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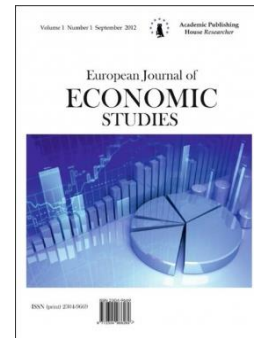
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Articles

Foreign Capital and Macroeconomic Performance in Nigeria: Principal Component Analysis

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Abstract

The study estimated differential impact of components of capital inflows on macroeconomic growth rate in Nigeria using principal component model. Study period span between 1980 to 2018. The study found that foreign investors' equity into Nigeria plus net advances to enterprises together with capital transfers in cash from abroad plus net compensation of employees of non-resident workers are two foremost components of foreign capital that significantly stimulate economic growth in Nigeria. The study recommends amongst others, the need for corporate sector such as banks and other financial institutions to intensify the volume of official flows by reducing transaction cost, streamlining transfer procedures and by encouraging the use of formal financial channels. Also, Nigerian foreign investment policy should be directed towards attracting and boosting more inflows of foreign capital especially in the direction of remittances and foreign direct investment.

Keywords: foreign direct investment, remittances, official development assistances, principal component model.

1. Introduction

Regardless of claim that Nigeria attracts most flows in Sub-Saharan Africa; its impact is yet to be felt in macroeconomic performance of Nigerian economy. Nigeria's economic performance in the two decades prior to economic reforms was generally poor. The boom in oil sector lured labour away from the rural sector to urban centres. The Nigerian economy contracted by -0.67 % in Q1, 2016, -1.49 % in Q2 2016, -2.34 % in Q3 2016, by -1.73 % in Q4 2016 and -0.91 % in Q1 2017 (CBN, 2017). Besides, inception of oil price shocks in mid-2014 confronted the government with challenge of constructing an institutional and policy framework capable of managing volatility of the oil sector and supporting sustained growth of the non-oil economy. With a renewed focus on economic diversification, promoting growth in the private sector and driving job growth, GDP grew by 0.6 % in the second quarter of 2017, driven by recovering oil production and some recovery in non-oil industries, together with modest growth in agriculture.

Economic growth remained positive in second half of 2017, averaging about 1.0 % for 2017; driven by continued recovery of oil production, sustained growth in agriculture and the positive

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impact on investment and other private sector activities from the improved availability of foreign exchange to support imports. By the third quarter of 2017, economic recovery was stabilized with a growth rate of 1.40 % (NBS, 2017). In 2017, real GDP growth rate was 0.8 %, while the growth rate of GDP was 2.7 %. GDP per capita stood at US\$5,900 in 2017, US \$ 6,000 in 2016 and US\$6,300 in 2015. Gross national saving stood at 14.9 % of GDP in 2017, 13.2 % of GDP in 2016 and 12.3 % of GDP in 2015 (CBN, 2018). Growth in the non-oil sector for 2014, 2015, 2016 and 2017 was 8.02, 4.40, 5.79 and 8.21 %, respectively (Table 1 below).

Table 1. Selected Macroeconomic Indicators

Growth Rates	2012	2013	2014	2015	2016	2017	2018
Real GDP (%)	1.8	3.5	10.9	1.4	-0.68	0.82	1.9
Oil GDP (%)	3.42	2.90	26.5	1.54	-0.62	0.84	1.94
Non-oil GDP (%)	2.4	3.85	8.02	4.40	5.79	8.21	2.3

Source: CBN (2017), IMF (2017).

In 2017, external reserves boosted to US\$31.22 billion from US\$29 billion in 2015. Consequently, savings increased to US\$2.29 billion in 2017 and twenty-four States of the federation were given bailout funds by the federal government to pay salaries of workers, repay debts and other contractual obligations. Notwithstanding trading window for portfolio investors at market rates and operation of Nigerian independent foreign exchange rate fixing, which allowed commercial banks to quote forex rates that are close to parallel market rates, policy targets aimed at attracting foreign capital flows have not achieved results owing to the fact that both income levels and domestic savings are very low (Olofin, 2003). A lack of infrastructure and volatile regulation is often blamed for stymying FDI into least developed countries, majority of which are found in SSA, but flows into these countries increased 4 % to US \$ 23 billion, helping raise Africa's still-low but improved 4.4 % share of world FDI (Ogbechie, Anetor, 2016).

The motivation and rationale for this study could be detailed to the extent that Nigeria is suffering from shortage of investible capital required for economic growth. But, the country has enormous economic growth potentiality in light of human and non-human capital resources which are the preconditions for economic growth. Unfortunately, the favourable economic growth in Nigeria has not been accomplished over the past years due to some extent poor capital supply. Moreover, empirical evidence regarding the favourable contribution of capital inflows on economic growth has been mixed.

The widely held FDI has been directed at developed countries (Bhavan, 2003). Country specific studies are desirable given the heterogeneous relationship between some components of foreign capital such as FDI and growth. This study thus seeks to evaluate the contribution of four different components by disaggregating foreign capital inflows into foreign direct investment, foreign portfolio investment, overseas development assistance and remittances. The effect of each of these variables would be estimated on economic output as measured by gross domestic output in Nigeria.

Nigeria's target of a favourable balance of payments and that of stimulating economic growth makes it imperative to identify positive spill over effects from foreign capital inflow. Thus, the study serves as an addition to the stock of country-specific studies on foreign capital inflows. However, since foreign portfolio investments are made with a view of making profits, which would eventually be repatriated to investors home country, the more dominant the foreign portfolio in the capital structure of quoted companies, the greater the tendency of financial distress or insolvency after repatriation.

In this study, we analysed differential impact of various components of capital inflows on economic growth rate in a principal component model taking into consideration role of dynamics of the variables for effective policy making. We reviewed selected theoretical and empirical literatures as our next. Section three describes the theoretical framework, research methodology

and the data sources. Empirical results are reported and analysed in section four, while section five is devoted to concluding remarks.

2. Discussion

Economic theory advocates the flow of capital from richer countries to poorer countries. Various theories have been put forward in analysing and explaining the flows of foreign capital. According to location-specific theory, firms with absolute low cost technology move to the LDC's with low wages due to inconsistency of real cost amongst countries coupled with the fact that trade restriction are implemented to restrict importation in some countries. The location-specific theory maintains that the location advantage of low wage, rates, availability and cheap raw materials and the trade restriction sometimes put in place by developing countries, attracts MNCs to invest in developing countries with the aim reaping these advantages to make profit (Aizenman et al., 2004). Operations of the multinational firm through production and manufacturing originate in such countries in order to collapse trade restriction.

To Hood & Young, (1979), while the firm-specific advantage at the firm level manifests itself in a higher productivity of comparable assets (tangible and intangible) than competitors (Caves, 1996), the location-advantage is basically the country-specific advantage which is immobile and is of a public-good nature as firms have access on equal terms. As location-advantage is bound to regions, it may lead to geographical fragmentation of value-added activities. Thus, the Figure 1 describes the relationship between Firm and Country Specific Advantage.



Fig. 1. Country/Firm Specific Advantage Matrix

Source: Caves (1996) Multinational Enterprise and Economic Analysis

In Quadrant 1 firms rely on strong low factor costs and energy costs. Cost leadership would be the typical strategy. Quadrant 4 firms have specialisms such as marketing, intellectual capital, R&D etc. that would drive a differentiated strategy. Where they are located is largely irrelevant as these skills are mobile. In Quadrant 3 benefit from both low costs and differentiation, which may be attributable to good infrastructure and good supply of skilled employees. Instance could be financial services in London or New York. Quadrant 2 firms would have no advantages and exit the market while Q4 firms attempt to move to Q3. It has been argued that Free Trade Zones can affect firms' position in the quadrants over time. For instance oil rich Canada has benefited from access to a larger US market. The Single European Market may have had similar benefits for firms.

Technology transfer theory upholds that developing countries do not have large and efficient institution dedicated to generate technological change, only the affluence countries have been able to organise such entity both private and public (Alfaro et al., 2008). To the LDC's, importation of technology is consider as superior to the local available technology. Importation of foreign technology is a sub-optimal decision which will downsize and relegate the existence of the local technology. The dual gap theory espouses that investment is a key to economic growth and development. Nevertheless, such investment cannot be uninterruptedly attained without huge domestic savings (Lucas, 1990).

MacDougall-Kemp theory considers two country model: host country and the investing country while marginal productivity and cost of capital are presumed equal, hence there is a free movement of capital from capital surplus country to capital deficit country which tend to equalise the marginal productivity of capital between the two countries (MacDonald, 2015). The abundant flow of capital from the surplus country to the deficit country ease productivity and efficient employment of resources which in turn stimulate economic prosperity. The organization theory according to Gourinchas & Jeanne (2013) was founded on an oligopolistic market whereby investing firm operates.

The eclectic theory of Dunning (1980) espouses that stock of international assets retained by a multinational firm is ascertained on basis of firm ownership benefit, (O) location endowments, (L) and firm's unit.

For empirical review, Basu & Krishna (2002) reported that international portfolio financial flows has failed to promote economic growth due to high incidence of uncontrolled capital outflows. Remittance increase saving and asset accumulation and improve access to health services and better nutrition (Bodo, Meissner, 2007). In Malaysia, Duasa (2007) evaluated FDI – growth relation and found absence of strong underlying association between FDI and economic growth. Hence, Malaysia FDI does not cause economic growth but it does provide stability to economic growth.

Ekeocha et al. (2012) argues that portfolio investment is significantly germane in the investment environment of Nigeria considering the saving-investment gap. Mohamed & Sidiropoulos (2010) evaluated effect of workers remittance on GDP utilizing both fixed effect and random effect models were used for empirical analysis. Their results showed support for fixed effect models, and revealed that remittances have a positive impact on economic growth both directly and indirectly via their interaction with financial and institutional channels. Kherfi & Soliman (2005) study the effect of FDI on economic growth of twenty three countries from two regions, six countries from Middle East and North Africa (MENA) while seventeen countries from Central and Eastern Europe (CEE). The key findings suggest that FDI on growth is detrimental. In a study of one hundred and forty countries in Central, Eastern Europe and former Soviet Union transition economies between sample period of 1990-1998, Chowdhury & Mavrotas (2005) based on simultaneous equation estimates reported positive effect of FDI on economic growth.

Ekeocha, Malaolu & Oduh, (2012) ascertained that FDI positively related with market capitalization, and trade openness in the long-run. Kolawole (2013) evaluated the impact of ODA and FDI on real GDP in Nigeria between 1980 and 2011 using the two-gap model and discovered ODA impacted negatively on real GDP in Nigeria. Obiechina & Ukeje (2013) reports that FDI does not promote economic growth in short-run while in the long run, a unilateral causality link between FDI and economic growth with causality flowing from GDP to FDI which suggest that foreign direct investment is having a parasitic effect on the growth of the economy. Driffiield & Jones (2013) adopting three stage least squares panel system estimation found that ODA had a positive and significant impact on economic growth in developing countries taking into cognizance the role of institutions.

Theoretical Framework

The requirement for inflow of foreign capital is entrenched on theory of two-gap model of growth and development developed to Chenery & Stout (1966). These two gaps are savings gap and foreign exchange gap and when anyone of the two gaps is binding, restrain the amount of investment and capital formation which can be undertaken.

The principal assumption of the model is that savings gap and foreign exchange gap are unequal and independent. Hence, they are binding for growth and development of countries. The model states that growth depends on capital formation which will lead to investment productivity. Though, from the national income analysis, saving is equal to investment and a saving gap will exist when domestic savings cannot be equated to the needed investment for growth. If there is savings gap, growth will be constrained by lack of investment pointing out need for foreign savings in form of capital inflow.

Also, there is a trade-gap since needed investment can be produced domestically. Given the role of investment and trade for growth, it becomes necessary that these two-gaps be bridged and as such there is a call for capital to cover these gaps from the relatively high capital based countries. When foreign exchange gap is fastened to saving, the excess productive resources (labour) in the developing countries and the available foreign exchange for the importation of new capital goods

and technical assistance will bring about increase in growth. Algebraically, given the sum of capital inflows (difference between imports and exports) and investible resources (domestic savings), the savings-investment restriction can be written as:

$$I \leq CF + sY \quad (3.1)$$

Where CF is amount of capital inflows, I is domestic investment, s is domestic savings. Thus, if capital flows plus domestic saving, sY, exceeds domestic investment, I, and the economy is at full capacity, a foreign-exchange constraint or gap is said to exist. Given that m_1 is the marginal import share of investment in a developing country and m_2 is the marginal propensity to import out of a unit of non-investment GNI (typically around 10% to 15%), the foreign exchange constraint or gap can be written as:

$$(m_1 - m_2)I + M_2Y - E \leq CF \quad (3.2)$$

Where E is the exogenous level of export, CF in the two equations is the critical factor. Countries can therefore be classified as weather deficient in savings or foreign exchange or in both. It is important to note here that from the above analysis, the impact of capital inflow will be greater where there is foreign exchange gap. Although E and CF are substitutable in equation (3.2), they can have quite indirect effects, especially in the case where CF represents interest bearing loans that needs to be repaid.

Consequently, variation of import and export parameters through government policy in both developed and developing countries can have a deep impact on whether the savings or foreign-exchange constraint is restricting the further growth of national output (Todaro, Smith, 2011). Following H-D model, output growth depends on stock of capital which counts as investment:

$$Y = f(\Delta k) = f(I) \quad (3.3)$$

where Y is growth rate, K is capital stock and I is investment. In nationwide income identity, we have that:

$$E = C + I + G + (X - M) \quad (3.4)$$

$$Y = C + S + T \quad (3.5)$$

where E is total spending, Y is total income, S is private saving, G is government expenses, T is tax, X is exports and M is imports. Therefore, two-gap becomes:

$$E - Y = (I - S) + (G - T) + (X - M) \quad (3.6)$$

For sake of equilibrium in (3.4), we have:

$$(I - S) + (G - T) = (M - X) = CF \quad (3.7)$$

where CF is inflows of capital. If we omit the fiscal balance (G-T) in (3.7) above, then:

$$I = CF + S = CF + sCF \quad (3.8)$$

where s is the economy's propensity to save. Substituting the obtained fact in (3.8) into (3.3):

$$Y = f(I) = F(CF, S) \quad (3.9)$$

Y is growth rate of the Nigerian economy that is impacted on by capital inflow into the economy.

