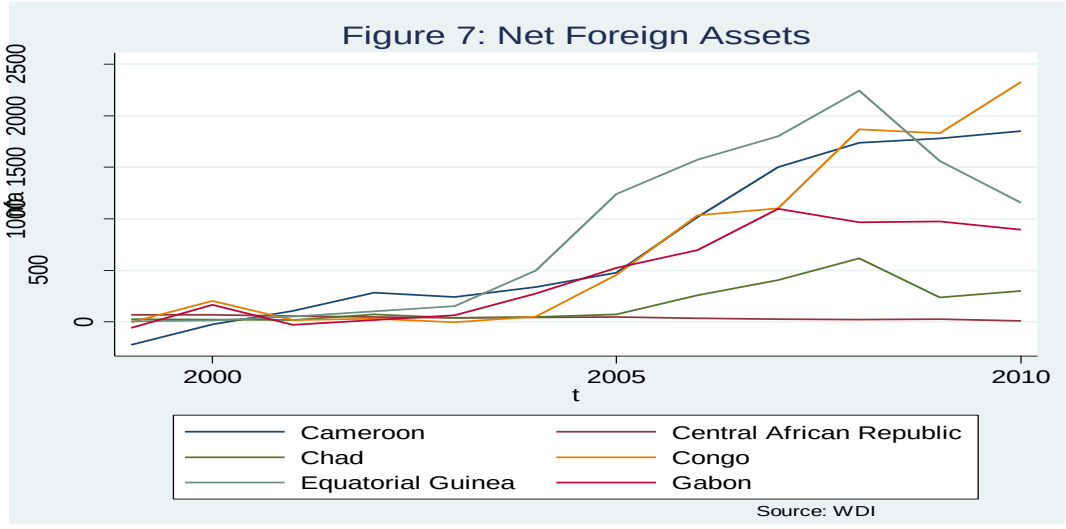


Figure 7: Net Foreign Assets
0
500
1000
1500
2000
2500
2000
2005
2010
t
Cameroon
Central African Republic
Chad
Congo
Equatorial Guinea
Gabon
Source: WDI

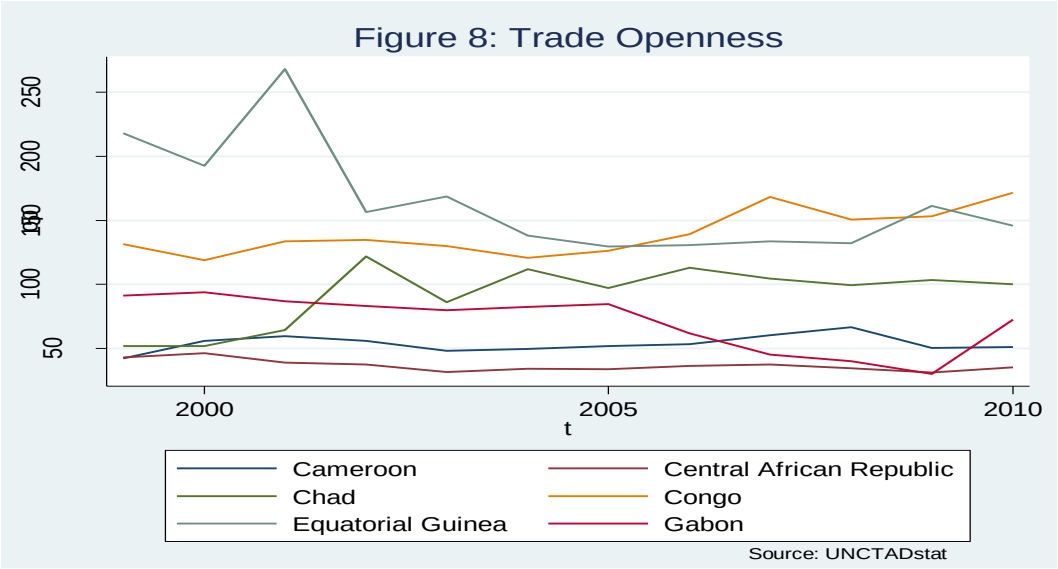


Figure 8: Trade Openness
50
100
150
200
250
2000
2005
2010
t
Cameroon
Chad
Equatorial Guinea
Central African Republic
Congo
Gabon
Source: UNCTADstat

