INTERNATIONAL RESERVES ACCUMULATION AND ECONOMIC GROWTH IN THE WEST AFRICAN MONETARY ZONE

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ABSTRACT

One of the convergence criteria of the West African Monetary Zone is the accumulation of international reserves. Common to every economic phenomenon, these developments have earned the praises of many as they equally have drawn severe criticisms from others who question the rationale for building reserves in the face of crippling domestic economic activities and high incidence of poverty in these countries. This study therefore sought to find out firstly, the effect of international reserves accumulation on economic growth and secondly, whether there is a threshold effect in the international reserves-economic growth nexus. The static panel regression analysis and the panel cointegration tests results confirm that international reserves accumulation promotes economic growth, a result which is consistent with that of Polterovich and Popov (2003) and Fukuda and Kon (2010). The results from the LOWESS technique as well as the non-linear model indicated the existence of the threshold effects in the economic growth-international reserves nexus. A U-shaped relationship between economic growth and international reserves was established, a result which is quite new to the literature on economic growth and international reserves.

Key words: international reserves; economic growth; panel cointegration; threshold effect; LOWESS technique

Introduction

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In Sub-Saharan Africa, regional alliances are common. The Economic Community of West African States (ECOWAS) is one of the most advanced partnerships on the continent. Since its creation in 1975, ECOWAS has espoused the objective of increasing trade liberalization, and the organization has recently intensified its move towards financial integration. The ECOWAS Monetary Cooperation Programme (EMCP) is the most prominent scheme for monetary integration in the West African sub-region. The specific objectives of the EMCP were to be implemented in three phases. In the short term, the aim was to strengthen the existing payment mechanism of the West African Clearing House (WACH) through the settlement of outstanding payment arrears in the clearing mechanism; introducing new payment instruments such as the traveller'scheque; introducing a credit guarantee fund facility to support the clearing mechanism; and removing all non-tariff barriers that tend to restrict the use of national currencies to effect payments for some current transactions such as hotel bills and air tickets.In the medium term, the EMCP was expected to achieve limited regional convertibility of national currencies by removing existing restrictions on their use. In the long run however, the ultimate goal of the EMCP is the establishment of a single ECOWAS monetary area involving the use of a common convertible currency, the establishment of a common central bank, the pooling of foreign exchange reserves and the negotiation of an external convertibility guarantee with an appropriate international agency. To facilitate these objectives, member states were to embark on an economic policy reform programme to achieve macroeconomic convergence.

The medium- to long-term objectives of the EMCP have also not been fully attained, leading to the deferral of the establishment of the single monetary zone.

Although ECOWAS was conceived with the possible future of monetary integration in mind, it was not until near the end of the 1990s that concrete steps were taken towards achieving this goal. It was planned that the West African Monetary Zone (WAMZ) would merge with the CFA zone in January 2004 in accordance with the EMCP, thus creating the long-awaited single monetary zone in the sub-region.However, before this goal is realised, the member states of the WAMZ are to comply with some convergence criteria, which will ensure macroeconomic stability and reasonable growth in the member states.

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One of the convergence criteria of the West African Monetary Zone was that the gross reserves of each country should be at least three months import cover by the end of 2000 and six months by the end of 2003. The attainment of this criterion has been very challenging if not difficult for member countries. Member countries are striving to build up more reserves in order to meet the criterion. As at the end of June 2006, Gambia had external reserves equivalent to 4.1 months of import cover, Sierra Leone had 2.1 months of import cover , Ghana had 3.6 months of import cover, Guinea, two months and Nigeria had 23 months of import cover and the region as a whole had 20 months of import cover(WAMI 2006). Apart from Nigeria, the other countries reserve position fell far short of the six months import cover targeted for 2003. According to World Bank estimates, by the close of 2009, Gambia had external reserves equivalent to 7.4 months of import cover, Sierra Leone had 7.2 months of import cover, Ghana had 3.6 months of import cover, Guinea, two months and Nigeria had 9.3 months of import cover and the region as a whole had 20 months of import cover. By the close of 2010, Gambia had external reserves equivalent to 7.1 months of import cover, Sierra Leone had 5.2 months of import cover, Ghana had 4.3 months of import cover, and Nigeria had 4.9 months of import cover The crave for international reserves accumulation even in the face of challenges associated with low investment, culminating in low economic growth in the sub-region brings to mind new questions to be answered by international macroeconomics literature. Common to every economic phenomenon, thesedevelopments have earned the praises of many as they equally have drawn severe criticisms from others who question the rationale for building reserves in the face of crippling domestic economic activities and high incidence of poverty in these countries.

In sum, the concern of the critics of reserves holdings (such as Cruz and Kriesler(2008, 2010), Cruz and Walters(2008)) is about the cost of holding reserves which is investment nations must forego in order to accumulate reserves. They are of the view that hoarding of international reserves crowd out public investment in the sense that it prevents governments from spending on public infrastructure which is very critical as far as promotion of economic growth is concerned and that holding of international reserves represents a potential source to boost growth. They further, argue that the resources being amassed largely overwhelm protective needs, and the excess reserves could be used to promote growth.