Principal Component Model

The principal component model was specified such that each component of foreign capital flows to Nigeria is represented as a linear combination of the factors plus an uncorrelated noise as shown:

$$GDP = \sum_{i=1}^p \delta_{j,i} F_i + \sum_{i=p+1}^n \delta_{j,i} P_i = \sum_{i=p+1}^n \delta_{i,j} P_i + e_{1t} \quad (3.9)$$

$$FDI = \sum_{i=1}^p \alpha_{j,i} F_i + \sum_{i=p+1}^n \alpha_{j,i} P_i = \sum_{i=p+1}^n \alpha_{i,j} P_i + e_{2t} \quad (3.10)$$

$$RMT = \sum_{i=1}^p \beta_{j,i} F_i + \sum_{i=p+1}^n \beta_{j,i} P_i = \sum_{i=p+1}^n \beta_{i,j} P_i + e_{3t} \quad (3.11)$$

$$ODA = \sum_{i=1}^p \phi_{j,i} F_i + \sum_{i=p+1}^n \phi_{j,i} P_i = \sum_{i=p+1}^n \phi_{i,j} P_i + e_{4t} \quad (3.12)$$

$$ORV = \sum_{i=1}^P d_{j,i} F_i + \sum_{i=P+1}^n d_{j,i} P_i = \sum_{i=P+1}^n d_{i,j} P_i + e_{5t} \quad (3.13)$$

Principal component analysis was applied as a technique for variable extraction by combining components of capital flows in a specific way that drops the “least significant” components. Thus, the modus operandi entails a calculation of the correlation matrix in order to estimate the eigenvalues and the relevant eigenvectors. Categorizing the eigenvalues $\lambda_1, \lambda_2, \dots, \lambda_p$ from largest to smallest, the matrix of eigenvectors is derived and these independent of one another. By intuition, principal components are statistically independent of one another.

To ascertain number of variables for component exploration, we choosed an arbitrary dimension; computed proportion of variance explained for each variable, choosed a threshold; categorize variables by percentage of variance explained and afterwards generated cumulative proportion of variance explained. The percentage variation is given by ratio of eigenvalues of variables used to totality of eigenvalues of whole sample of variables.

In effect, given $(\ell \times p)$ data matrix, Z , with column zero mean, the k^{th} component can be found by subtracting the first $k - 1$ principal components from Z :

$$Z_k = Z - \sum_{j=1}^{k-1} Z \omega_{(j)} \omega_{(j)}^T \quad (3.14)$$

where $W_{(k)} = (\omega_1, \omega_2, \dots, \omega_p)_{(k)}$ are weighted vectors, that is, coefficients that chart all row vectors $Z_{(i)}$ of Z to a new vector of principal component scores $T_{(i)} = (t_1, t_2, \dots, t_p)_{(i)}$. Accordingly, principal component as defined by weight vector, $\omega(k)$ which removes maximum variance from the data matrix is given by:

$$\begin{aligned} \omega(k) &= \arg \max_{[\omega=1]} \left[\|Z_{k\omega}\|^2 \right] \\ &= \arg \max \left[\frac{\omega^T Z_j^T Z_{j\omega}}{\omega^T \omega} \right] \end{aligned} \quad (3.15)$$

Eqn (3.15) gives outstanding eigenvectors of $Z^T Z$ such that weighted vectors are eigenvectors of $Z^T Z$ and Z^T represents observed sample covariance matrix of the dataset. The complete principal components decomposition of our dataset, Z can then be given as:

$$T = ZW \quad (3.16)$$

where W is a $(\ell \times \ell)$ matrix of weights whose columns are eigenvectors of $Z^T Z$. The effect is that loadings in PCA are scaled up eigenvectors and sample covariance Q between two different principal components over the dataset were obtained as:

$$\begin{aligned} Q(PC_{(j)}, PC_{(k)}) &\propto (Z_{\omega(j)})^T (Z_{\omega(k)}) \\ &= \omega_{(j)}^T Z^T Z_{\omega(k)} \\ &= \omega_{(j)}^T \lambda_{(k)} \omega_{(k)} \\ &= \lambda_{(k)} \omega_{(j)}^T \omega_{(k)} \end{aligned} \quad (3.17)$$

In matrix form, observed covariance matrix for the original variables can be transcribed as:

$$Q \propto Z^T Z = \omega \Lambda \omega^T \quad (3.18)$$

where Λ is the diagonal matrix of eigenvalues $\lambda_{(k)}$ of $Z^T Z$ such that $\lambda_{(k)}$ is sum of squares over the dataset linked with each component k .

Table 2. Definition of Variables

Variable	Definition
lnFDI	log value of foreign investors' equity into Nigeria plus net advances to enterprises
lnRMT	log value of capital transfers in cash from abroad plus net compensation of employees of non-resident workers.
lnODA	log value of foreign government aid
lnORV	log of oil proceeds
lnGDP	log of real GDP proxy for Nigeria's economic growth

Method of Estimation & Data Sources

The study adopts principal component estimations techniques on basis of covariance/correlation matrix, eigenvectors, and eigenvalues. Estimating principal component model is equivalent to determining the eigenvalues and eigenvectors of the variance-covariance matrix or of the correlation matrix. Known that the variance-covariance matrix is sensitive to the units of measurement, in this study, the matrix of factors were not be obtained by diagonalizing the variance-covariance matrix since capital flows do not observe strict factor flows. Overall, we opted to choose the largest eigenvalues for our analysis by applying the principal component analysis on the correlation matrix. The resultant eigenvectors are the weights of capital flows that form the flow factors. The study used annual time-series data extracted from the World Bank and CBN data bases.

3. Results

Correlation Analysis

This section examines the degree of association between the variables of the model [Table 2](#) below presents the estimated partial correlation coefficient. Decisively, it bids an earliest glimpse at data and provides guidance in assessing presence and severity of multicollinearity among independent variables. In terms of sign, positive values indicate that any two variables under analysis move in same direction and so are positively correlated. In contrast, negative correlation coefficients suggests that the variables move in the opposite direction. An absolute value of one indicates a perfect linear relationship while a correlation coefficient equal to zero designates absence of a linear relationship between the variables.

Implementing the above for [Table 3](#) below, the partial correlation coefficients of economic growth as measured by GDP, foreign direct investment, remittances, official development assistance, imports and foreign portfolio investment are reported for the study. The apparent high correlation coefficient between GDP and foreign direct investment which is 0.763616 implies that both variables tend to move together strongly. Similarly, the correlation coefficient between economic growth and remittances is 0.925152; between economic growth and official development assistance is 0.778033; between economic growth and domestic savings is 0.618479; and between economic growth and foreign portfolio investment is 0.864103.

Table 3. Correlation Matrix of Variables

Variable	lnGDP	lnFDI	lnRMT	lnODA	lnORV
lnGDP	1.000000	0.763616	0.925152	0.778033	0.618479
lnFDI	0.763616	1.000000	0.420462	0.346455	0.004380
lnRMT	0.778033	0.346455	0.835138	1.000000	0.530695
lnODA	0.618479	0.004380	0.633234	0.530695	1.000000
lnORV	0.864103	0.508383	0.873301	0.716322	1.000000

Source: Author's estimation using Eviews 9 Results

It is easily seen that all things being equal, economic growth is positively related to all the variables. These results reveal strong positive relationship between the economic growth and other variables except development assistance whose relationship with economic growth seems to be moderate on the basis of the correlation coefficient which is 0.618479. Nonetheless, we cannot conclude that changes in all the variables (foreign direct investment, remittances, official development assistance, and oil revenue) cause changes in economic growth on correlation basis. The reason being that correlation analysis does not establish cause-effect type of relationship. This is addition to the fact

that a correlation coefficient could at times be very sensitive to extreme data values (outliers) as the case may be. Relatively, a low correlation coefficient in this study does not imply absence of relationship between variables. The variables may be having some nonlinear association.

Principal Components Analysis

Extracting 6 of 6 possible components, the key output results as shown in Table 4 includes the eigenvalues, and the proportion of variance that the principal component explains. We thereafter determine the minimum number of principal components that account for most of the variation in our data using the proportion of variance that the components explained. Hence, we utilized cumulative proportion to score amount of variance that principal components explain. In this study therefore, we utilized size of the eigenvalue to retain the number of principal components with the largest eigenvalues that indeed accounted for an appreciable level of variance that exceeded 60 %.

Table 4. Principal Components Results (Eigenvalues)

Eigenvalues: (Sum = 6, Average = 1)					
Number	Value	Difference	Proportion	Cumulative Value	Cumulative Proportion
1	4.186396*	3.185306	0.6977	4.186396*	0.6977
2	1.001090*	0.586504	0.1668	5.187486*	0.8646
3	0.414587*	0.178615	0.0691	5.602073*	0.9337
4	0.235972*	0.138330	0.0393	5.838044*	0.9730
5	0.097642*	0.033328	0.0163	5.935686*	0.9893
6	0.064314	---	0.0107	6.000000*	1.0000

Source: Author's estimation using Eviews 9 Results

Notes: *Significant at 1 % level of significance

Table 5 reports eigenanalysis of correlation matrix. According to the results, first two principal components have eigenvalues that exceeded one. These two components explained about 55.6 % of the variation in the data. Consequently, since the variance proportion accounted for by the two principal components is not adequate amount of variation in the data, not up to 60 %, we choose to base our analysis on all the six principal components.

Table 5. Eigenanalysis of the Correlation Matrix

Eigenvalue	2.9476**	2.6420**	0.1457	0.5675	0.6382	0.9362
Proportion	0.3625	0.1930	0.1567	0.1529	0.0592	0.0757
Cumulative	0.3625	0.5555	0.7122	0.8651	0.9243	1.0000

Source: Author's estimation using Eviews 9 Results

Notes: **Significant at 5 % level of significance

In what follows, we place interpretation of each principal components on the magnitude and direction of the coefficients for the original variables. The larger the coefficient value in absolute terms, the more substantial matching variable is in calculating component. We established size of coefficient on basis of coefficient above ± 0.5 .

As shown in Table 6, first principal component has enormous positive associations with remittances (0.470644), official development assistance (0.422655) and foreign portfolio investment (0.459742). In effect, it implies that first principal component mostly measures history of remittance flows to Nigeria. The second component has large negative associations with domestic savings (-0.542473) but with a strong positive relationship with foreign direct investment (0.836343). Accordingly, the second principal component mostly measures foreign direct investment history. The third component has large positive associations with official development assistance (0.612675) and high positive relationship with domestic savings measured by (0.599021). Consequently, this component primarily measures the Nigeria's foreign aid history.

The fourth principal component has large positive links with development assistance (0.622325). So, the component describes history of foreign aid inflows in Nigeria. The fifth principal component has positive associations with remittances (0.3144). Hence, the component

describes history of portfolio investment inflows in Nigeria. The sixth principal component has large positive correlations with remittances (0.776026). This goes to show that the sixth principal component just like the first component place emphasis on the history of remittances in Nigeria. In all, the eigenvectors loadings show the results for the various principal components.

By intuition, remittances have significant positive loadings on principal component one, foreign direct investment has large significant positive loadings on principal component two, development assistance has significant positive loadings on principal component four (0.622325) but exerted some insignificant negative loadings on component five, (-0.181297) oil revenues have significant negative loadings on principal component two. recognize absence of outliers that can unfavorably influence results of our analysis, our results uphold that foreign investors' equity into Nigeria plus net advances to enterprises as well as cash transfers from abroad are significant sources of foreign capital inflows that heightens macroeconomic growth performance in Nigeria.

Table 6. Principal Components Results (Eigenvectors Loadings)

Eigenvectors (loadings):						
Variable	PC 1	PC 2	PC 3	PC 4	PC 5	PC 6
lnGDP	0.459249	-0.049265	-0.171672	-0.540340	0.327895	0.598088
lnFDI	0.234299	0.836343	0.343931	0.250874	0.239890	0.082835
lnRMT	0.470644	-0.007036	0.183221	-0.209309	0.314400	0.776026
lnODA	0.422655	-0.016959	0.612675	0.622325	-0.181297	0.159835
lnORV	0.350269	-0.542473	0.599021	0.392434	0.254639	0.073238

Source: Author's estimation using Eviews 9 Results

4. Conclusion

The study examined the impact of foreign capital flows on economic growth in Nigeria by implementing the principal component model. The principal component analysis accounted for significant positive relationship of foreign direct investment flows, and overseas development assistance flows with economic growth performance in Nigeria. More importantly, the study builds multiple indicators of capital inflows in the principal component modelling setting to explore the interactive effects of capital inflow and conditioning variable of oil proceeds on macroeconomic growth performance in Nigeria. FDI and remittance inflows are evidently imperative sources of economic growth prospects for developing countries like Nigeria. Thus, we recommend that Nigerian foreign investment policy should be directed towards attracting and encouraging more inflow of foreign capital especially in the direction of remittances and foreign direct investment inflows in Nigeria do not exert significant influence on the level and growth rate and so such impact is insignificant in stimulating economic performance in Nigeria. Nigeria as a remittance receiving nation needs to provide a friendly economic location through sound macro-economic policies, reliable financial conditions that can lead the economy for development and equip it adequately to benefit from these external impetuses. This could attract remittances as major source of development capital.

References

- [Adam, 2002](#) – Adam, Z. (2002). Fine-tuning foreign investment: Differentiating FDI and portfolio investment in post-communist East Central Europe. Paper presented at the Second EPIC Workshop in Florence. May 16-22.
- [Adelegan, 2000](#) – Adelegan, J.O. (2000). Foreign direct investment and economic growth in Nigeria: a seemingly unrelated model. *African Review of Money, Finance and Banking*. 5–25.
- [Adeniyi et al., 2012](#) – Adeniyi, O., Omisakin, O., Egwaikhide, F.O., Oyinlola, A. (2012). Foreign direct investment, economic growth and financial sector development in small open developing economies. *Economic Analysis and Policy*. 42(1).
- [Adegboye et al., 2014](#) – Adegboye, A.C., Ogbobor, O.A., gharvba, M.I. (2014). External capital flows and economic growth in Nigeria. *JORDIN* 12(2).
- [Akinlo, 2004](#) – Akinlo, A.E. (2004). Foreign direct investment and growth in Nigeria: An empirical investigation. *Journal of Policy Modelling*. 26(5): 627-639.

Alfaro et al., 2008 – Alfaro, L., Kalemli-Ozcan, S., Volosovych, V. (2008). Why doesn't capital flow from rich to poor countries? An empirical investigation. *Review of Economics and Statistics*. 90(2): 347-368.

Bailliu, 2000 – Bailliu, J. (2000). Direct capital flows, financial development, and economic growth in developing countries. Bank of Canada Working Paper No. 2000-15.

Basu, Krishna, 2002 – Basu, A., Krishna, S. (2002). Foreign direct investment in Africa some case studies. IMF Working Paper No. 02/61, IMF, Washington.

Berument, Dincer, 2004 – Berument, H., Dincer, N.N. (2004). Do capital flows improve macroeconomic performance in emerging markets? *The Turkish experience. Emerging Markets Finance and Trade*. 40(4): 20-32.

Bhavan, 2013 – Bhavan, T. (2013). Policies and Effectiveness of Foreign Aid: The case of Sri Lanka. *Asian Economic and Financial Review*. 3(3):363-376.

Caves, 1996 – Caves, R.E. (1996). Multinational Enterprise and Economic Analysis. 2nd Edition, Cambridge University Press, Cambridge, New York and Melbourne.