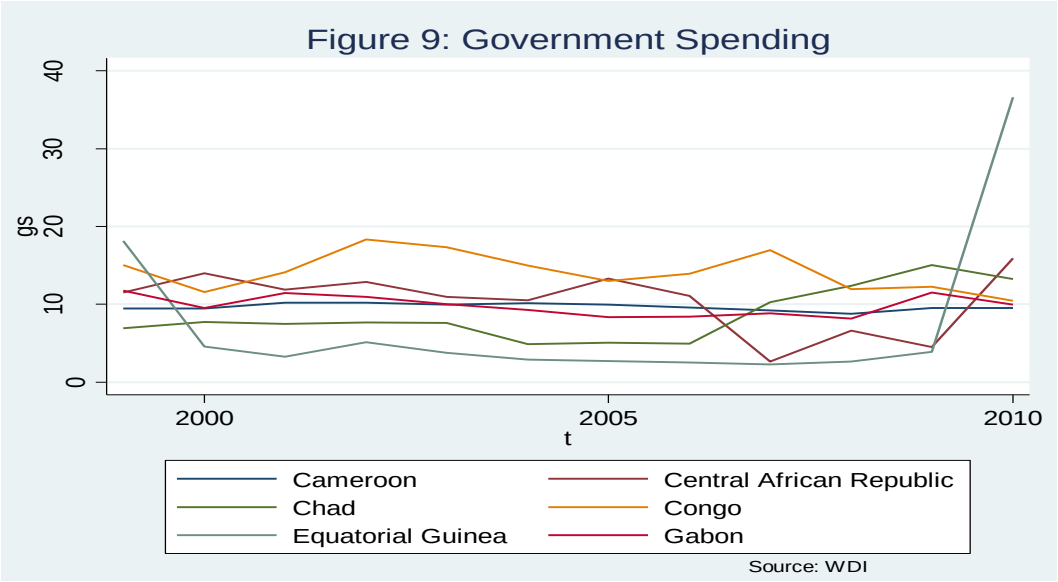


Figure 9: Government Spending
gs
0
10
20
30
40
2000
2005
2010
t
Cameroon
Chad
Equatorial Guinea
Central African Republic
Congo
Gabon
Source: WDI

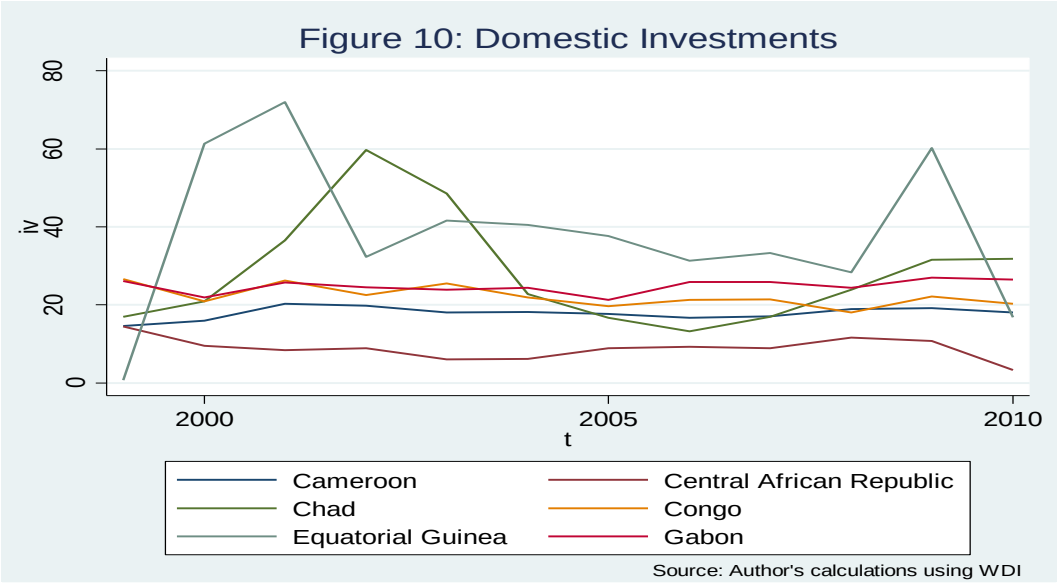


Figure 10: Domestic Investments
iv
0
20
40
60
80
2000
2005
2010
t
Cameroon
Chad
Equatorial Guinea
Central African Republic
Congo
Gabon
Source: Author's calculations using WDI