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Polterovich and Popov (2003), like other supporters of reserves holding, argue in favour of reserve accumulation that it appears that under certain conditions (externalities associated with international trade and/or various kinds of traps in which developing countries often find themselves due to market failures), the authorities/central bank can boost economic growth by building up the stock of foreign exchange reserves instead of using them for consumption. The reasons offered to explain why exchange rate under-valuation can promote long-term economic growth are: First, accumulation of foreign exchange reserves has the conventional short-term expansionary effect – relative prices of tradables increase with respect to prices of non-tradables and wages. In the long run this effect disappears as increased profits are invested and lead to increased demand for nontradables and labor. But if there are subsequent unexpected rounds of foreign exchange reserves build up, the long-term growth rates may increase. Second, undervaluation of the currency stimulates the increase in exports. This increase in exports raises accumulated knowledge due to learning from external trade and therefore economic productivity as well. The rate of growth rises and this outweighs the potential gain from spending reserves for current needs. Third, undervaluation lowers foreign currency prices of domestic real assets and thus attracts foreign direct investment. Besides, continuing foreign exchange reserves build up (especially in periods of trade deterioration) gives a powerful signal to investors that the government is in full control of the situation and can afford costs for the sake of pursuing a consistent policy. Even if foreign exchange reserves accumulation outweighs the FDI flow, FDI externalities may be strong enough to accelerate growth. For obvious reasons technologically backward countries have much more to gain from export externality and from the inflow of foreign direct investment and that is why the benefits of reserve accumulation should be especially promising for developing countries.

This study therefore, attempts to find out first, whether there is any relationship between international reserves accumulation and economic growth and secondly whether there is a threshold effect in the international reserves-economic growth nexus. The study will be one of the very few studies, if not the only study so far, that has adopted the locally weighted scatterplot smoothing (LOWESS) and the panel cointegration techniques to examine the relationship between economic growth and international reserves and also to find out the existence of a

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threshold effect. The study therefore, helps bridge the research gap and expands the frontiers of knowledge.

International reserves accumulation has been one of the preferred policies put in place by member economies of WAMZ to achieve financial stability culminating in the introduction of a single currency. The aim of this policy is to increase liquidity and thus reduce the risk of suffering a speculative attack. However, no analysis has been done to find out whether this strategy is, or could be, more broadly supportive of economic growth and development, an issue that must be of central interest for the countries of WAMZ. This study therefore, helps throw some light on the relationship between international reserves accumulation and economic growth and by so doing contribute to the on-going debate on international reserves accumulation i.e. whether it is necessary for countries in WAMZ to accumulate international reserves.

Furthermore, the results of the study will inform policy makers on the appropriate policy direction to follow concerning the issue of international reserves accumulation. If international reserves accumulation is proven to be supportive of economic growth and development in WAMZ then that will give a very strong indication to policy makers to put in place appropriate policy measures that will help promote a sustained increase in the reserve holdings of the countries of WAMZ. On the other hand, if international reserves accumulation is proven to be non-supportive of economic growth and development in WAMZ then the convergence criterion concerning reserve accumulation will have to be revisited.

Measuring the adequacy of International Reserves in the West African Monetary Zone

Table 1 shows the descriptive statistics of the five countries of WAMZ as far as their reserve holdings are concerned. Over the period, 1984 – 2009, Nigeria as it is expected has the highest mean amount of reserves. This is followed by Ghana, Guinea, Gambia and Sierra Leone in that order. The mean amount of reserves for the WAMZ as a group is $13396.59 million. The Gambia registered the lowest amount of reserves of $1.73 million in the period under consideration. This is followed by Sierra Leone with an amount of $3.73 million. The high standard deviations can be interpreted as indicating a lot of variations in the international reserve holdings behavior of these countries. This is quite understandable given their nature as less

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developed/developing countries which depend heavily on the export revenues from mainly primary commodities which face fluctuating world market prices.

Table 1: International reserves (in millions of US Dollars) 1984 – 2009

	N	Min.	Max.	Mean	Std. Deviation
Ghana	26	195.13	3200.00	884.60	848.59
Nigeria	26	651.15	53001.77	12189.6	16709.31
Gambia	26	1.73	224.18	84.37	49.83
Guinea	26	62.81	388.10	164.58	97.57
Sierra Leone	26	3.73	404.96	73.44	94.80
WAMZ	26	1034.80	55723.89	13396.59	17683.75

Source: Author's calculations based on WDI data

The issue of reserve adequacy has gained widespread attention in international circles. According to Fischer(2001), the level of reserves can be an important factor in explaining and predicting currency crisis. Various benchmarks have been used to measure the adequacy of international reserves. These include reserves to import ratio, reserves to short term external debt ratio, and reserves to broad money supply ratio. However, the only benchmark which features prominently in discussions in the WAMZ is the reserve to import ratio.

Reserves to Import Ratio

Contemporary literature considers reserve-to-import (R/M ratio) a proper measure of reserve adequacy and three months prospective level of imports cover became rule of thumb to judgment (Fischer, 2001). This three month import cover criterion is one of the convergence criteria set by the countries of the West African Monetary Zone for the introduction of a single currency.This amount of import cover is seen as a guarantee of no hindrance in external trade transaction even in a case of complete cut off from foreign flows.