Chatterjee, Turnosky, 2005 – Chatterjee, S., Turnosky, S.J. (2005). Foreign aid and economic growth: the role of flexible labour supply. A paper presented at the annual conference of the royal economic society in Swansea.

Driffield, Jones, 2013 – Driffield, N., Jones, C. (2013). Impact of FDI, ODA and migrant remittances on economic growth in developing countries: A Systems Approach. *European Journal of Development Research*. 25(2): 173-196.

Dunning, 1980 – Dunning, J.F. (1980). Towards an eclectic theory of international production, *Journal of International Studies*. XI: 9-31.

Durham, 2003 – Durham, J.B. (2003). Foreign portfolio investment, foreign bank lending, and economic growth. International finance discussion. Paper Number 757.

Ekeocha, 2008 – Ekeocha, P.C. (2008). Modelling the long run determinants of Foreign Portfolio Investment in Emerging Market; Evidence from Nigeria, International conference on Applied Economic ICOAE, pp. 289-303 ERP (2002.2003.2006): Economic Report of the President. Government printing press USA.

Eregba et al., 2012 – Eregba, P.B., Sede, P.I., Ibidapo, C.O.K. (2012). Foreign Aid flows, Investment and Economic Growth in Africa: Does Uncertainty Matter? *Journal of Social Sciences*. 2(2): 100-107.

Fasanya, Onakoya, 2012 – Fasanya, I.O., Onakoya, A.B. (2012). Does foreign aid accelerate economic growth? An empirical analysis for Nigeria. *International Journal of Economics and Financial Issues*. 2(4): 423-431.

Gourinchas, Jeanne, 2013 – Gourinchas, P.O., Jeanne, O. (2013). Capital flows to developing countries: the allocation puzzle. *Review of Economic Studies*. 80(4): 1484-1515.

Karras, 2006 – Karras, G. (2006). Foreign aid and long run economic growth: empirical evidence for panel of developing countries. *Journal of International Development*. 18: 15-26.

Knill, 2005 – Knill, A.M. (2005). Can foreign portfolio investment bridge the small firm financing gap around the world? World Bank Policy Research Working Paper 3796, December. The World Bank Group Washington, DC 20433.

Loxley, Sackey, 2008 – Loxley, J., Sackey, H. (2008). Aid effectiveness in Africa. *African Development Review*. 20(2): 163-199.

Lucas, 1990 – Lucas, R.E. Jnr. (1990). Why doesn't capital flow from rich to poor countries? *American Economic Review*. 80(2): 92-96.

Mohamed, Sidiropoulos, 2010 – Mohamed, S.E., Sidiropoulos, M.G. (2010). Do worker's remittance affect growth: evidence from seven MENA labour exporting countries. *International Research Journal of Finance and Economics*. 1(46): 181-194.

Obiechina, Ukeje, 2013 – Obiechina, M.E., Ukeje, E.U. (2013). Economic Growth, capital flows, foreign exchange rate, export and trade openness in Nigeria. *International Journal of Economics and Management Sciences*. 2(9): 01-13.

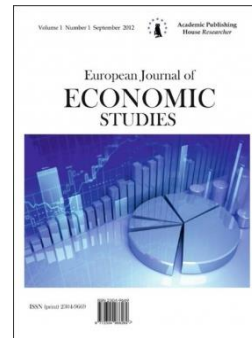
UNCTAD, 2017 – UNCTAD (2017). Economic development of Africa: rethinking the role of foreign direct investment. New York and Geneva.

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Women in Top Management and Profitability of SMEs in IT Sector: Evidence from Federation of Bosnia and Herzegovina

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Abstract

This research examines the possible positive relationship between the presence of women in top management teams and the profitability of SMEs in the IT sector in Bosnia and Herzegovina. Data is collected from the TRON Business Intelligent System for the SME's Profitability data and top management structure, covering three years, 2014 to 2019. The total sample, which aims to shed a light on the composition of top management teams, and the potential positive impact of the women's presence on profitability indicators, consists of 635 companies from Bosnia and Herzegovina. The outcome of this research outlined that even in the male-dominated industry, as the IT is, companies led by a woman are profitable, without significant difference from those led by a man. This research also aims to display the current and real gender disbalance in this industry, with the intention to trigger further research and more interest into this issue. The results of this paper contribute to knowledge about workplace diversity and equality in an under-researched country. The results of this study could be used as a guideline for business practices, and in process of top management composition. The results of this research are neither undeniable nor conclusive. Further academic research on link between females and profitability should be taken in different sectors, and/or different business scales, as SMB or large business. The impact of Women's presence on other performance indicators should also be researched.

Keywords: women, top management, profitability, SMEs, tech companies, gender, diversity, ROA, ROE, profit margin.

1. Introduction

This research is the first paper in the literature that provides a comprehensive insight into women's presence in top management teams of small and medium-sized enterprises in B&H, considering specifically and exclusively the information technology sector. The reason for focusing this study only on the tech industry is because the tech industry is one of the rapidly growing, and the outcomes of the research are unpredictable but valuable in future practice. Besides the obstacles and fast-changing environment of the 21st century, the growth of the IT industry is accelerated. The importance of IT is increasing continuously. The presence of women in top management has been reviewed by the reports, supporting the top management evolution of SMEs. The IT industry is dominated by men, while women have greater opportunities to appear in the top management of industries other than those product-oriented and companies other than physical or technical. The reasons for supporting more often female appointments could be divided into two

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groups. In the first place, reasons focused on performance indicators, and second, reasons focused on social arguments. This research is focused on performance indicators, more precisely profitability indicators. These are the main reasons for choosing exactly this industry, firstly to display how big is the gender gap, and to see if the performance of the SMEs differs with the presence of women. Creating an impact is effortlessly possible with more corporate power, which usually comes with a higher position in the management structure. For that reason, TMT positions are considered in the first place.

2. Discussion

Retrospectively females are represented through the lenses of stereotypes, domestication, and under-representation. Considering the literature, not much has changed. In all media platforms, females are typically under-represented which improves man domination (Lakhal Faten et al., 2011). The conclusion of the final gender report is that despite the improvements on a global level, there is still much to be done with the 32 % average proportion of women yet to be narrowed (The Global Gender Gap Report 2018, n.d.). The gender gap exists in many industries, and lack of women on corporate boards and top management positions seem to be a long-standing concern in many countries in Europe (Wahl, 2013). There are several professions where women are under-utilized, even though they have the needed expertise. They might also contribute to all of them, including high-tech and managerial roles where they are under-represented, if the existing obstacles were to be tackled (Global Gender Gap Report 2020, 2020). It is inviolable fact that in the accelerated transition to digital, high globalization, and everyday changes, the gender disparity gap must be closed on a global level (Halilbegovic, Ertem, 2020). Besides the changes in the global economy and overtake of the new technologies, there is no room for gender-based disparities. To utilize the environment changes and to face challenges, society must find a way to include both women and men (Halilbegovic et al, 2017). Despite the high and rising numbers of educated females with higher education degrees that are gaining employment throughout various industries, there are still comparatively limited numbers on company boards and top management roles taken by women (Hanna Rosin, 2012). Profitability is one of the main indicators of company success, and it is the main interest of this research while being linked with women's presence. There are many studies completed with the same interest. Some of them suggest a positive impact of female presence on firm profitability (Kevin Campbell, Antonio Mínguez-Vera, 2008; Perryman et al., 2016), some address unfavorable or no relation between gender balance in TMTs and corporate financial results (Egerová, Nosková, 2019; Kompa, Witkowska, 2018). This study analyzed if SMEs across the Federation of Bosnia and Herzegovina and from IT industry, are more profitable if there is a woman in top management.

3. Methodology

For the overall understanding of the theme background and its realistic global presence, the previous studies were contacted from the different management, business, HR, and human development journals and research websites. The statistical dataset from the UNDP was used to capture different aspects of women's position in B&H and spot the reality by considering the dots in the current time for the specific region.

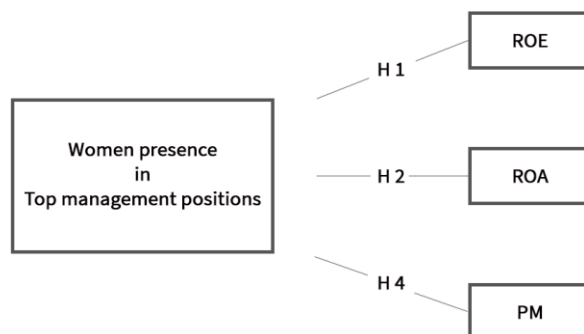


Fig. 1. Proposed research model

Source: Author

Figure 1 represents a conceptual model developed on the foundations of prior research and studies observations. The one-way model analyzes the relationship between Women as an independent variable and profitability as a dependent variable, which is measured through three different financial indicators: return on equity (ROE), return on assets (ROA), and profit margin (PM).

Hypotheses

The central hypothesis of research:

H1: Women in Top Management teams have positive effects on SME's Profitability in the IT sector

Supporting Hypothesis:

H1a: SME's with women in Top Management have higher Return on Equity (ROE)

H1b: SME's with women in Top Management have higher Return on Assets (ROA)

H1c: SME's with women in Top Management have higher Profit Margin (PM)

Data collection

To make clear conclusions and get concrete results, the flow of this research went strict by choosing the specific territory, industry, and size of business.

The data is provided by a secondary source TRON Business Intelligent System. The dataset includes financial information needed to calculate performance indicators of the profitability (ROE, ROA, and PM) within the timeframe of the past 5 years. The information about the Women's presence in TMT was collected from the same source. The pool from which the sample is created contained small and medium-sized enterprises SMEs, specifically from the tech industry. The first version provided data about 635 tech companies, and after reviewing this dataset, 412 companies were included in the analysis. The companies, besides the requirement to belong to the tech industry, require the existence longer than five years, so that the data collected for that period can be complete and useful for understanding the performance of the companies. The data set is secondary, avoiding any influence of respondent obstacles, neither the incomplete data. The source is highly reliable with compatible data to be used in research analysis without trust or credibility issues.

4. Results

Sample

There were 412 companies in the sample, of which 83.7 % are the companies which are led by male, while the remaining 16.3 % are led by women. Based on this, we conclude that men are more represented in the management structures of companies whose data were taken for analysis.

Table 1. Sample characteristics

Gender	n	%
males	345	83.70 %
females	67	16.30 %
Total	412	100.00 %

Source: Author

Data distribution

Before we start with the analysis of the collected data, and on the basis of which we need to give answers to research questions, it was important to consider the form of data distribution, with the aim of selecting an adequate statistical procedure. More specifically, it was necessary to check whether the distribution of the collected data differed from the normal distribution. Although there are several tests to check the distribution of data, we decided to test it by calculating skewness and kurtosis and their standard errors. Depending on the sample size, different minimal values are considered as reference values for deciding whatever distribution is normal or not. In our case, where the sample size is larger than 300, absolute skew value larger than 2 or an absolute kurtosis (proper) larger than 7 should be used as reference values for determining substantial non-

normality. In this case, skewness and/or kurtosis values are usually larger than reference values and therefore we consider the data distribution as non-normal, which means that for the inferential statistical test we should use non-parametric procedures.

ROE

H1a: SME's with women in Top Management have higher Return on Equity (ROE)

Before we answer the research question, we consider important to present some basic descriptive statistic on ROE for all companies we took in sample. In period of 2014-2018, the companies in average had 0,5063 of ROE with standard deviation of 5,979. The high standard deviation indicates large differences between companies. The average ROE varies from -59.1 to 81.8. 25 % of companies have the ROE lower than or equal to 0.18, while half of the companies have an ROE equal to or lower than 0.527. Also, 25 % of companies have an average ROE equal to or larger than 0.86. However, such information still cannot answer on our research question. So, we performed non-parametric inferential test, and the result of the test is shown on the table below. More concretely, we performed Mann-Whitney U test and Wilcoxon W test. In a case of average ROE (2014–2018) the Mean Rank for the companies led by males are a bit higher than ROE of companies led by females. Although, the Mean Rank differ, it still does not mean that the average ROE differs significantly between the companies led by male and companies led by female. In each case we did not find any statically significant difference in average ROE, and therefore we conclude that SME's with women in Top Management do not have higher Return on Equity (ROE). So, our hypothesis is rejected.

Table 2. ROE Outcome

Test Statistics ^a						
	average ROE (2014–2018)	ROE 2018	ROE 2017	ROE 2016	ROE 2015	ROE 2014
Mann-Whitney U	8178	7538	5946	4709	4108	2864
Wilcoxon W	10131	9368	7542	5934	5189	3530
Z	-1.99	-1.952	-1.342	-0.728	-0.251	-0.498
Asymp. Sig. (2-tailed)	0.051	0.051	0.18	0.466	0.801	0.619
a. Grouping Variable: gender						

Source: Author

ROA

H1b: SME's with women in Top Management have higher Return on Assets (ROA)

In period of 2014–2018, the companies in average had 0,2181 of ROE with standard deviation of 0,218. The high standard deviation indicates large differences between companies. The average ROA varies from -2,28 to 14,55. 25 % of companies have the ROA lower than or equal to 0.0098, while half of the companies have an ROA equal to or lower than 0.169. Also, 25 % of companies have an average ROA equal to or larger than 0.439. In a case of average ROA (2014–2018) the Mean Rank for the companies led by males are a bit higher than ROA of companies led by females. Although, the Mean Rank differ that does not mean that the average ROA differ significantly between the companies led by male and companies led by female. In each case there is no any statically significant difference in average ROA, and therefore we conclude that SME's with women in Top Management do not have higher Return on Assets (ROA). So, our hypothesis is rejected.

Table 3. ROA Outcome

Test Statistics ^a						
	average ROA (2014–2018)	ROA 2018	ROA 2017	ROA 2016	ROA 2015	ROA 2014
Mann-Whitney U	10310	10263	7468	5503	4549.5	3470
Wilcoxon W	12588	12541	9359	7099	5875.5	4416
Z	-1.331	-1.384	-1.3	-1.732	-1.288	-1.447
Asymp. Sig. (2-tailed)	0.183	0.166	0.194	0.083	0.198	0.148
a. Grouping Variable: gender						

Source: Author

PM

H1b: SME's with women in Top Management have higher Profit Margin (PM)

In period of 2014–2018, the companies in average had -0.135 of PM with standard deviation of 1.51. The high standard deviation indicates large differences between companies. The average PM varies from -15.94 to 1.65. 25% of companies have the PM lower than or equal to 0.0131, while half of the companies have an PM equal to or lower than 0.1005. Also, 25 % of companies have an average PM equal to or larger than 0.251. In a case of average PM (2014-2018) the Mean Rank for the companies led by males are a bit higher than PM of companies led by females. Although, the Mean Rank differ that does not mean that the average PM differ significantly between the companies led by male and companies led by female. In each case there is no any statically significant difference in average PM, and therefore we conclude that SME's with women in Top Management do not have higher Profit Margin (PM). So, our hypothesis is rejected.