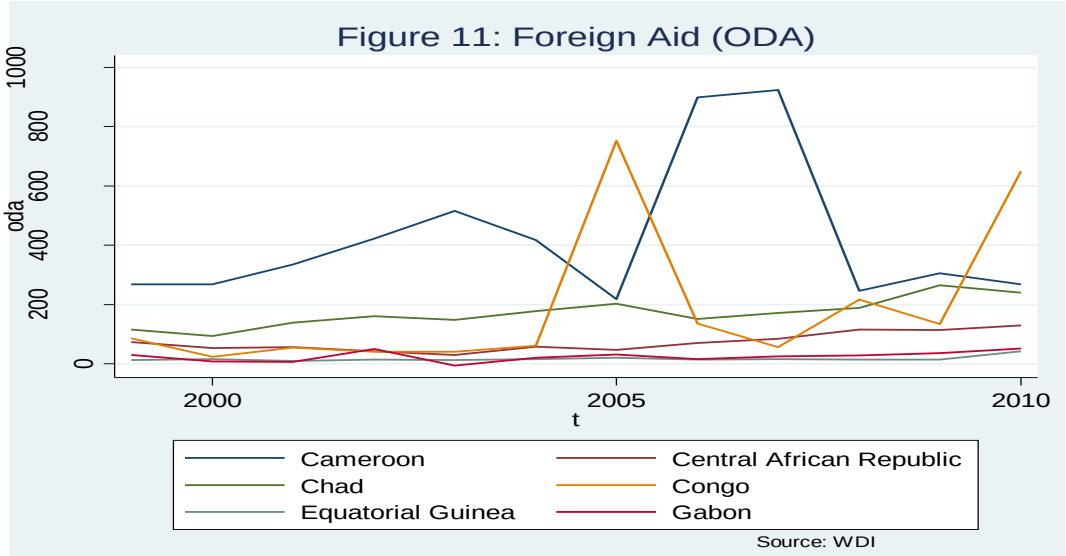


Figure 11: Foreign Aid (ODA)
oda
0
200
400
600
800
1000
2000
2005
2010
t
Cameroon
Central African Republic
Chad
Congo
Equatorial Guinea
Gabon
Source: WDI

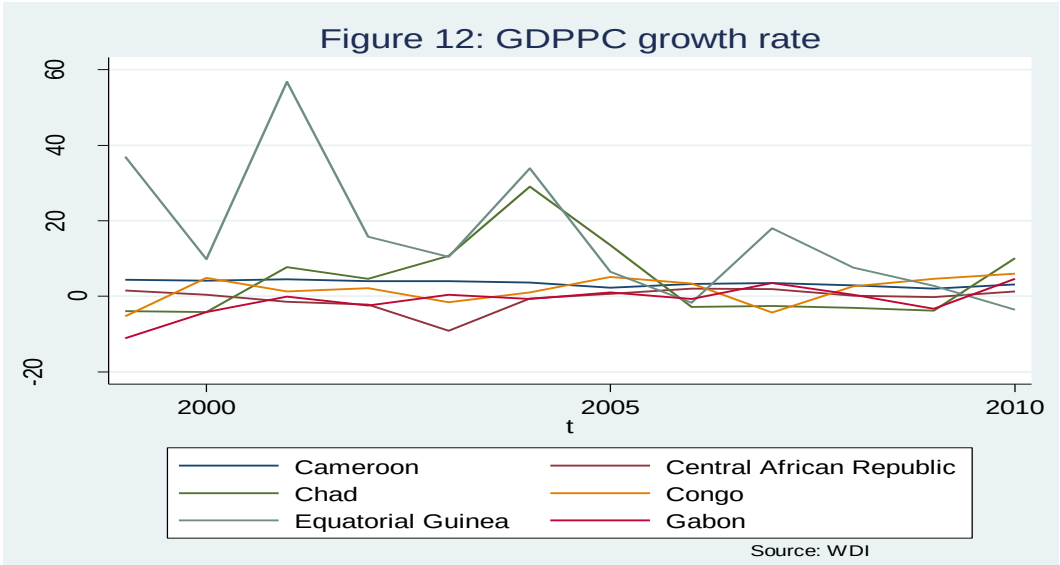


Figure 12: GDPPC growth rate
-20
0
20
40
60
2000
2005
2010
t
Cameroon
Central African Republic
Chad
Congo
Equatorial Guinea
Gabon
Source: WDI