This benchmark is especially relevant to low-income countries exposed to current account shocks, such as a fall in the price of a country's main export or a drop in tourism receipts due to natural disaster and also to low-income countries without significant access to capital markets. Table 2 shows the descriptive statistics of the five countries of WAMZ as far as this criterion of three-month import cover is concerned. International reserves in month of import

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cover have ranged from as low as 0.18 to as high as 11.64 months within the period 1984 to 2009. Three countries, Guinea, Gambia and Sierra Leone, at one time or the other, registered international reserves of less than a month of import cover with Sierra Leone, in this case, registering the lowest amount of reserves 0.18 months. Nigeria, an oil exporting country, again tops the list with a maximum of 11.64 months and a mean of about 5 months over the period. The WAMZ as a group has a minimum of 8.74 and a maximum of 30.6 and a mean amount of reserves of approximately 17 months of import cover. This puts the group in a stronger position than the individual countries.

Table 2: International reserves (in months of imports), 1984 – 2009

	N	Min.	Max.	Mean	Std. Deviation
Ghana	26	1.07	6.96	3.35	1.58
Nigeria	26	1.25	11.64	5.00	3.23
Gambia	26	.22	7.85	3.87	2.00
Guinea	26	.93	4.87	2.26	.96
Sierra Leone	26	.18	9.08	2.45	2.17
WAMZ	26	8.74	30.60	16.93	5.84

Source: Author's calculations based on WDI data

Basic descriptive statistics

Table 3 to Table 4 present the basic descriptive statistics of the two main variables, gross domestic product and international reserves, over the full sample. To determine the normality of the distributions of the two variables, the Jarque-Bera normality tests have been performed and the results are also reported in the tables. For a variable to be normally distributed, the Jarque-Bera normality test statistic should not be significant.

Table 3: Basic Descriptive Statistics for Gross Domestic Product (in logs)

Country	Mean	Std. Dev.	Skewness	Kurtosis	Jarque-Bera Normality Test
Ghana	21.295	0.377	1.047	0.146	51.246 [0.0000]**

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Nigeria	23.815	0.436	0.296	-0.782	6.831 [0.0329]*
Gambia	20.131	0.284	0.409	-0.720	10.007 [0.0067]**
Guinea	22.959	0.304	-0.250	-1.116	12.619 [0.0018]**
Sierra Leone	21.042	2.146	1.097	-0.156	84.667 [0.0000]**

Notes: Statistical significance at the 1%, 5%, levels is indicated by **, *, respectively.

Table 4: Basic Descriptive Statistics for International Reserves (in logs)

Country	Mean	Std. Dev.	Skewness	Kurtosis	Jarque-Bera Normality Test
Ghana	20.110	0.825	0.496	-0.622	12.542 [0.0019]**
Nigeria	22.293	1.357	0.286	-0.869	8.024 [0.0181]*
Gambia	17.799	1.233	-1.717	1.907	160.630 [0.0000]**
Guinea	18.133	0.729	-0.614	-0.517	18.090 [0.0001]**
Sierra Leone	17.209	1.255	0.044	-0.702	1.985 [0.3707]

Notes: Statistical significance at the 1%, 5%, levels is indicated by **, *, respectively.

All the five countries reject the normality assumption for the GDP. This means that the GDP in all the five countries are not normally distributed. In the case of international reserves accumulation, except that of Sierra Leone all the rest are not normally distributed.

Moreover, in most of these countries except Guinea, the distributions of GDP are right-skewed (positively skewed). This means that apart from Guinea the larger values of GDP vary more than the lower and that the majority of values are less than the mean. Concerning international reserves, three countries, Ghana, Nigeria and Sierra Leone have the distributions of their international reserves being right-skewed implying that the majority of values are less than

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the mean whereas Gambia and Guinea have theirs being left-skewed (negatively skewed) meaning that the majority of values are greater than the mean.

Literature review

There is a plethora of empirical literature on the determinants of economic growth. However, there are very few studies that have looked at the effect of international reserves on economic growth. These studies include Polterovich and Popov(2003),Fukuda and Kon(2010) andElhiraika and Ndikumana (2007) whose study did not directly look at the effect of international reserves on economic growth but on some variables which affect economic growth.

Elhiraika and Ndikumana (2007) use a panel data from 21 African countries to examine the causes and economic implications of reserve accumulation with a focus on the impact on the exchange rate, inflation, and public and private investment. They assert that while the level of reserves remains adequate on average, some countries have accumulated excessive reserves especially in recent years. Empirical analysis shows that the recent reserve accumulation cannot be justified by portfolio choice motives (in terms of returns to assets) or stabilization objectives. At the same time it has resulted in exchange rate appreciation while it has yielded little benefits in terms of public and private investment. The evidence suggests that African countries, especially those endowed in natural resources, need to adopt a more pro-growth approach to reserve management.