Table 4. PM Outcome

Test Statistics ^a						
	average PM (2014-2018)	PM 2018	PM 2017	PM 2016	PM 2015	PM 2014
Mann-Whitney U	9957	8539.5	6549	5363	4253	3345
Wilcoxon W	12168	10492.5	8260	6741	5579	4206
Z	-0.991	-1.562	-1.318	-0.748	-1.688	-0.984
Asymp. Sig. (2-tailed)	0.322	0.118	0.188	0.455	0.092	0.325
a. Grouping Variable: gender						

Source: Author

4. Conclusion

This article outlined the low involvement of women in TMTs of small and medium-sized companies in the IT sector across the Federation of Bosnia and Herzegovina, aiming to disrupt the usual business mindset. It is unnecessary to think of different approaches to manipulate social and political opinions. The outcome of this research outlined that even in the male-dominated industry,

as the IT, companies led by a woman are profitable without significant difference from those led by a man. Which, at the same time, shows the complexity of this issue and how outreach of one person, one company, or public authorities that could borne fruit is valuable. The factors for the under-representation of women are defined as processes at the individual, organizational, and societal levels. Female's under-representation in new jobs is the biggest barrier to closing the economic gender disparity.

In future research, the link between women's presence in leadership positions and performance indicators of companies should be analyzed from different aspects and on different levels. A different aspect that could impact this relationship should be taken into future analyses. Some of these could be the age of the company, experience of women or man that is managing the company, the proportion of females in the whole top management team, etc. When it comes to the size of business and industry, the same link could be analyzed in different dimensions.

The outcome of this study displayed that women are capable of top management positions, even in a male-dominated industry. Regarding the results of this study, more chances should be given to women when appointing to the top management positions.

References

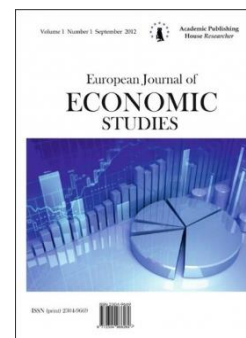
- Campbell, Mínguez-Vera, 2008 – Campbell, K., Mínguez-Vera, A. (2008). Gender Diversity in the Boardroom and Firm Financial Performance. DOI: <https://doi.org/10.1007/s10551-007-9630-y>
- Egerová, Nosková, 2019 – Egerová, D., Nosková, M. (2019). Top management team composition and financial performance: Examining the role of gender diversity. DOI: <https://doi.org/10.15240/TUL/001/2019-2-009>
- Halilbegovic et al., 2017 – Halilbegovic S., Halaba A., Ilguen E. (2017). Behavioral economics perspective on foreign direct investment in emerging markets: The case on Bosnia and Herzegovina. *Accounting – Growing Science*. 181-196
- Halilbegovic, Ertem, 2020 – Halilbegovic, S., Ertem, N. (2020). An Explorative Paper on Speculative Approaches to Smart Contracts. *Prague Economic Papers*. 29(4): 469-480.
- Kompa, Witkowska, 2018 – Kompa, K., Witkowska, D. (2018). Gender Diversity in the Boardrooms of Public Companies in Poland: Changes and Implications. *Montenegrin Journal of Economics*. 14: 79-92. DOI: <https://doi.org/10.14254/1800-5845/2018.14-1.6>
- Lakhal et al., 2011 – Lakhal, F., Amel, A., Lakhal, N., Malek, A. (2011). (PDF) Do Women On Boards And In Top Management Reduce Earnings Management? Evidence In France. *ResearchGate*, 33(8). DOI: <https://doi.org/10.19030/jabr.v3i1i3.9236>
- Hanna Rosin, 2012 – Maclean's, Hanna Rosin in Conversation with Brian Bethune. 2012. 125(37): 16-17. [Electronic resource]. URL: <https://library3.webster.edu/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=aph&AN=80225132&site=ehost-live>
- Perryman et al., 2016 – Perryman, A.A., Fernando, G.D., Tripathy, A. (2016). Do gender differences persist? An examination of gender diversity on firm performance, risk, and executive compensation. *Journal of Business Research*. 69(2): 579-586. DOI: <https://doi.org/10.1016/j.jbusres.2015.05.013>
- Wahl, 2013 – Wahl, A. (2013). Women on Corporate Boards and in Top Management. European Trends and Policy Work and Welfare in Europe Series. *European Societies*. 15(3): 467-469. DOI: <https://doi.org/10.1080/14616696.2013.792115>
- World Economic Forum, 2018 – World Economic Forum, The Global Gender Gap Report 2018. (n.d.). Retrieved August 29, 2020. [Electronic resource]. URL: <https://www.weforum.org/reports/the-global-gender-gap-report-2018/>
- World Economic Forum, 2020 – World Economic Forum, The Global Gender Gap Report 2020. (n.d.). Retrieved September 6, 2020. [Electronic resource]. URL: www.weforum.org/reports/gender-gap-2020-report-100-years-pay-equality

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Estimating the Strength of Interaction between Financial Market Integration, Financial Depth and Economic Growth in Economic Community of West African States: Simultaneous Equations Analysis

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Abstract

In this study, an attempt was made to investigate the strength of the interaction between financial integration, financial development and economic growth for countries of ECOWAS sub-region covering 1986 to 2019. The study employed ARDL model suitable for treatment of panel data with cross-sectional dependencies and heterogeneities. Unlike our previous study that measured financial depth by money supply/GDP ratio, financial depth was measured by domestic credit to private sector/GDP ratio. The results of the estimated regression revealed that the current degree of financial integration among ECOWAS countries is very low. The evidence shows that only four countries in the sub-region were more integrated when integration is measured as the ratio of a country's financial assets to the regional pool: Gambia (18.38 %), Ghana (22.87 %), Guinea (17.94 %) and Nigeria (20.22 %), at 0.10, 0.05, 0.10 and 0.05 levels of significance respectively. Interestingly, integration measured as interest rate convergence reveals that only Senegal exhibited significant integration level of 29.22 %, at the 0.05 significance level of the test. The result further shows that financial integration does not have short run significant effect on financial development, but, a deleterious effect on financial development, in the long run. A well-coordinated, capable and robust central regulatory oversight regulatory system cannot be over-emphasized. Such central agency is suited to provide timely support in macro-prudential management and generate both short run and long run macroeconomic stability that further enhances integration conditions in the long run and avert potential downside risks of spillovers and spillbacks which are often associated with increasingly regional interconnected financial markets. Policy coordination is necessary to avert potential detrimental impacts of financial integration on the domestic financial development.

Keywords: ECOWAS, financial sector development, financial integration.

1. Introduction

ECOWAS member countries' economies still face challenges of deepening and strengthening their domestic financial system to enhance economic growth. The financial services systems are still very fragmented. For OECD countries, impact of financial integration on economic growth is well established. But ECOWAS financial markets are very poorly developed. The few where evolving financial markets exist in the region, these markets are characteristically different and independent. The considerable diversity in degree of development and sophistication of ECOWAS

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financial system support argument in favor of financial integration. These diverse initial conditions should be potentially advantageous at a time where ECOWAS is poised to become an increasingly financially integrated area. Reason is, financial integration is bound to cause accelerated development in most backward financial market in the region, and allow consumers and corporations in these countries to access security markets and credits of the more advanced countries of ECOWAS.

In our previous study, we focused on identifying link between financial services sector development and economic growth for ECOWAS nations. This study fills the gap and makes significant contribution to empirical literature of ECOWAS sub-region. The major strength of this study is that it evaluates the relationship between markets integration and growth using financial market development as intermediary factor.

The purpose of this research therefore is to estimate the strength of interaction between financial market integration, financial development and economic growth in ECOWAS sub-region. The study thus provided a simultaneous equation framework for determining the concurrent effect of financial markets integration and development on economic growth, while accounting for cross-section dependencies and heterogeneities problems present in the data set. Succeeding to this background is study environment. What follows next is empirical review of empirical literature. Thereafter, is the methodology used in carrying out the study, analysis/interpretation of econometric results and finally, we have concluding remarks respectively.

2. Discussion

Study Environment/Economy of ECOWAS Countries

ECOWAS comprises 15 countries in West Africa and was founded in 1975 with the aim of fostering and accelerating the economic and social development of member states. ECOWAS is home to about 240 million people, with an average per capita income just above US \$ 300, and about 50 % of the population lives in absolute poverty. Recorded intra-regional trade is very small about 10 % of ECOWAS' GDP. All members of ECOWAS, apart from Liberia and Cape Verde, are members of WTO and in principle have signed on to its market access commitments. Almost all ECOWAS countries have restrictions in place on capital account transfers.

Article 55 of ECOWAS Treaty states in part that "setting up of a West African monetary union, establishment of a single regional Central Bank and creation of a single West African currency". The monetary integration process started with founding of West African Clearing House (later transformed to West African Monetary Agency, WAMA) in Freetown in 1975 to promote trade in sub-region by providing a payment mechanism for clearing and settlement of intra-regional transactions, as well as to encourage use national currencies in transactions.

In 1987 ECOWAS launched a Monetary Cooperation Program that defined the process leading to the creation of a single monetary zone and the introduction of a common currency. These goals were to be achieved in three phases: in short-term, objective was to strengthen payment mechanisms by introducing an ECOWAS-travelers check and a credit guarantee fund; in medium term, limited currency convertibility was to be achieved; and, in long term, achieve a single monetary zone with a common central bank and common currency. However, even short term objectives were achieved only after long delays, with ECOWAS travelers check introduced only in 1998.

ECOWAS could not proceed towards a single currency in immediate future. This led to instituting WAMZ amongst non-UEMOA countries. WAMZ members were Gambia, Ghana, Guinea (a Francophone country), Nigeria and Sierra Leone. [Table 1](#) gives a snapshot of relative sizes and some economic indicators of ECOWAS countries. Income per capita is higher on average for WAMZ when compared with UEMOA counterparts. Cote D'Ivoire and Nigeria are leading countries from each UEMOA and WAMZ in terms of income levels.

Table 1. Major economic indicators of ECOWAS countries

Country	Language	1990				2016			
		GDP per capita	GDP growth (%)	Inflation rate (%)	Pop. (Mill.)	GDP per capita (USD Mill.)	GDP growth (%)	Inflation rate (%)	Pop. (Mill.)
UEMOA									
Benin	French	1,469.86	8.976	1.112	5.001	1,964.74	4.027	-0.809	11.128
Burkina Faso	French	844.342	-0.603	-0.807	8.811	1,659.55	5.874	-0.194	18.42
Cote d'Ivoire	French	3,510.52	-1.09	-0.658	11.246	3,350.83	7.713	0.724	24.327
Guinea-Bissau	Portuguese	1,422.08	4.58	33.001	0.959	1,602.00	5.093	1.498	1.664
Mali	French	1,311.81	9.31	1.608	8.482	1,939.17	5.787	-1.8	18.289
Niger	French	953.764	-1.308	-2.026	7.523	1,039.42	5.033	0.298	18.194
Senegal	French	1,840.25	-0.676	0.325	7.562	2,355.96	6.743	0.851	15.6
Togo	French	1,591.63	5.897	1.13	3.666	1,437.14	5	0.857	7.509
Average							5.659		
WAMZ									
The Gambia	English	1,660.61	5.696	12.168	0.855	1,541.26	2.216	7.225	2.057
Ghana	English	1,959.54	3.329	37.241	14.306	4,064.31	3.469	17.455	27.573
Guinea	French	1,416.99	4.324	25.694	6.02	1,786.19	6.627	8.174	12.654
Nigeria	English	3,138.86			90.557	5,504.40	-1.617	15.696	183.636
Sierra Leone	English	1,798.42	1.611	110.946	4.043	1,568.88	6.067	11.542	6.439
Average							3.352		
Observer Members									
Liberia	English					788.958	-1.637	8.844	4.399
Cape Verde	Portuguese	2,528.08	0.692	11.111	0.354	6,159.50	3.817	-1.408	0.531

Source: World Bank, GDF and WDI Central (April 2016) Database

Interestingly, there is indication of higher per capita income for all countries in 2016, compared with 1990, although the increase for some countries is minimal. GDP growth rates are more impressive in UEMOA countries than in WAMZ countries, suggesting that economic management is better for countries in UEMOA region. Between the two periods, GDP growth in UEMOA sub-unit averaged 5.7 % against 3.35 % average in WAMZ. Perhaps difference in GDP growth rate between the two sub-blocs may be due to greater integration arising from monetary structure of a single monetary zone and adoption of common currency, the CFA Franc.

All countries in UEMOA sub-blocs exceeded regional average GDP growth rate of 5 % except Benin which had 4 percent. In WAMZ, only three out of five countries exceeded average of 3 %. The Gambia recorded 2.2 % Nigeria which is the biggest economy in the region exhibited negative growth rate of 1.6 % in comparable period. When we juxtapose this with GDP per capita, it could be reasonably explained that higher growth rate of smaller economies may be due to marginal productivity increase from increased capital. Figures 1, 2 give pictorial analyses of GDP and GDP growth rates, respectively, in ECOWAS member countries between the two periods under review.