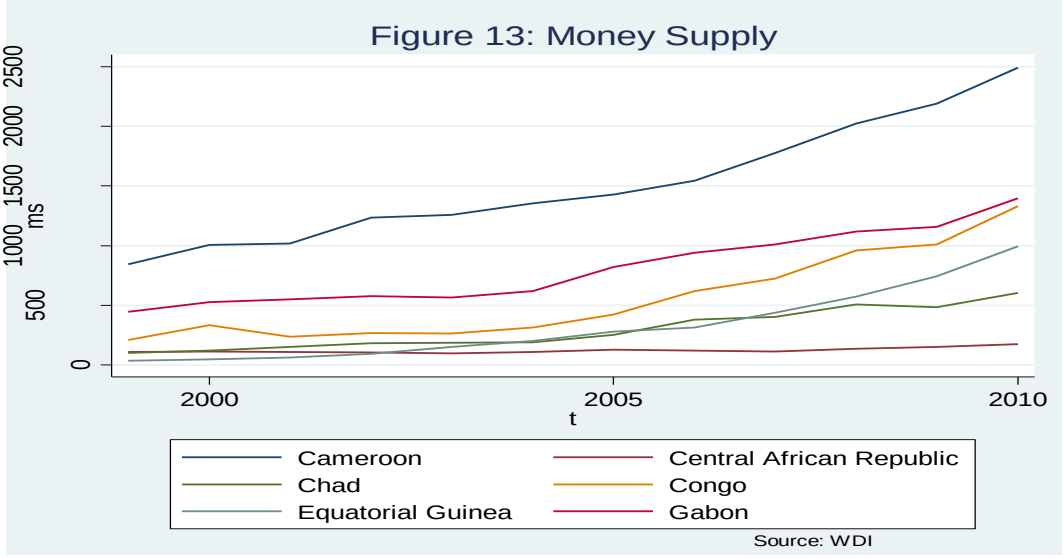


Figure 13: Money Supply
ms
0
500
1000
1500
2000
2500
2000
2005
2010
t
Cameroon
Central African Republic
Chad
Congo
Equatorial Guinea
Gabon
Source: WDI

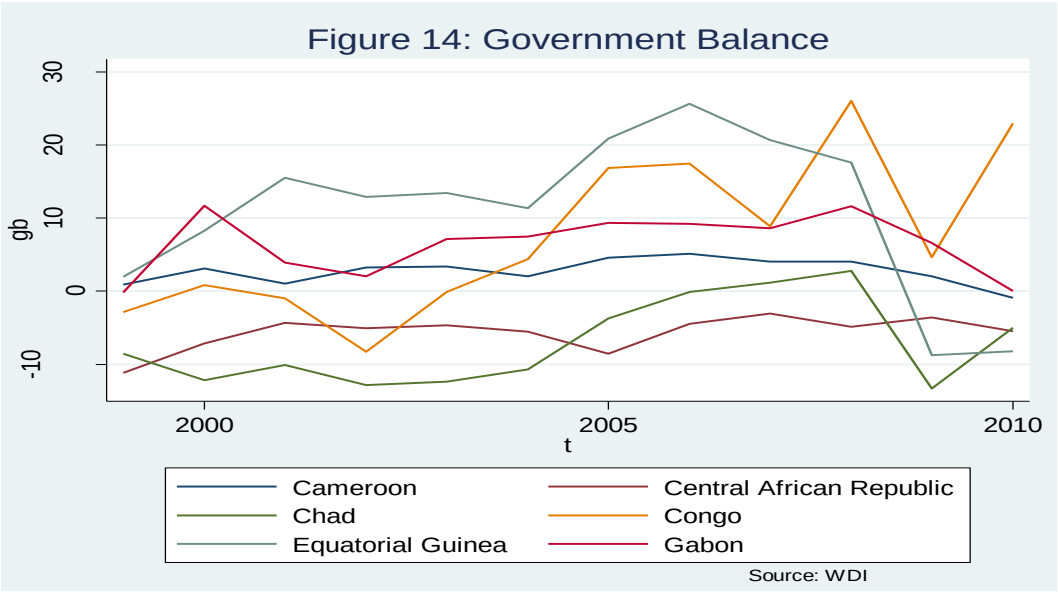


Figure 14: Government Balance
gb
-10
0
10
20
30
2000
2005
2010
t
Cameroon
Central African Republic
Chad
Congo
Equatorial Guinea
Gabon
Source: WDI