Fukuda and Kon(2010) also, explores the possible long-run impacts of accumulation in foreign exchange reserves on macroeconomic variables in developing countries. They analyze a simple open economy model where increased foreign exchange reserves reduce the costs of liquidity risk. Given the amount of foreign exchange reserves, utility-maximizing representative agents decide consumption, capital stock, and labor input, as well as the amounts of liquid and illiquid external debt. The equilibrium values of these variables depend on the amount of foreign exchange reserves. A rise in foreign exchange reserves increases both liquid and total debt, while shortening debt maturity. To the extent that interest rates of foreign exchange reserves are low, an increase in foreign reserves also leads to a permanent decline in consumption. However, when the tradable sector is capital intensive, the increase may enhance investment and economic

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growth. They provide empirical support for their theoretical analysis using panel data from the Penn World Table. The cross-country evidence shows that an increase in foreign exchange reserves raises external debt outstanding and shortens debt maturity. The results also imply that increased foreign exchange reserves may lead to a decline in consumption, but can also enhance investment and economic growth. According to them the positive impact on economic growth, however, disappears when the impact is controlled through investment.

Methodology

Following earlier studies such as Mankiw et al. (1992), Abdullahi and Suardi(2007) among others, the growth model used in this study is an augmented neoclassical Solow-Swan model. Thus, we specify the economic growth equation as

$$\ln Y_{it} = \gamma_0 + \gamma_1 \ln Fr_{it} + \gamma_2 \ln CPR_{it} + \gamma_3 \ln Lab_{it} + \gamma_4 \ln Rmt_{it} + \gamma_5 \ln M2Y_{it} + \gamma_6 \ln FDI_{it}$$
$$+ \gamma_7 \ln TOp_{it} + \gamma_8 \ln GCF_{it} + \delta_{it} \tag{1}$$

where Y is GDP, Fr is international reserves, CPR is civil liberties and political rights, Lab is labour force, Rmt is remittances, M2Y is financial development, FDI is foreign direct investment capturing technological environment, TOp is trade openness and GCF is gross capital formation.

The effect of international reserves on economic growth may come from two possible channels namely the export channel and investment channel. Accumulation of international reserves brings about undervaluation of the domestic currency. This undervaluation of the currency stimulates the increase in exports. This increase in exports raises accumulated knowledge due to learning from external trade and therefore economic productivity as well. The rate of growth rises and this outweighs the potential gain from spending reserves for current needs.

The undervaluation lowers foreign currency prices of domestic real assets and thus attracts foreign direct investment. Besides, continuing foreign exchange reserves build up (especially in periods of trade deterioration) gives a powerful signal to investors that the government is in full control of the situation and can afford costs for the sake of pursuing a consistent policy. Even if foreign exchange reserves accumulation outweighs the FDI flow, FDI externalities may be strong enough to accelerate growth (see Polterovich and Popov (2003)).

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Also, the availability of reserves makes it possible to import capital goods, thus facilitating increased domestic private investment which may impact positively on economic growth. Also, there may be an increase in investment due to the inflow of foreign capital attracted by higher profitability in the tradable sector and due to the decline in government budget deficit resulting from increased revenues attributable to price increases in the tradable sector.It is therefore expected that an increase in international reserves should increase economic growth in accordance with Polsterovich and Popov (2003) postulation.

The discussions on the effect of political freedom on growth indicate that the net effect of more political freedoms on growth is theoretically ambiguous. According to Barro (1996), one cannot conclude from the available evidence that more or less democracy is a critical element for economic growth but there is some indication of a nonlinear relation in which more democracy raises growth when political freedoms are weak but depresses growth when a moderate amount of freedom is already established.

Human capital is the main source of growth in several endogenous growth models as well as one of the key extensions of the neoclassical growth model. Nelson and Phelps (1966) suggest that a large sized labour force makes it easier for a country to absorb new products or ideas that have been discovered elsewhere. Romer (1990) states that quality development of labour force generates new products or ideas that underlie technological progress. He also notes that those countries with a large and well developed labour force experience a more rapid rate of introduction of new goods and thereby tend to grow faster. A large number of studies has found evidence suggesting that educated population is key determinant of economic growth (see Barro, 1991; Mankiw et al, 1992; Barro and Sala-i-Martin, 1995; Brunetti et al, 1998, Hanushek and Kimko, 2000). However, there have been other scholars who have questioned these findings and, consequently, the importance of human capital as substantial determinant of economic growth (e.g. Levine and Renelt, 1992; Benhabib and Spiegel, 1994; Topel, 1999; Krueger and Lindahl, 2001; Pritchett, 2001).

Generally, the economic literature suggests that remittance flows contribute to investment growth, the alleviation of poverty, an improved standard of living, and economic growth and development. According to the World Bank (2006) remittances are more effective in both raising

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investment and enhancing growth in countries with higher levels of human capital, strong institutions, and good policy environments. However, as noted by Burnside and Dollar (2002) the impact ofthese flows on the rate of growth of the recipient economy depends on whether that particular money transfer is invested or consumed. If it is invested, it is likely to positively affect growth, whereas if it is consumed it may have a negative or no impact. Incentives to invest remittances and any returns on investment and its subsequent productivity, depends on the policy environment that exists. A good policy environment will increase the returns on investment and raise the opportunity cost on consumption, while on the contrary, a bad policy environment will reduce the returns on investment and lower the opportunity cost of consumption. Thus the effect could be positive or negative.