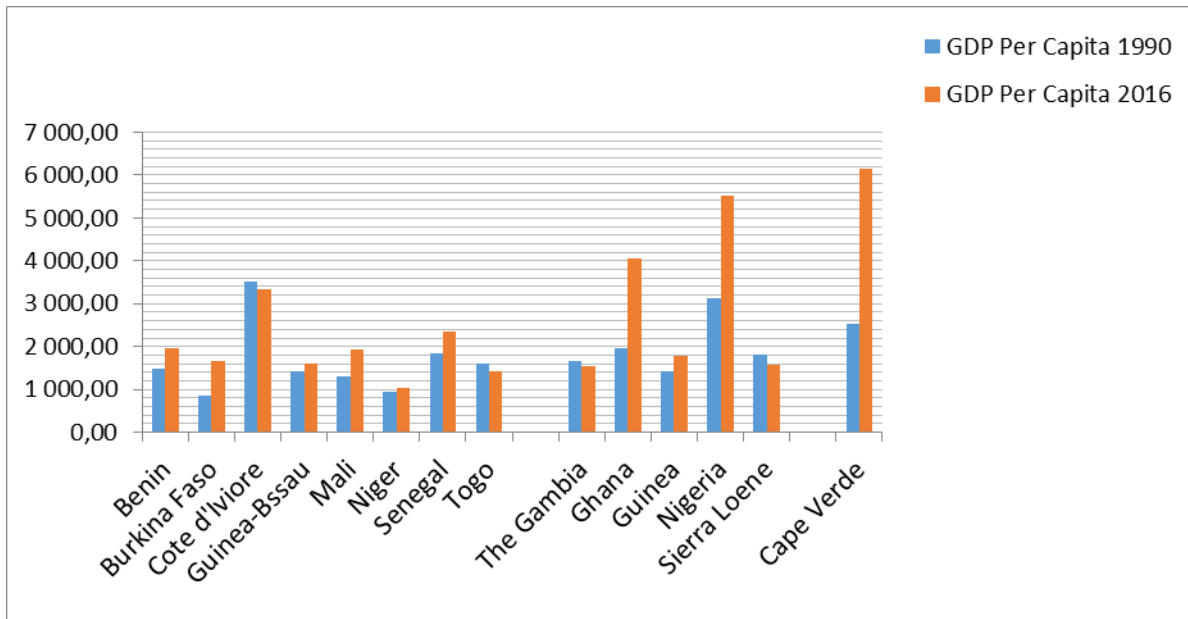


Fig. 1. GDP per capita in ECOWAS countries
Source: Compiled by authors

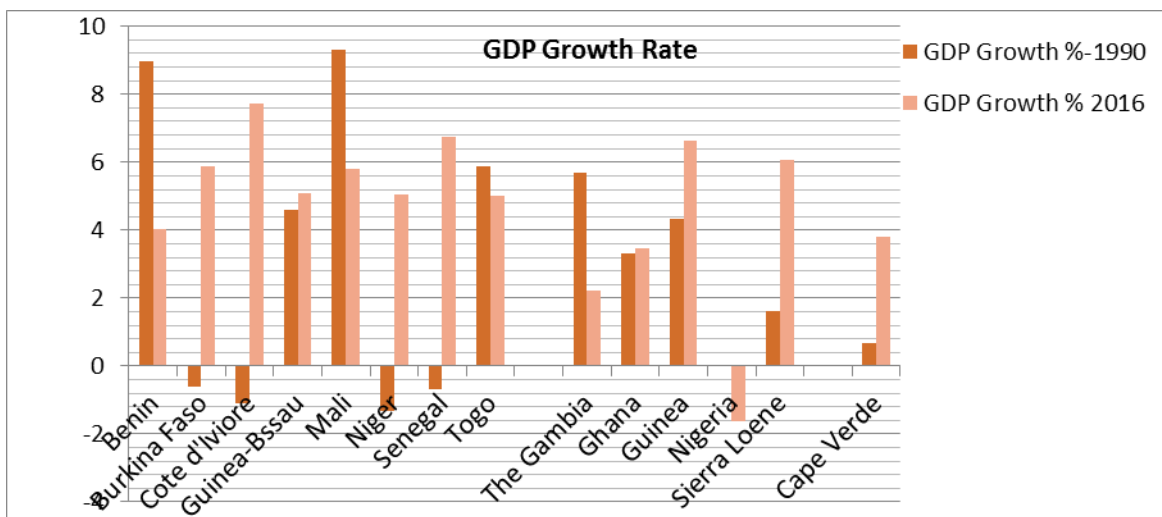


Fig. 2. GDP growth rate in ECOWAS countries
Source: Compiled by Authors

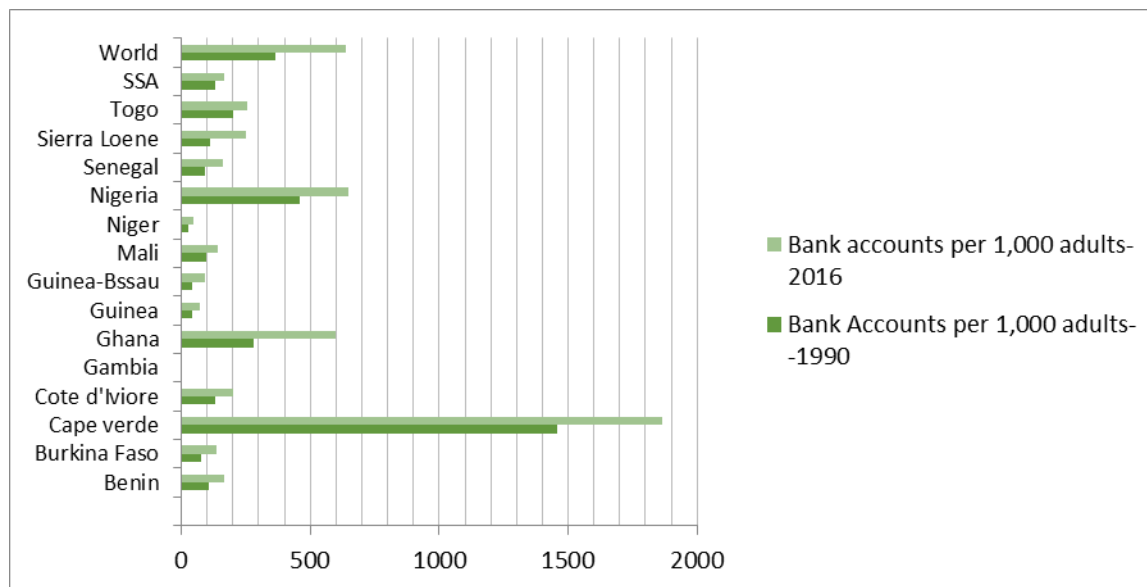
About financial sector in ECOWAS, bank or monetary financial intermediaries dominate SSA financial system, including that of ECOWAS sub-region. Other specialized institutions exist but they typically account for only a small proportion of total financial intermediation in the economy. Bank deposits remain most important form of household saving, and bank loans are most important source of finance for firms, both for working capital needs and fixed assets finance.

Table 2 below presents a summary of financial deepening within the region with respect to development of the banking sector in terms of financial inclusion (defined here as the ratio of bank accounts per 1,000 adults) and ease of accessibility to banks (the number of bank branches per 100,000 adults).

Table 2. Indicators of financial deepening

Country/Year	2010			2015		
	Bank accounts per 1,000 adults	Bank branches per 100,000 adults	Bank deposits to GDP (%)	Bank accounts per 1,000 adults	Bank branches per 100,000 adults	Bank deposits to GDP (%)
Benin	106.49	2.94	25.32	167.82	3.26	29.41
Burkina	78.64	1.94	20.40	137.88	2.71	30.77
Cape Verde	1457.12	31.18	72.18	1864.16	33.86	89.84
Civ	129.71	4.38	18.72	199.75	4.83	25.74
Gambia		9.47	39.33		9.05	
Ghana	282.91	5.36	20.73	599.33	7.17	24.41
Guinea	43.98	1.3	17.01	70.46	2.35	21.97
guinea Bissau	43.5	1.78	11.05	89.46	2.47	17.9
Mali	95.9	3.6	19.58	141.91	5.74	-
Niger	26.44	0.94	10.16	48.87	1.5	13.16
Nigeria	460.96	6.43	34.66	647.92	5.56	17.91
Senegal	93.81	3.92	26.39	163.44	4.62	33.71
s-l	112.2	2.74	13.29	249.52	4.93	38.21
Togo	198.61	4.06	28.73	253.52	4.98	40.78
SSA	129.71	3.6	19.34	165.665	4.75	21.02
World	366.8	13.49	41.77	638.14	14.06	49.54

Source: Author's compilation. Data obtained from IMF Economic Structure Data, 2016

**Fig. 3.** Bank accounts per 1, 000 adults in ECOWAS sub-region

Source: Compiled by authors

Bank account per 1,000 adults is very low for most countries in ECOWAS. Only Nigeria and Cape Verde met world average of 638.14 accounts per 1,000 adults as at 2015. Ghana followed closely with an average of 599.33 accounts, although still short of world average figure of 638 accounts. Other ECOWAS member countries had very low figures comparable to the World.

Those figures did not show significant improvement between 2010 and 2015. This suggests that financial sector development is quite low for the ECOWAS region.

In same vein, bank branch per 100,000 adults is quite dismal for most countries when compared to the world average. Only Cape Verde had strong financial development in terms of this indicator. The country appears to be highly developed financially when compared to the other countries in the region. When we consider that most of the bank branches are concentrated in the cities, the distribution of bank branches per 100,000 adult indicates that a significant portion of the rural population is unbanked or under-banked.

Overall, data on ECOWAS region highlights quite low financial development in all indicators. These suggests that these countries (with the remarkable exception of Cape Verde) economic growth may be constrained by internal resource generation arising from an underdeveloped financial system. The trend in bank branches per 1,000 adult, bank accounts per 100,000 adult and deposit-to-GDP ratio imply that financial deepening as an aspect of financial development enhances saving mobilization and subsequently impact growth. The chart analysis in [Figure 4](#) below illustrates this fact.

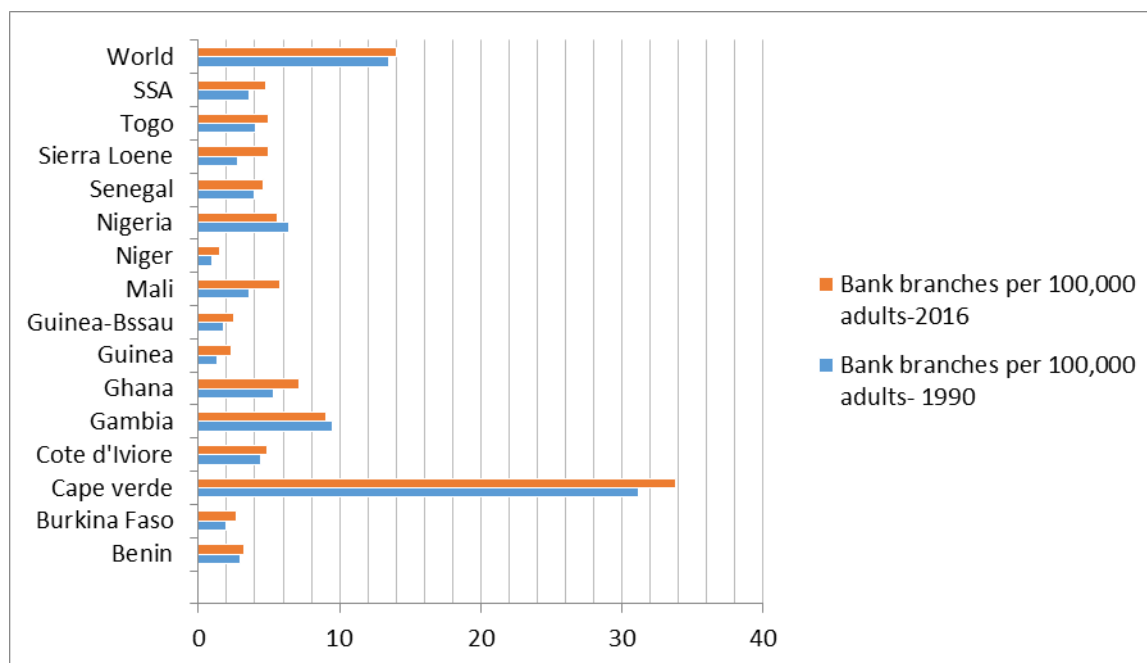


Fig. 4. Bank branches per 1,000 adults

Source: Compiled by Authors

From financial deepening metrics above, we observed how ease of access to bank, for instance, could have effect on economic growth through internal resource generation. The limit of availability of capital to agents may force the resort to borrowing from informal sources like money lenders whose cost of funds is usually very high. As captured by M2, financial systems in ECOWAS economies are extremely small. Except for Nigeria, the dominant economy in the region and to a certain extent the Cote d'Ivoire, Ghana and Senegal, the financial market size in the overwhelming majority of ECOWAS economies is below US 2 billion, i.e. less than that of a small bank in an industrial economy (see [IMF, 2007](#)).

The depth of the financial market for the entire economies are however low for all the countries (apart from Cape Verde) when compared to that of the whole world at 47.3% in 2015. The liquidity measure corroborates the evidence drawn from the financial deepening indicators (that is, financial deepening generally increases the ratio of money supply to GDP). Again Cape Verde with a highly developed financial system possess over 78 % M2/GDP.

In [Table 3](#), interest rate spread for most of the ECOWAS countries is quite higher than those of the world average. This gives implication that most money markets in the region are less efficiently run than those of the other countries in the world. Credit to GDP ratio is also lower for

SSA countries in comparison to that of the world. Credit appears to be scares in many of ECOWAS countries even though these countries require a lot of credit for development purposes.

Erstwhile Studies

As observed by Baele et al. (2004), financial integration provides additional opportunities for firms, households and countries to share financial risk and to smooth out consumption intertemporally such that by enabling domestic households to smooth their consumption path over time, capital flows can, therefore, increase welfare.

Bekaert, Harvey & Lundblad, (2006) found that financial liberalization (in the form of equity market liberalization and capital account openness) is indeed associated with lower consumption growth volatility. Berkaert et al discovered that countries that have more open capital accounts witnessed a greater reduction in volatility after opening their equity markets. They also found that financial liberalizations are closely associated with declines in the ratio of consumption growth volatility to GDP growth volatility. This suggests improved risk sharing.

Similar findings were reported for other empirical studeies carried out on the EU. For example, Edison, Levine, Ricci & Slok (2002); Prasad, Kose, & Terrones (2003), and other researchers like Guiso, Jappelli, Padula & Pagano (2004) in their study of European Union concluded that financial integration generates growth benefits, although to varying degrees. Specifically, using instruments such as country origin of financial assets, measures of creditor rights, quality of law enforcements to capture the effect of financial integration on financial development, the authors found that institutional quality determines the size and efficiency financial markets in Europe.

Accodiring to Kalemli-Ozcan & Manganelli (2008) financial integration enhances extensive investment prospects and financing sources that further licenses unfathomable liquid markets. Many other studies that posit that a well-functioning European financial system has the potential to foster the accumulation of physical capital, improve economic efficiency and thus promote long-term growth through the intermediation role of mobilizing saving from the surplus economic unit to the deficit units (Christopoulos, Tsionas, 2004; Levine, 2003; Bekaert et al., 2001; Levine et al., 2000). Jalilianm & Kirkpatrick (2007), Odhiambo (2010a,b) found that financial deepening, through improved intermediation efficiency, lowers the cost of credit and widen access to credit in the developing countries. This spurs economic growth as more people can access credit. This finding supports Tressel & Detragiache (2008) argument that financial reforms could led to financial deepening, and efficiency in allocation of investments.

Theoretical Frmwework

The Solow-Swan growth model (Solow, Swan, 1969) provides us theoretical basis for the study as it shows that any positive change in net investment will increase income per worker and generate growth in short run taking economy to a new steady-state but without stable 'growth effect'.

The analytical form of neoclassical growth model begins with denoting production opportunities in the economy as a function that maps the vector of factors into a composite output, Y and focuses on four variables: output (Y), capital (K), labor (L) and *knowledge* or the *efficiency of labor* (A). At any time, the economy has some amount of capital, labor, and knowledge, and these are combined to produce output. The production function takes the form:

$$y(t) = f[k(t), A(t)L(t)] \quad (1)$$

Where t denotes time, time enters the production function indirectly through K , L , and A . This implies that output changes over time only if the inputs to production change. In particular, the amount of output obtained from given quantities of capital and labor rises over time only if there is technological progress. AL is referred to as *active labor*, and technological progress that enters in this fashion is known as *labor-augmenting* or *Harrod-nuetral* (Romer, 2012).