Recent extensions of the endogenous growth models to incorporate effects of financial deepening and intermediation on growth have emphasized the important role that financial intermediation plays in improving the efficiency of investment and thus stimulating economic growth. A survey of studies on economic growth, using the ratio of money to GDP as a financial indicator concluded that financial intermediation has beneficial effects on growth (King and Levine, 1993). Thus the effect is expected to be positive.

Foreign direct investment (FDI) has recently played a crucial role of internationalising economic activity and it is a primary source of technology transfer and economic growth. This major role is stressed in several models of endogenous growth theory. The empirical literature examining the impact of FDI on growth has provided more-or-less consistent findings affirming a significant positive link between the two (e.g. Borensztein et al, 1998; Hermes and Lensink, 2000; Lensink and Morrissey, 2006). Thus the effect is expected to be positive.

Openness to trade has been used extensively in the economic growth literature as a major determinant of growth performance. There are sound theoretical reasons for believing that there is a strong and positive link between openness and growth. On the one hand, a large part of the literature has found that economies that are more open to trade and capital flows have higher GDP per capita and grew faster (Dollar, 1992, Sachs and Warner, 1995, Edwards, 1998, Dollar and Kraay, 2000). Thus the effect is expected to be positive.

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Investment is the most fundamental determinant of economic growth identified by both neoclassical and endogenous growth models. However, in the neoclassical model investment has impact on the transitional period, while the endogenous growth models argue for more permanent effects.The importance attached to investment by these theories has led to an enormous amount of empirical studies examining the relationship between investment and economic growth (see for instance, Kormendi and Meguire, 1985; Levine and Renelt, 1992; Mankiw et. al, 1992; Auerbach et al, 1994; Barro and Sala-i- Martin, 1995; Sala-i-Martin, 1997; Easterly and Levine, 1997; Bond et al, 2001; Podrecca and Carmeci, 2001). Nevertheless, findings are not conclusive.

Econometric procedure

This study uses panel data econometric techniques. The standard model to analyse panel data is the unobserved effects model. Observations are pooled over time and units of observation, with or without individual-specific effects. These effects can be fixed (fixed effects model) or random (random effects model). Analytically it can be written as

$$Z_{it} = \beta' \chi_{it} + \mu_i + \pi_{it}$$ (2)

where z is the level of real GDP and x represents a set of variables that potentially affect the level of real GDP. ß is a vector of slope parameters, μ represents the country specific effect and π is the error term, i denotes a specific country and t stands for time. In total, we observe N countries over T time periods.

The choice between fixed or random effects formulation can be justified by considerations on the data-generating process as well as by statistical tests.When the sample is open, i.e. when the N cross-section units are drawn randomly from a large population, random effects are natural candidates. When, on the other hand, the sample contains all units of interest and is not a sample drawn from a larger population, fixed effects are appropriate.

For our specific analysis of a sample of countries, all mentioned considerations point to the fixed effects formulation. The sample is closed in the sense that it contains almost the whole population, namely all countries constituting the WAMZ. Moreover, it is likely that the individual effects are correlated with the observed explanatory variables.

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Panel unit root tests

Panel data unit root and cointegration tests are based on pooling the information in the individual units in the panel. The main reason for using panel tests is that the power of individual tests to reject the null hypothesis of a unit root or no cointegration can be low.

There are two types of panel unit root processes. When the persistence parameters are common across cross-section then this type of processes is called a common unit root process. Levin, Lin and Chu (2002) employ this assumption. When the persistent parameters freely move across cross-section then this type of unit root process is called an individual unit root process. The Im, Pesaran and Shin (IPS), Fisher-ADF and Fisher-PP tests are based on this form.

Panel cointegration tests

Westerlund (2007) developed four panel cointegration tests. The underlying idea is to test for the absence of cointegration by determining whether the individual panel members are error correcting. Consider the following error-correction model:

$$Dy_{it} = \alpha_i + \beta_{i1}Dy_{it-1} + \beta_{i2}Dy_{it-2} + ... + \beta_{ip}Dy_{it-p} + \delta_{i0}Dx_{it} + \delta_{i1}Dx_{it-1} + ... + \delta_{ip}Dx_{it-p}$$
$$+ \beta_i(y_{it-1} - \delta_i x_{it-1}) + u_{it} \qquad (3)$$

β_i provides an estimate of the speed of error-correction towards the long run equilibrium $y_{it} = -(\delta_i / \beta_i)x_{it}$ for that series i. The Ga and Gt test statistics test H0: $\beta_i = 0$ for all i versus H1: $\beta_i < 0$ for at least one i. These statistics start from a weighted average of the individually estimated β_i's and their t-ratio's, respectively. The Pa and Pt test statistics pool information over all the cross-sectional units to test H0: $\beta_i = 0$ for all i versus H1: $\beta_i < 0$ for all i. Rejection of H0 should therefore be taken as rejection of cointegration for the panel as a whole.

The tests are very flexible and allow for an almost completely heterogeneous specification of both the long- and short-run parts of the error-correction model, where the latter can be determined from the data. The series are allowed to be of unequal length. If the cross-sectional units are suspected of being correlated, robust critical values can be obtained through bootstrapping.