The production function is assumed to exhibit constant returns to scale in its two arguments, capital, and effective labor. This allows us to work with production function in *concentrated form*. Hence, dividing equation (1) by $1/AL$ yields:

$$y = f(k, 1) = f(k) \quad (2)$$

where $y \equiv Y/AL$, output per unit of effective labor; $k \equiv K/AL$, is amount of capital per unit of effective labor; $f(k) = f(k, 1)$, output per unit of effective labor as a function of capital per unit of effective labor. Setting the model in continuous time, implying that arguments are stock variables such that the initial levels of capital, labor, and knowledge are exogenously determined and are assumed to be strictly positive; labor and knowledge grow at constant rates, n and g respectively, thus:

$$\dot{L} = nL(t) \quad (3)$$

$$\dot{A}(t) = gA(t) \quad (4)$$

The growth rate of L and A are constant at n and g , respectively. Accordingly, from eqns (3) and (4) can be expressed as:

$$\ln L(t) = [\ln L(0)] + nt \quad (5)$$

$$\ln A(t) = [\ln A(0)] + gt \quad (6)$$

where $L(0)$ and $A(0)$ are values of stock of labor and knowledge at time 0. Exponentiating (5) and (6) give us:

$$L(t) = L(0)e^{nt} \quad (7)$$

$$A(t) = A(0)e^{gt} \quad (8)$$

Eqns (7) and (8) imply that L and A each grow exponentially. Given that capital stock increases in any given situation especially that people saves constant fraction “ s ” of gross income Y , and that the constant fraction “ δ ” of capital stock depreciate each year, the rate at which new capital accumulates is sY , and the rate at which old capital wears out is δK . So, the net rate of increase in capital stock, (capital accumulation) is given by:

$$\dot{K}(t) = sY(t) - \delta K(t), \quad 0 < \delta, \quad \delta < 1 \quad (9)$$

Eqn (9) incorporates equilibrium condition of goods market, that is, equality between investment and saving, $I = sY$. Since economy may be growing over time, we focus on dynamics of capital stock per unit of effective labor, k , rather than on unadjusted capital stock, $K(t)$ Since $k = K/AL$. Hence,

$$\dot{K}(t) = sf(k) - [n + g + \delta]k(t) \quad (10)$$

With eqn (10), net rate of increase in capital stock per unit of labour man-hour is the resultant of rate at which new saving raises k and amount of investment that is just sufficient to replace worn out capital. The long-run growth rate of the economy can then be represented as:

$$g \equiv \frac{\dot{A}}{A} + A f_k \frac{\dot{k}}{k} + A f_n \frac{\dot{n}}{n} = g_A + \beta_k g_k + \beta_n g_n \quad (11)$$

where g is rate of growth of TFP, g_A is rate of growth of FTP that controls shift in the aggregate production function; $\alpha_k g_k + \alpha_n g_n$ adjust movement along steady state growth path of the economy.

Our Model

We specified simultaneous equations model to determine impact of interaction between financial development and financial integration on economic growth as well as the impact of financial integration on financial sector development are specified below:

$$\begin{aligned} D(y_n)t = & b_0 + b_1(y_n)t-1 + b_2(fng)t-1 + b_3(fsd * fng)t-1 + \\ & b_4sav(t-1) + b_5I_Q(t-1) + \sum_{i=1}^{p-1} a_1 D(y_n)t-i + \sum_{i=1}^{p-1} a_2 D(fng)t-i + \\ & \sum_{i=1}^{p-1} a_3 D(fsd * fng)t-i + \sum_{i=1}^{p-1} a_4 D(sav)t-i + \sum_{i=1}^{p-1} a_5 D(I_Q)t-i + \varepsilon_t \end{aligned}$$

$$D(fsd)_t = d_0 + d_1(fsd)_{t-1} + d_2(fng)_{t-1} + b_3(I_Q * fng)_{t-1} +$$

$$\sum_{i=1}^{p-1} \delta_1 D(fsd)_{t-i} + \sum_{i=1}^{p-1} \delta_2 D(fng)_{t-i} + \sum_{i=1}^{p-1} \delta_3 D(I_Q * fng)_{t-i} + \varepsilon_t$$

where yn is real GDP growth rate, sav is sum of private and public sector saving, and I_Q represent institutional quality, fsd is measure of financial depth; fng is financial integration, I refers to institutional quality. Financial depth was measured by domestic credit to private sector/GDP ratio ($cregdp$).

The variable ($I_i * fng_{.i}$) is an interactive variable that indicates that institutional quality tends to interact with financial integration to determine level of financial development in a given country. Issues of restrictions and capital account liberalization are highly political and institutional, hence the use of this variable.

Data Sources and Measurement of Variables

Panel data involving annual values for the entire 15 ECOWAS countries were used in the empirical analysis of the study. The data is obtained from Development Indicators of World Bank; and UNCTAD World Investment Report Database.

Table 3. Description of Variables

S/N	name	symbol	description	used to measure:
1	growth rate of real gross domestic products (gdp)	yn	This is the real income level in the economy which shows the basic structure of an economy in terms of aggregate income levels.	Economic Growth Variable
2	lag of real gross domestic products	rgp	Represents the initial economic condition of a country	Economic Growth Variable
3	credit rate	cregdp	Ratio of Credit to the private sector to GDP and measures the extent of bank-based financial intermediation in an economy.	Financial development variable
4	interest rate gap	inrg	Computed spread between Average Interest rate in ECOWAS and an individual country's interest rate	Financial Integration variable
5	assets	assets	The ratio of a country's external assets to that of ECOWAS regional total	Financial Integration variable
6	number of convergence criteria met	convergence index	Formal commitment made by ECOWAS member country to deepen integration in the sub-region in line with the ECOWAS Monetary Cooperation Program (EMCP)	Financial Integration variable
7	capital account openness	kpn	The level at which countries allow inflow and outflow of capital formulated by Chinn and Ito	Financial Integration variable
8	investment profile	inprl	Explains the bureaucratic and legal hurdles that an entrepreneur has to overcome to establish a business and the efficiency of a country's contract enforcement process.	Institutional Quality Variable
9	law and order	law	Explains the general respect to the rule of law (as opposed to arbitrariness or discretionary behavior) in a country, as measured by the International Country Risk Guide (ICRG)	Institutional Quality Variable
10	government stability	gst	Explains the degree of stability and consistency in the policy environment, as measured by as measured by the International Country Risk Guide (ICRG)	Institutional Quality Variable
11	gdp per capita	gpc	The ratio of RGDP to Population of a country	Control Variable
12	interest rate	intr	Defined as a country's lending Rate	Control Variable
13	saving rate	sav	The rate at which output of a country is preserved (not consumed) for future production	Control Variable
14	consumer price index	cpi	The rate of change in commodity prices over time in a given country	Control Variable
15	inflation rate	inl	Average rate of change in the general price level of a country over time	Control Variable
17	Exchange Rate	exr	The rate at which a country exchanges a unit of her currency of another's	Control variable

Source: Authors' construction

The study analyzed linkage between financial market integration and economic growth in ECOWAS sub-region. The choice of ECOWAS sub-region for this study is due to existing legal instrument in the form of the ECOWAS' treaty of 1975 which provide for economic integration of the sub-region. The empirical analysis covers 15 countries of ECOWAS for the period, 1986 to 2019. The selection of the period is to further evaluate strength of market integration, financial sector development and growth in ECOWAS countries using credit/GDP ratio as monetary policy variable.

The study adopted fixed effect within group model for the estimation. All observations in this case are pooled together, but for each unit, we express each variable as a deviation from its mean value and then estimate an OLS regression on such 'mean-corrected' values (Gujarati, Porter, 2009). In this study, estimation of ARDL models and their error corrections-representation for estimation of long-run relationships, was employed for the dynamic analysis. This procedure lends itself for application to models with mixed stationary properties of variables in our sample. It also allows for inferences on long-run estimates, which is not possible under alternative co-integration procedures.

The procedure is suitable irrespective of whether series are integrated to order zero $I(0)$ or integrated to order $I(1)$. The bounds testing procedure process by Pesaran, Shin & Smith (2001) is used to test for the existence of a linear long-run relationship, when orders of integration of underlying regressors are not known with certainty. But before this application, as suggested by Westerlund (2007), study addressed issues of cross-section dependency that may arise in panel dataset like those employed in this study.

According to Kuoassi, Silue & Brou (2017) acknowledging problem of cross-section dependency constitutes a bridge between first and second generation tests of unit root and co-integration in panel data (Baltagi, 2013). Hence, we carried out necessary check for presence of cross-section dependence in our data-set using the average pairwise correlation coefficient. The CD_{LM} diagnostic test based on the above pair-wise correlation coefficients as suggested by Frees (1995) was also carried out.

3. Results

Descriptive Analysis

The initial aspects of the empirical analysis of the study consider the basic characterization of the datasets used in the study by considering the moment conditions and other time series characteristics of the data. The descriptive statistics are presented in Table 4. It should be noted that the descriptive statistics are reported for all cross sections (countries) combined and for individual countries for each of the variables. Table 4 presents the summary statistics of all the variables used in the study for a combined process of the 14 countries used in the empirical analysis.

The Table 4 shows that average real GDP growth for the entire ECOWAS sub-region is 3.49 for the entire period which is relatively low, considering that a much larger value of consistent growth rate (average 7.0 percent) was suggested by the World Bank in 1999 as the basic rate that will ensure sustainable long run welfare benefits for countries like those in the ECOWAS. Moreover, a minimum value of 24.79 growth rate for a given year is rather dramatic, highlighting the highly unstable patterns of growth experienced by countries in the sub-region.

The standard deviation of growth rate for the period is slightly higher than mean value, which suggests that growth was largely inconsistent either over time within economies or by comparing countries in the sample. Indeed, there is highly significant J-B value for real GDP growth (and for all other variables) shows that the datasets are non-normally distributed with a high degree of heterogeneity among the countries.

Table 4. Descriptive statistics of variables taken as a Group

variables	mean	max	min	std. dev.	skew	kurtosis	j-b	prob.
yn	1856.19	6326.97	718.10	966.82	2.31	9.38	1373.2	0.000
rgdp	3.49	26.43	-24.79	4.79	-0.90	9.80	1097.5	0.000
cre	16.07	120.04	0.41	12.17	2.42	14.98	3700.0	0.000
inr	15.55	62.83	4.74	9.18	1.27	5.59	290.82	0.000
ctia	4.78	9.00	0.00	1.87	-0.41	2.80	16.1	0.000
assets	7.05	84.10	0.00	15.57	3.33	13.17	3271.9	0.000
inrg	0.01	39.62	-17.27	8.39	1.22	4.85	207.7	0.000
kpn	-0.91	2.35	-1.92	0.89	2.14	8.48	1072.5	0.000
sav	11.00	44.29	-98.14	11.01	-3.12	35.43	24168.8	0.000
gst	6.91	11.00	2.00	2.23	-0.06	2.17	15.4	0.000
inprl	6.09	11.50	0.00	2.07	-0.13	3.05	1.6	0.443
law	2.76	5.00	0.44	0.95	-0.04	3.05	0.2	0.897
cpi	148.68	3007.01	0.07	306.53	5.51	38.45	30554.1	0.000
inl	11.06	178.70	-24.52	19.10	3.66	22.15	9321.7	0.000

Source: Authors' compilation

The mean of ratio of credit to private sector to GDP rate is 16.07 % respectively. These values are essentially low, especially when the critical relevance of credit as a major component of private sector development is considered. The values suggest the continued predominance of informality in the financial sectors of most ECOWAS countries.

For financial development variables, standard deviation values are relatively low, which shows that average financial development value is quite representation of most of ECOWAS countries. Accompanying low financial development indicators is high average interest rate for the sub-region at 15.55 %. Apparently, these figures suggest that financial environment for these countries is stringent and offers little room for financial inclusiveness. This is as expected especially with the high mean interest rate of 15.55 which tend to attract foreign investment into the region.

The characteristics of four measures of financial integration provide insight into extent of financial interactions among countries. The average number of convergence conditions met by countries in the region over the years is 4.78 out of 11 conditions provided in ECOWAS Monetary Cooperation Program manual. Thus, less than half of the conditions were met within period of study by countries which underlies difficulty of integration within the sub-region.

The other measure of financial integration is share of individual country's external assets to the total for the sub-region. The average value for this measure is 7.05 %, which is also low and indicates that most of countries have less shares of the aggregate financial position of the ECOWAS. For interest rate gap (as a measure of integration), the average gap value is 0.01, which very low and impressive. It shows that interest rates across region reflect average value of 15.55 % and rates are stable among countries. This suggests that cost of funds is high and domestic investment may be constrained by low fund availability. However, relative stability of rates demonstrates a form of efficiency of financial sector management which should provide more impetus for inflow of foreign capital into the sub-region.

Though interest rate gap suggests attraction for more foreign capital inflow, average capital account openness for the sub-region at -0.91 shows less open financial sectors among the countries. Largely, average figures highlight ECOWAS countries appear to be less integrated than is to be desired. The indicators of institutional quality for the region are shown by government stability, investment profile and law and order. The average values for each of the variables are at

half-way level (around 6.0 out of 12.0 for government stability and investment profile, and around 3.0 out of 6.0 for rule of law). Essentially, there is more room for improvement in institutional quality for the countries, especially for government stability which is a critical aspect for developing a strong financial sector in a country.

Table 5 analyses only indicators of financial development for each country. The mean value of financial development indicator is quite low in the region, with exception of Cape Verde, which has a comparable high degree of financial development to that of developed economies. Only Cape Verde had a liquidity value of over 50% and a corresponding credit to GDP ratio of over 30 %. Guinea has least liquidity ratio and it also has least credit to GDP ratio along with Sierra Leone. The average values for these countries are so low that they suggest strong liquidity constraint for both fiscal management and private sector participation in the respect economies. Surprisingly, large economies in sub-region (Nigeria and Ghana) do not appear to possess higher liquidity when compared to other economies.

Table 5. Descriptive statistics of financial development variables, country per country

country	credit	
	mean	std. dev.
Benin	17.82	7.90
Burkina Faso	14.64	5.40
Cape Verde	35.58	18.28
CIV	23.58	10.85
Gambia	12.69	6.24
Ghana	12.45	18.89
Guinea	4.84	2.00
Guinea-Bissau	10.11	6.34
Mali	15.14	4.35
Niger	10.74	4.88
Nigeria	15.00	5.94
Senegal	25.09	7.22
Sierra Leone	4.43	1.93
Togo	22.91	7.83
All	16.07	12.17

Source: Authors' results using Eviews 9.0

Table 6 presents mean values and standard deviations of financial integration variables which is measured by assets, capital account openness (kpn), interest rate gap (inrg), and number of convergence criteria met. It can be seen that 60.13 % of external central bank assets for countries in sub-region is owned by Nigeria, while 11.66 % is owned by Cote d'Ivoire. Clearly, countries with larger economies (and perhaps possessing capital markets) dominate in external asset ownership within the sub-region.