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Finding the threshold effects

In the first instance, the LOWESS which stands for locally weighted scatterplot smoothing has been used to determine the possibility of threshold effects in the demand for international reserves as well as the economic growth-international reserves nexus. LOWESS carries out a locally weighted regression of y-variable on x-variable, displays the graph, and optionally saves the smoothed variable.

LOWESS is one of many non-parametricregression techniques, but arguably the most flexible. LOWESS is a bivariate smoother meant to represent the notion of locally weightedregression–a curve- or function-fitting technique that provides a generally smoothcurve, the value of which at a particular location along the x-axis is determined onlyby the points in that vicinity. The method consequently makes no assumptions aboutthe form of the relationship, and allows the form to be discovered using the data itself.

Secondly, quadratic functional form has been formulated and estimated in order to confirm the existence of threshold effectin the economic growth-international reserves nexus.

Data type, description and sources

The study uses panel data for the five members of the West African Monetary Zone namely Ghana, Nigeria, Gambia, Guinea and Sierra Leone for the period 1984(1) to 2009(4).

Economic growth is measured by real GDP in constant 2000 US dollars. Trade openness is calculated as ratio of imports plus exports to GDP. Technological environment is captured by the contribution of FDI, in percentage, to capital formation. Financial development is measured by the ratio of broad money to GDP.Gross capital formation in constant 2000 US dollars is used as a measure of investment. Remittances refer to migrants' remittances in US dollars. All variables are transformed into natural logarithms before estimation. Thus, allowing us to interpret the coefficient estimates as elasticities.

Data on GDP, international reserves, broad money supply, gross capital formation, imports and exports have been obtained from the World Bank's World Development Indicators (WDI) and from IMF's International Financial Statistics (IFS). Data on remittances, foreign direct investment and labour force have been obtained from United Nations Conference on

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Trade and Development Statistics (UNCTADSTAT). Data on political rights and civil liberties have been obtained from Freedom house's annual surveys of freedom available at http://www.freedomhouse.org. The index of political rights and civil liberties rates countries based on the scale of 1 to 7, where 1 represents the highest degree of political rights and civil liberties and 7 the lowest. Both indexes were summed up to get one single index to capture civil liberties and political rights. In this case 2 represents the highest degree of political rights and civil liberties and 14 the lowest. The factors that are considered in the measurement of civil liberties and political rights include electoral process, political pluralism and participation, functioning of Government, freedom of expression and belief; associational and organizational rights; rule of law; personal autonomy and individual rights.

Results

Panel regression analysis

According to the static panel regression result which is robust to disturbances being heteroscedastic andautocorrelated shown in Table 5, international reserves accumulation has a positive correlation with economic growth. This means that accumulation of international reserves promote economic growth. This is consistent with the findings of Polsterovich and Popov (2003) and Fukuda and Kon(2010). Promotion of more civil liberties and political rights also boost economic growth. Labour force and gross capital formation have the expected positive effects on economic growth. Remittances have negative relationship with economic growth whereas in case of broad money supply, the relationship is positive. The negative effect of remittances on growth is not surprising. As noted by Burnside and Dollar (2002) the impact ofthese flows on the rate of growth of the recipient economy depends on whether that particular money transfer is invested or consumed. If it is invested, it is likely to positively affect growth, whereas if it is consumed it may have a negative or no impact.The negative effect on growth means that in the WAMZ a significant amount of the remittances go into consumption which is not strange given the prevailing levels of poverty.Trade openness has negative relationship with economic growth contrary to expectation. Foreign direct investment has positive effect on economic growth.

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Table 5: Economic Growth (GDP) equation- Static panel regression

Fixed-effects (within) regression   R-sq: within =0.7902
 F(8,507   =   238.65
              Prob> F=   0.0000

lnY	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
lnFr	.032	.010	3.25	0.001	.013	.051
lnCPR	-.098	.024	-4.09	0.000	-.145	-.051
lnLab	.577	.093	6.24	0.000	.396	.759
lnRmt	-.012	.004	-2.87	0.004	-.021	-.004
lnM2Y	.059	.013	4.52	0.000	.033	.084
lnFDI	.044	.011	4.05	0.000	.023	.066
lnTOp	-.092	.016	-5.70	0.000	-.123	-.060
lnGCF	.115	.016	7.07	0.000	.083	.147
Cons	9.765	1.165	8.38	0.000	7.477	12.053

Possibility of threshold effects in economic growth-international reserves nexus—LOWESS technique