This pattern of asset ownership may present certain challenges in terms of financial sector integration, especially with respect to currency and Central Banks' unification. Interestingly, index of capital account openness among the countries is similar. Only Gambia has a positive indicator of capital account openness, suggesting that country is most financially open in ECOWAS. Few of countries (including Ghana, Gambia, Sierra Leone, and Senegal) report high average interest rate gaps, but several others have low gaps which are a sign of more integration. In terms of criteria met for the convergence conditions, no country actually stood out in its quest to facilitate convergence within the ECOWAS sub-region.

Table 6. Descriptive statistics of financial integration variables per country in ECOWAS region

country	assets		capital account openness		interest rate gap		convergence	
	mean	std. dev.	mean	std. dev.	mean	std. dev.	mean	std. dev.
Benin	2.42	0.99	-0.76	0.53	-6.56	2.04	6.34	1.24
Burkina Faso	2.52	1.08	-1.01	0.58	-3.48	2.63	6.08	0.94
Cape Verde	1.13	0.68	-1.17	0.22	-5.04	3.23	4.29	0.90
CIV	11.66	5.48	-0.93	0.48	-6.72	1.77	5.26	0.79
Gambia	0.41	0.17	1.18	1.64	10.16	6.54	2.68	1.60
Ghana	7.03	2.83	-1.54	0.44	12.04	6.80	2.34	1.17
Guinea	1.39	0.42	-1.47	0.35	1.50	2.00	3.47	1.52
Guinea-Bissau	0.19	0.16	-1.25	0.23	4.40	9.93	4.89	1.31
Mali	2.68	1.21	-0.76	0.53	-2.86	3.27	6.11	1.29
Niger	1.42	0.85	-0.84	0.50	-2.79	5.17	6.08	1.15
Nigeria	60.13	13.56	-1.08	0.50	2.00	4.40	5.13	0.96
Senegal	5.27	2.23	-0.76	0.53	-9.02	4.00	6.34	1.38
Sierra Leone	0.61	0.22	-1.24	0.67	10.11	9.05	2.39	1.24
Togo	1.87	0.93	-1.06	0.38	-3.57	3.43	5.55	1.13
All	7.05	15.57	-0.91	0.89	0.01	8.39	4.78	1.87

Note: Authors' results using EViews 9.0

Table 7 presents descriptive statistics of growth rate of ECOWAS countries measured by real output/GDP and some selected macroeconomic control variables which comprise, saving rate, interest rate, exchange rate and inflation. Most of the countries of ECOWAS, with exception of Sierra Leone, Togo, Cote D'Ivoire and Guinea-Bissau appear to have relatively good growth rate when compared with the sub-regional average growth rate of 3.49 %.

Cape Verde, Burkina Faso and Ghana grew at an average rate of 5.2 %, 4.9 % and 4.5 %, respectively over the period. Most of the other countries of the ECOWAS grew at above the region's mean growth rate of 3.5 %. Similarly, GDP per capita is highest in Cape Verde (averaging 3922.97), followed by Cote D'Ivoire (average of 3246.22) and Ghana (averaging 2546.06). Although the rgdp in Cote D'Ivoire is low, gdp per capita is high due to size of country's population. But sustained growth is better accounted for when it is accompanied by a high Saving rate, again, highest in Cape Verde (21 %) followed by Mali (18.87 %) and Nigeria (18.11 %).

Table 7. Descriptive statistics of real gdp and some selected macroeconomic control variables in ECOWAS (country-by-country)

Country	rgdp		rgp		sav		inr		exr		inl	
	$\bar{X}$	S.D	$\bar{X}$	S.D	$\bar{X}$	S.D	$\bar{X}$	S.D	$\bar{X}$	S.D	$\bar{X}$	S.D
Benin	3.76	2.62	1659.17	158.45	13.9 3	5.50	8.97	2.64	466.23	136.10	3.80	6.86
Burkina Faso	4.93	3.09	1110.13	299.26	11.43	4.34	12.0 5	5.23	83.96	16.76	3.50	5.29
Cape Verde	5.16	3.08	3922.9 7	1594.0 1	21.0 0	28.7 7	10.5 0	0.88	466.68	136.48	5.76	5.99
CIV	2.59	3.75	3246.2 2	553.99	10.0 6	6.29	8.81	2.74	466.68	136.48	4.31	4.70

Gambia	3.27	5.16	1587.3 9	106.62	9.94	5.52	25.6 9	4.96	17.84	13.41	8.99	9.60
Ghana	4.53	3.64	2546.0 6	756.80	8.70	5.47	27.5 7	7.18	0.84	1.16	27.17	25.30
Guinea	3.69	1.78	1457.6 2	166.29	5.44	6.51	17.0 4	3.78	2711.74	2823.1	18.02	13.61
Guinea-Bissau	2.64	4.44	1446.4 5	91.99	5.47	4.12	19.9 4	13.3 4	466.68	136.48	26.26	30.78
Mali	3.95	4.39	1505.9 6	293.58	18.8 7	8.17	12.6 7	5.79	466.68	136.48	3.59	6.93
Niger	2.97	5.59	927.14	148.37	11.9 0	7.60	12.7 4	6.81	466.68	136.48	3.34	7.73
Nigeria	3.89	4.35	1696.7 5	482.34	18.11	6.33	17.53	5.07	80.50	80.35	8.72	12.05
Senegal	3.47	2.71	1991.2 6	176.66	11.02	6.29	6.51	2.00	466.68	136.48	3.76	6.61
Sierra Leone	1.73	10.1	1473.7 9	369.21	0.58	5.46	25.6 4	11.43	1973.5 4	1985.0 1	33.46	37.42
Togo	2.32	5.85	1415.7 0	188.58	7.55	6.80	11.97	5.40	466.68	136.48	4.18	7.11
All	3.49	4.79	1856.1 9	966.82	11.0 0	11.0	15.55	9.18	614.39	1180.3 3	11.06	19.10

Note: Authors' results using Eviews 9.0

Unit Root Test Results

Country specific characteristics (individual heterogeneity) and common (homogenous) characteristics of the ECOWAS' member countries reflect in the data employed for this study. This calls for use of panel unit root tests to check for the stationarity of the data, in order to avoid incidence of "spurious" inference. We used the tests developed by Levin, Lin and Chu (LLC) and Breitung, to examine the stationarity properties of the homogenous panel.

These tests assume identical co-integration vectors among countries. But ECOWAS member countries are likely to exhibit differences in their economic, policy, institutional and other unobserved space, hence the common unit root assumption may not be sufficiently realistic. To overcome this seemingly unrealistic assumption for the ECOWAS sub-region, we undertake Im, Pesaran and Shin (IPS, 2003) and ADF tests, which allows for heterogeneity in panel's cross-section and assumes a null hypothesis of no co-integration in panel data. Results are reported below (Table 8).

Table 8. Panel unit root tests results

variable	intercept and trend								remarks: variables are all stationary @ $I(1)$
	homogenous unit root process				heterogeneous unit root process				
	LLC		Breitung		IPS		ADF-Fisher		
	$I(\mathbf{o})$	$I(1)$	$I(\mathbf{o})$	$I(1)$	$I(\mathbf{o})$	$I(1)$	$I(\mathbf{o})$	$I(1)$	
rgd	−16.33**	−31.83**	−11.17**	−20.59**	−15.68**	−32.09**	252.36**	899.45**	Stationary
cpi	10.44	12.18**	14.69	−8.30**	8.45	−12.06**	12.92	177.97**	Stationary
rgp	−2.04*	−16.95**	5.26	−9.25**	−2.61	−16.44**	35.76	259.07**	Stationary
sav	5.39**	−25.98**	−2.62**	−14.43**	−6.59**	−23.13**	100.55**	481.75**	Stationary
exr	4.30	−10.35**	6.26	−9.00**	4.40	−11.93**	11.36	174.41**	Stationary
cre	0.78	−18.01**	3.63	−4.35**	3.87	−17.09**	10.31	264.47**	Stationary
asset	0.70	−13.43**	1.99	−1.39**	0.24	−15.80**	26.22	235.66**	Stationary
kpn	0.65	−16.57**	−0.62	−4.45**	0.29	−16.54**	27.55	256.31**	Stationary
inrg	−0.84	−17.55**	−1.67*	−13.70**	−1.06	−16.93**	31.78	257.06**	Stationary
convergence	−8.82**	−26.69**	−9.09**	−16.71**	−11.86**	−30.34**	176.62**	666.27**	Stationary

law	-0.06	-13.83**	-0.88	-9.62**	0.23	-11.88**	33.91	172.56**	Stationary
gst	1.32	-12.47**	-0.25	-13.76**	3.20	-11.13**	6.92	152.29**	Stationary
inprl	0.11	-15.53**	-1.71*	-13.85**	-0.53	-12.72**	22.82	184.17**	Stationary

Source: Authors' results using Eviews 9.0, ** and * indicate significant at 1 % and 5 % levels respectively; IPS = Im, Pesaran & Shin; LLC = Levin, Lin & Chu

In unit root results, it can be seen that coefficient of test for the variables in levels indicates that only the coefficients of real GDP growth, rgp, sav, and convergence index are significant. These are the only variables that are stationary in levels either for the homogenous tests or for heterogeneous tests. Other variables are I[1]. The mixture of variables in the model in terms of level of integration either I[0] or I[1] does not however matter for the ARDL estimation procedure since the estimator account for the different integration levels.

Co-integration Test Results

Given the unit root results strongly indicate that the stationarity status of the variables are mixed with certain variables I[1] and others at I[0], long run conditions of the variable interactions can however be established to present a stronger circumstance for a dynamic relationship among the variables. Table 9 shows outcomes of the Pedroni and Kao panel co-integration tests on both panel and group assumptions along with respective variance ratios and rho statistics (non-parametric tests). We use both within dimension and between-group dimension tests to check whether panel data are co-integrated.

Table 9. Panel co-integration test result

Growth-Creyr (credit) equation	Panel Statistics	Group Statistics	Kao (ADF)
variance ratio	0.636	--	
rho	1.259	1.014	-2.440*
pp	-0.304*	-2.130*	
adf	0.133*	-1.548*	
financial development and financial integration interacting equation (creyr), with control for institution quality	Panel Statistics	Group Statistics	Kao (ADF)
variance ratio	6.042	--	
rho	3.929	4.954	2.772**
pp	2.586	2.490	
adf	-3.618*	-1.757*	

**, * indicates the rejection of the null hypothesis of no co-integration at the 0.01 and 0.05 level of significance respectively

The coefficients of PP & ADF test statistics for both panel and group assumptions are significant at the 0.05 % significant level. Thus, there is strong evidence of panel co-integration according to both ADF-t and non-parametric-t statistics. These results are complemented by another residual based (kao) panel co-integration test. The kao residual co-integration test indicates that null hypothesis of no co-integration can be rejected for each of equations at the 0.05 significant level.

Results of Financial Integration and Financial Sector Development

In Table 10, the result of the financial integration measured by domestic private credit is presented.

Table 10. Regression results

variable	no interaction			interaction effect		
	convergence conditions	inrg	assets	convergence conditions	inrg	assets
<i>long run results</i>						
fng	0.077**	-0.003	-0.672***	0.281***	0.409***	-0.041***
fng*I	--	--	--	-0.030***	-0.066***	0.010***
lnrgp	1.379***	2.152***	3.036***	1.408***	1.570***	1.669***
kpn	-0.097	-0.035	-0.119**	-0.134***	-0.240***	-0.007
gst	0.040*	0.117***	0.139***	0.153***	0.084***	0.023
inprl	-0.080***	0.087***	0.063*	-0.066***	-0.083***	0.021
<i>short run results</i>						
ecm _{t-1}	-0.198***	-0.206**	-0.198***	-0.239***	-0.251***	-0.198***
Δ (fng)	0.002	-0.014***	0.161***	-0.065**	0.097	-0.024
Δ (fng _{t-1})	-0.099	0.002	0.130***	--	0.175	0.024
Δ (I*fng)	--	--	--	0.009*	-0.009	0.002
Δ (I*fng _{t-1})	--	--	--	--	-0.019	-0.004
Δ (lnrgp)	0.074	-0.131	-0.186	-0.124	-0.195	-0.111
Δ (lnrgp _{t-1})	-0.028*	0.159	0.044	--	0.131	0.314
Δ (ops)	0.008	0.120	0.038	0.098*	0.109*	0.090*
Δ (ops _{t-1})	-1.566***	-0.039	-0.052	--	-0.125	-0.055
Δ (gst)	0.009	-0.019*	-0.008	-0.063**	0.016	-0.014
Δ (gst _{t-1})	0.239	0.006	-0.003	--	0.025	0.008
Δ (inprl)		-0.015	-0.034	0.004	-0.017	-0.033
Δ (inprl _{t-1})	24.497	-0.003	-0.011	--	0.023	-0.023
c	184.025	-3.174**	-4.289***	-2.151***	-2.366***	-2.000***
mean (yn)		0.009	0.009	0.009		
s.e.e.(reg)		0.224	0.213	0.237		

Source: Authors' results using Eviews 9.0, ***, **, * indicates the 0.01, 0.05 and 0.10 level of significance, respectively

Short-run estimates show financial integration does not have strong short term relevance for financial sector development among ECOWAS countries. The convergence coefficient has significant negative impact on credit ratio in short run, although its effect is positive with interactions with institutions. The share of regional assets also has significant positive impact on financial development, both by itself and with interactions with institutional quality. There is therefore evidence that financial integration in the form of asset shares and convergence criteria have short term effects on credit supply in a country.

Error correction results show that each coefficient had expected negative sign and are significantly different from zero at the 1 percent level. Since these values are both significant and negative, it is shown that long run stability is present within the estimates and any short-term deviation from equilibrium will be restored over time. Again, capacity for restoring long run equilibrium is also low, considering the low values of the coefficients of error correction term in each equation. This denotes that up to 25 % of long run adjustments to equilibrium is completed within the first year for each equation. This shows that financial integration tends to provide more long run stability for credit supply than for overall financial market depth among ECOWAS countries.

For long run results in upper panel of Table 7, it can be seen that when institutional quality is not taken into cognizance, both convergence and regional asset shares have significant impacts on financial development as measured by credit supply. This implies that meeting convergence conditions tends to aid domestic financial sector in terms of loan provision and loan access. Conversely, larger share of external financial assets owned within sub-region by a country, implies lower credit supply to the economy. So, effects of financial integration on the economy is rather mixed, and strictly depends on indicator used for measuring integration.

When policy interactions with integration variables are included in estimates, each coefficients becomes significant at 1% level; although that of share of assets becomes negative and that of institutional quality is positive which indicates capacity for interest rate alignment to reduce credit supply. The size of positive coefficient of conditions met increases with inclusion of institutional interaction. This shows that better institutions strengthen benign impact of convergence conditions on credit supply in a country. Coefficient of per capita income is explicitly positive and significant. It is an indication that economic performance significantly increases credit supply in the economy. Financial openness has significant negative impacts on credit supply, while institutional factors are shown to be mainly positively related to credit supply. Essentially, better institutions tend to stimulate either credit availability of means of assessing credit among ECOWAS countries.