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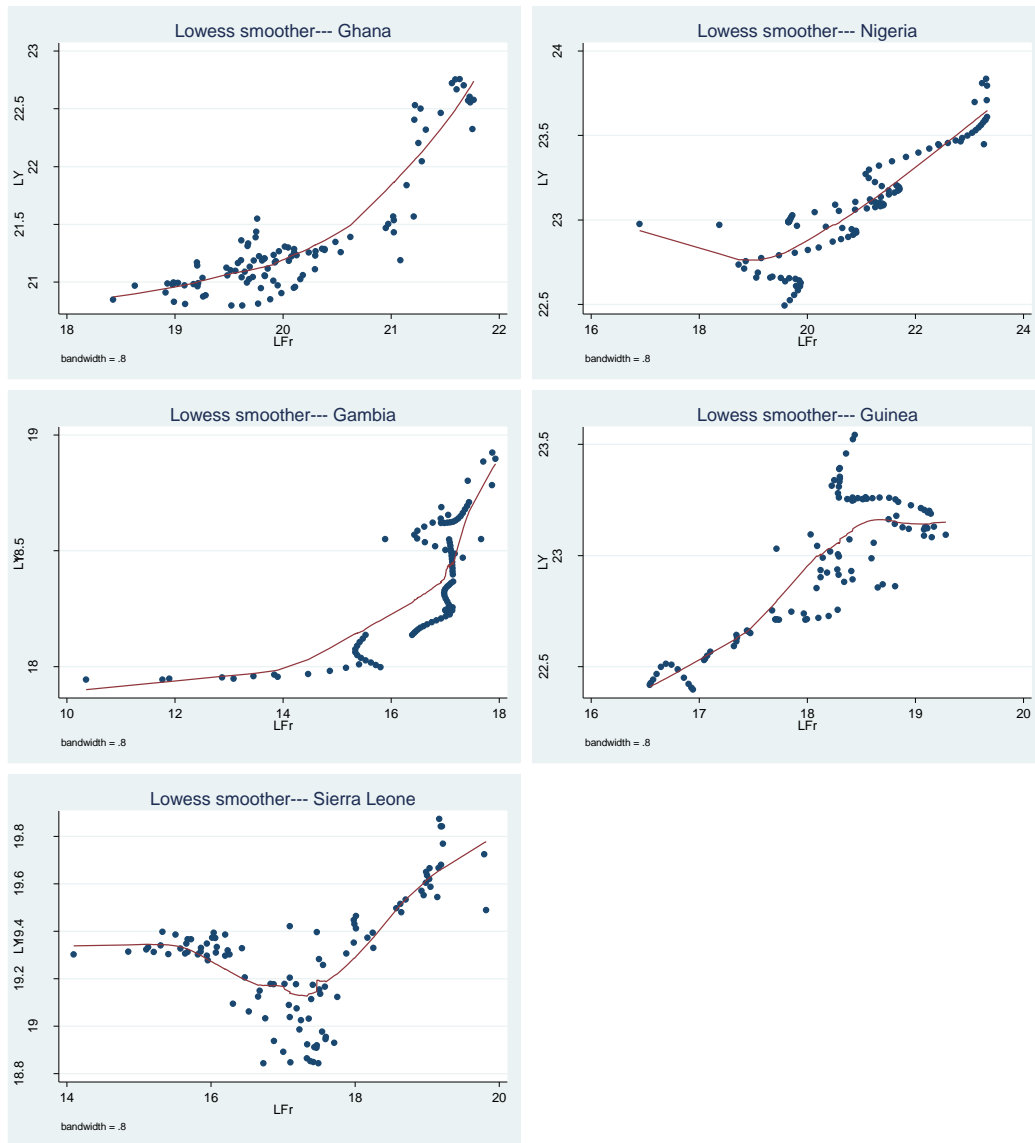
Figure 32: Relationship between economic growth and international reserves --- LOWESS

An examination of the graphs reveals the possibility of threshold effects in the relationship between economic growth and international reserves accumulation in Nigeria, Guinea, and Sierra Leone. In Nigeria and Sierra Leone, there is clearly a U-shaped relationship meaning that international reserves accumulation initially retards growth but later on promotes it. In the cases of Ghana and Gambia, it is not quite clear. To confirm or reject the non-linearity in the relationship between economic growth and international reserves for the panel as a whole, we

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incorporated a squared term of international reserves in the growth model. In the non-linear model of the economic growth shown in Table 6, the squared term of foreign exchange reserves is significant implying that there is indeed a threshold effect in the relationship. There is a U-shaped relationship between international reserves accumulation and economic growth in the WAMZ. In other words, international reserves accumulation initially causes a decrease in economic growthbut after a certain threshold it increases economic growth. The U-shaped nature of the curve may be explained by the fact that at the initial stages, international reserves accumulation may fuel inflation because of increase in supply of money, and also may increase interest rates because of possible sterilization measures monetary authorities may put in place such as sale of government bonds, causing a decrease in economic growth but after some time when some critical amount of reserves are accumulated then it may give a strong signal to prospective foreign investors about the financial health of the economy and about the falling/lower prices of domestic assets in dollar terms (because the build-up of reserves underprices the exchange rate), resulting in increased inflow of foreign direct investment. Even more important is probably the demonstration effect – the ability of authorities to accumulate reserves for a considerable period of time is taken as a sign of the government credibility and consistency of its policy. Also, the attainment of that critical amount of reserves may be enough to cause a significant exchange rate undervaluation to enhance export competitiveness bringing about exports growth. The cumulative effects of these may outweigh any negative effect of inflation and interest rates thereby bringing about long term economic growth.

This threshold effect established in the relationship between economic growth and international reserves is new to the literature on economic growth and international reserves. Although, Polterovich and Popov (2003) and Fukuda and Kon (2010) studied the relationship between economic growth and international reserves, they did not attempt to find out the possibility of a threshold effect in the relationship.

Table 6: Economic Growth (GDP) --- Static panel non-linear model

Fixed-effects (within) regression	R-sq: within $= 0.8365$
$F(9,506) = 287.72$	
Prob> F $= 0.0000$	

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lnY	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]
lnFr	-.510	.046	-11.07	0.000	-.600 -.419
$lnFr^2$	.015	.001	11.98	0.000	.013 .018
lnCPR	-.079	.021	-3.72	0.000	-.121 -.037
lnLab	.784	.084	9.38	0.000	.619 .948
lnRmt	-.014	.004	-3.75	0.000	-.022 -.007
lnM2Y	.024	.012	1.99	0.047	.000 .047
lnFDI	.032	.010	3.30	0.001	.013 .051
lnTOp	-.157	.015	-10.32	0.000	-.187 -.127
lnGCF	.115	.014	7.97	0.000	.086 .143
Cons	11.686	1.041	11.22	0.000	9.640 13.732

Analysis of panel unit root and cointegration tests results

Since the main objective of this study is to find the effect of international reserves accumulation on economic growth, we try to isolate international reserves and examine its long term effect on economic growth in a panel setting using the Westerlund error correction model. Panel unit root tests were first carried out to determine the stationarity status of the two main variables of interest, economic growth and international reserves. The results as shown in table 7 indicate that the two variables are both integrated of order one ((I(1) series).

Table 7: Results of panel unit root tests

Variable	Levin Lin & Chu		Im, Pesaran& Shin		ADF-Fisher Chi-square		PP-Fisher Chi-square	
	Statistic	P-value	Statistic	P-value	Statistic	P-value	Statistic	P-value
lnFr	-0.72590	0.2339	-0.22206	0.4121	8.60977	0.5695	8.02948	0.6260
DlnFr	-22.4443	0.0000	-22.0787	0.0000	284.589	0.0000	317.196	0.0000
lnY	-1.19003	0.1170	1.05367	0.8540	4.70593	0.9099	5.13670	0.8819
DlnY	-2.12610	0.0167	-9.09091	0.0000	107.671	0.0000	87.7533	0.0000

Table 8: Economic Growth and International Reserves

Results for H0: no cointegration
With 5 series and 1 covariate
Average AIC selected lag length: 2.4
Average AIC selected lead length: 0

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Staistic	Value	Z-value	P-value
Gt	-3.449	-3.044	0.001
Ga	-34.595	-7.630	0.000
Pt	-6.152	-1.663	0.048
Pa	-12.673	-1.392	0.082
Long run Coefficients			
Country		Coefficient of international Reserves	
Ghana		0.4893 (0.0240)**	
Nigeria		0.0266 (0.0058)**	
Gambia		0.0232 (0.0043)**	
Guinea		0.1111 (0.0117)**	
Sierra Leone		0.1199 (0.0120)**	

"**" significant at 1%. In the parenthesis are the standard errors.

The results of the cointegration tests shown in Table 8,indicate a rejection of the null hypothesis of no cointegration in favour of cointegration. This means that there is a stable long run relationship between economic growth and international reserves. The long run coefficients also indicate that international reserves accumulation impacts positively on economic growth as postulated by Polterovich and Popov (2003) and Fukuda and Kon (2010). A 10% percent increase in international reserves would increase economic growth by about 4.9% in Ghana, 0.3% in Nigeria, 0.2% in Gambia, 1.1% in Guinea and 1.2% in Sierra Leone in the long run.

Conclusions and Recommendations

The crave for international reserves accumulation even in the face of challenges associated with low investment, culminating in low economic growth in the sub-region brings to mind new questions to be answered by international macroeconomics literature. Common to every economic phenomenon, these developments have earned the praises of many as they equally have drawn severe criticisms from others who question the rationale for building reserves in the face of crippling domestic economic activities and high incidence of poverty in these countries. This study therefore sought to find out firstly, the effect of international reserves accumulation on economic growth and secondly, whether there is a threshold effect in the international reserves-economic growth nexus.

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The static panel regression analysis and the panel cointegration tests results confirmed that international reserves accumulation promotes economic growth, a result which is consistent with that of Polterovich and Popov (2003) and Fukuda and Kon (2010). The results from the LOWESS technique as well as the non-linear model indicated the existence of the threshold effects in the economic growth-international reserves nexus. A U-shaped relationship between economic growth and international reserves was established, a result which is quite new to the literature on economic growth and international reserves.

The convergence criterion that member countries of WAMZ should accumulate reserves is in the right direction and makes a lot of economic sense since it promotes economic growth in the long run. The study therefore, recommends that international reserves accumulation be used as a tool to promote economic growth in the West African Monetary Zone. The policy makers should put in place appropriate policy measures that will help promote a sustained increase in the reserve holdings of the countries of WAMZ. In the short term, accumulation of international reserves may adversely affect economic growth but in the long term economic growth would be promoted. International reserves accumulation could send a good signal that could attract foreign direct investments and also increase exports through exchange rate undervaluation. The membercountries of WAMZ should therefore, not reduce their foreign reserves because reserves accumulation really helps the economic growth.

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