Results of Financial integration (interface with financial development) and Economic Growth

Finally, effects of financial integration and its interaction with financial development on economic growth is estimated and analyzed. The results of estimation are reported in Table 11.

Table 11. Regression results

variable	<i>dep.v (yn)</i>			
	assets	convergence conditions	k account	inrg
<i>long run results</i>				
ln(cre)	0.082	1.818**	0.129***	0.178***
fng	-0.185*	1.093**	--	-0.031**
cre*fng	0.127***	-0.334**	-0.027***	0.012**
ln(sav)	0.211***	1.136***	0.135***	0.003***
gst	0.009	0.058	-0.021	-0.003
inprl	0.070***	0.177***	0.102***	0.130***
law	0.061	0.068	0.142***	-0.004
<i>short run results</i>				
ecm _{t-1}	-0.069***	-0.022***	-0.087***	-0.094***
Δ(lncre)	0.048	-0.008	-0.004	-0.010
Δ(fng)	0.094	-0.009	--	-0.005
Δ(cre*fng)	-0.028	0.001	0.000	0.003
Δ(lnsav)	0.007	-0.002	0.004	0.002**
Δ(gst)	0.000	0.000	0.002	-0.001
Δ(inprl)	0.004	0.003	0.001	0.000
Δ(law)	-0.002	0.001	-0.008	0.006
c	0.419***	-0.056**	0.518***	0.588***
mean (yn)	0.006	0.006	0.006	0.006
s.e.e.(reg)	0.046	0.046	0.045	0.046

Source: Authors' results using Eviews 9.0, ***, **, * indicates the 0.01, 0.05 and 0.10 level of significance

The short run estimates are mostly not significant, but coefficient of error correction term is significant and negative. The coefficients of error correction term are also very low and show that adjustment to long run equilibrium is slow. The long run estimates also show that credit rate is significant and has positive impact on economic growth, moreover, assets share in region has significant negative effect on the economy, while the interaction of the integration indicator with credit supply has a significant positive effect on the economies.

This shows that though credit ratio and regional asset shares have unfavorable effects on economic growth when considered apart, their interaction tends to provide strong growth-enhancing effects in the economies. In contrast, while credit ratios and financial integration have positive impacts on growth when considered apart, their interaction has significant negative impacts on growth. The same unfavorable effect is found for impact of interaction of capital account openness and credit ratios as well as interaction between interest harmonization and credit ratio. The results clearly reveal that interactions of most financial integration components and financial development measured as credit supply have debilitating effects on growth in the sub-region.

Financial Integration, Financial Development and Economic Growth

The results shows that in short run, financial integration measured by number of conditions met has significant negative impact on economic growth, while effects of others are insignificant.

Table 12. Regression results

Variable	<i>dep.v (yn)</i>			
	assets	convergence conditions	k-account	inrg
<i>long run results</i>				
ln(cre)	0.216***	0.028	0.159***	0.155***
fng	0.086***	0.248***	0.036	0.001
ln(sav)	0.092***	1.199***	0.053**	0.005***
gst	-0.016	0.048	-0.003	0.008
inprl	0.117***	0.209**	0.145***	0.114***
law	0.024	0.097	0.014	0.008
<i>short run results</i>				
ecmt-1	-0.090***	-0.021***	-0.087***	-0.107***
$\Delta(\ln cre)$	-0.008	0.006	-0.004	-0.007
$\Delta(\ln fng)$	0.007	-0.006**	-0.006	-0.001
$\Delta(\ln sav)$	0.010	-0.002	0.008*	0.001**
$\Delta(gst)$	0.002	0.000	-0.001	-0.002
$\Delta(inprl)$	0.000	0.003	-0.001	0.001
$\Delta(law)$	0.002	-0.003	0.006	0.011
c	0.541***	0.035***	0.532***	0.669***
mean (yn)	0.006	0.006	0.006	0.006
s.e.e.(yn)	0.045	0.046	0.045	0.046

Source: Author's result using Eviews 9.0, ***, **, * indicates the 0.01, 0.05 and 0.10 level of significance, respectively

Capital account openness, once again, does not appear to possess any long run relevance in promoting economic growth. Indeed, when credit to private sector is considered, only asset shares and conditions met have significant effects on economy in the long run. Only coefficient of investment profile passed significance test among institutional variables and these coefficients are all positive.

Robustness Checks for Regression Results

The results provided by ARDL estimates are evaluated using robustness checks with estimations from panel estimation technique. In Table 13, result for financial integration effect on financial development is shown. The focus is especially on signs of coefficients in order to evaluate coefficient performances. It can be seen that coefficients are similar to those of estimates in Table 12.

Table 13. Robustness estimates

variable	cregdp		
	1	2	3
c	-2.45***	-1.23***	-0.04
convergence	0.10***		
inrg		-0.03***	
assets			0.15***
ln(gpc)	0.57***	0.51***	0.31***
kpn	0.19***	0.24***	0.20***
gst	0.09***	0.06***	0.06**
inprl	0.03*	0.03	0.07***
Adj. R ²	0.39	0.46	0.43
F-statistic	9.12	11.71	10.35

Source: Authors' results using Eviews 9.0, ***, **, * indicates the 0.01, 0.05 and 0.10 level of significance, respectively

With results of Table 14, there is a role for financial integration in stimulating economic growth in SSA of ECOWAS.

Table 14. Robustness estimates

variable	dep v (lncregdp)			
	1	2	3	4
c	6.428***	6.378***	6.587***	6.794***
ln(cre)	0.206***	0.204***	0.162***	0.287***
inrg	0.006***			
kpn		-0.075***		
assets			0.060***	
convergence				-0.078***
sav	0.002	-0.017	-0.028*	-0.006
gst	0.010	0.006	-0.011	0.006
inprl	0.049***	0.053***	0.064***	0.041***
law	0.035**	0.051***	0.051***	0.005
adjusted R ²	0.271	0.280	0.304	0.350
F-statistic	5.583	5.814	6.384	7.649

Source: Authors' results using Eviews 9.0, ***, ** and * indicate significant at 0.01, 0.05 and 0.10 levels

The panel estimation results of interaction between financial integration and financial development on growth are shown in Table 15. As can be seen, results show that coefficients switch between lone variables and interface variables just as was demonstrated in ARDL estimates. Apparently, results show that financial integration and financial sector development needs deeper analysis to evaluate interactive impact on economic growth.

Table 15. Robustness estimates

	ln(cregdp)				
	1	2	3	4	
c	6.281***	7.27***	6.476***	6.21***	
	0.194***	-0.012	0.130***	0.234***	
assets	-0.08***				
assets*fsd	0.059***				
convergence		-			
		0.18***			
convergence*fsd		0.05***			
kpn					
kpn*fsd			-0.02***		
inrg				0.061***	
inrg*fsd				-0.02***	
ln(sav)	-0.014	0.04***	0.021	0.004***	
gst	-0.006	-0.014	-0.005	0.002	
inprl	0.064***	0.08***	0.07***	0.064***	
law	0.059***	-0.024	0.017	0.012	
adjusted R ²	0.333	0.265	0.234	0.294	
F-statistic	7.022	5.350	4.764	6.026	

Source: Authors' results using Eviews 9.0, ***, ** and * indicate significant at 0.01, 0.05 and 0.10 levels

Diagnostic Test Results

In order to observe relevance of estimations provided in this study, post-estimation tests are conducted. In particular, test for multicollinearity among variables of study is performed on basis of Variance Inflation Factor (VIF). The results of VIF are reported in Tables 16 and 17. Theoretically, VIF ranges from 1 upwards. The numerical value of VIF gives an indication of percentage of inflation of variance. The results from Table 16 and Table 17 showed that all variables have variance inflation ratio of less than 10, which is the condition for relative absence of multicollinearity.

Table 16. Variance inflation factor (VIF) test for multicollinearity

Statistics	cre		convergence conditions		fng		gpc	
	max z	prob.	max z	prob.	max z	prob.	max z	prob.
Benin	2.74	0.02	2.53	0.04	0.85	0.87	2.12	0.13
Burkina Faso	2.24	0.10	1.33	0.56	1.17	0.67	0.82	0.88
Cape Verde	0.47	0.98	1.61	0.36	1.02	0.77	4.21	0.00
CIV	4.07	0.00	1.98	0.18	0.97	0.80	3.73	0.00
Gambia	2.56	0.04	1.96	0.19	1.35	0.54	1.18	0.66

Ghana	11.3	0.00	2.02	0.16	2.34	0.07	3.30	0.00
Guinea	0.29	1.00	2.40	0.06	2.33	0.08	0.40	0.99
Guinea-Bissau	1.21	0.64	2.21	0.11	2.12	0.13	1.35	0.54
Mali	0.35	0.99	2.11	0.13	0.97	0.80	0.56	0.97
Niger	5.77	0.00	2.15	0.12	2.63	0.03	2.28	0.09
Nigeria	1.00	0.79	1.54	0.41	0.62	0.95	6.25	0.00
Senegal	4.48	0.00	2.42	0.06	1.15	0.69	1.64	0.35
Sierra Leone	0.25	1.00	2.44	0.06	1.76	0.28	3.50	0.00
Togo	1.15	0.68	1.82	0.25	1.87	0.22	1.12	0.70

Source: Authors' results using Eviews 9.0

*Probability approximation using studentized maximum modulus with parameter value 14 and infinite degrees of freedom

Table 17. Variance inflation factor (VIF) test for multicollinearity (cont'd)

statistics	gst		inrg		inprl		df.
	max z	prob.	max z	prob.	max z	prob.	
Fisher Combind	52.98	0	28.93	0.42	26.6	0.54	28
cross- section	max z	prob.*	max z	prob.*	max z	prob.*	obs.
Benin	0.75	0.91	0.63	0.95	0.71	0.92	37
Burkina Faso	1.44	0.48	0.83	0.88	1.62	0.36	37
Cape Verde	1.6	0.37	1.66	0.33	1.43	0.49	37
CIV	2.2	0.11	1.23	0.63	1.11	0.71	37
Gambia	1.32	0.56	1.2	0.65	1.35	0.54	37
Ghana	1.83	0.24	1.84	0.24	2.01	0.17	37
Guinea	2.56	0.04	1.16	0.68	2.65	0.03	37
Guinea- Bissau	1.18	0.66	2.22	0.1	2.08	0.14	37
Mali	2.46	0.05	1.05	0.75	1.96	0.19	37
Niger	2.58	0.04	1.28	0.59	0.75	0.91	37
Nigeria	1.75	0.29	0.96	0.81	0.9	0.84	37
Senegal	2.18	0.11	3.52	0	1.13	0.7	37
Sierra Leone	2.19	0.11	1.16	0.68	1.51	0.43	37
Togo	3.15	0.0065	1.2	0.65	0.9	0.84	37

Source: Authors' results using Eviews 9.0

*Probability approximation using studentized maximum modulus with parameter value 14 and infinite degrees of freedom

4. Conclusion

In this study, an attempt was made to investigate relationship between financial integration, financial development and economic growth for countries in ECOWAS sub-region. The place of interactions between financial integration and development on economic growth was also examined. Financial development was considered in terms of credit supply, while financial integration were taken as share of a country's external assets in the regional pool of assets; number

of convergence conditions that a country has met at a given year, gap in interest rates between a country and that of a sub-regional benchmark; and extent of capital account openness in a country.

A dynamic framework was devised for empirical analysis and ARDL panel data estimator was used in analysis because of dynamic nature of financial sector. Based on empirical analysis, to the extent that bank lending and financial depth could be constrained by monetary policy, restrictive monetary policy may affect the economy through channels demonstrated in this study. However, policy measures themselves could be highly influenced by regional integration factors. Financial integration is shown to be more related to financial development than with overall economic growth. Moreover, significant role of institutional quality in effective interactions was also demonstrated. Hence, a major lesson from the study is that financial integration needs to be properly guided with efficient institutions. The pursuance of financial integration as a strictly independent policy from that of financial sector development among economies in sub-region could be catastrophic to financial sectors of economies.

Even when financial integration has become desired policy choice for the sub-region, need for strong and quality institutional involvements is critical. Uncoordinated regimes of financial openness and integration policies may hurt financial markets and could be precursor for deeper financial sector problems in a country. Although assumed in this study, financial markets may not represent only channel through which financial integration can influence economies of ECOWAS sub-region. Also, domestic moves in financial sectors could also have significant impacts on financial integration in ECOWAS.

The study found that financial integration constructed based on dispersion of a country's interest rate spreads from average spread of countries in the sub-region, is negatively related to GDP growth. Additionally, a coordinated central regulatory oversight regulatory system cannot be over-emphasized in face of imminent challenges that an integrated financial ECOWAS market poses to the sub-regional financial systems stability. Such central agency is best suited to provide timely support in macro-prudential management and generate both short run and long run macroeconomic stability that further enhances integration conditions in the long run and avert potential downside risks of spillovers and spillbacks which are often associated with increasingly regional interconnected financial markets.

References

- Baele et al., 2004 – Baele, L., Ferrando, A. Hordahl, P. Krylova, E., Monnet, C. (2004). Measuring financial intergration in the euro area. European Central Bank, Occasional Paper Series No 14.
- Baltagi, 2013 – Baltagi, B. (2013). *Econometric Analysis of Panel Data* (5th ed.). Chichester: John Wiley and Sons
- Bekaert, G., R. Harvey, & C. Lundblad (2001). Does financial liberalization spur growth? *Journal of Financial Economics*. 77 (1): 3-55.
- Bekaert et al., 2006 – Bekaert, G., Harvey, R., Lundblad, C. (2006). Growth volatility and financial liberalization *Journal of International Money and Finance*. 25(1): 370-403.
- Christopoulos, Tsionas, 2004 – Christopoulos, D.K., Tsionas, E.G. (2004). Financial Development and Economic Growth: Evidence from Panel Unit Root and Cointegration Tests. *Journal of Development Economics*. 73: 55-74.
- Economic Commission for Africa, 2008 – Economic Commission for Africa (2008); *Assessing regional integration in Africa III (ARIA III). Towards monetary and financial integration in Africa*, Addis Ababa: United Nations Economic Commission for Africa.
- Edison et al., 2002 – Edison, H.J., Levine, R., Ricci, L., Slok, T. (2002). International financial integration and economic growth. *Journal of International Money and Finance*. 21: 749-825.
- Guiso et al., 2006 – Guiso, L., Sapienza, P., Zingales, L. (2006). Does culture affect economic outcomes. *Journal of Economic Perspectives*. 20: 23-48.
- Guiso et al., 2004 – Guiso, L., Jappelli, T., Padula, M., Pagano, M. (2004). Financial market Integration & economic growth in the EU, *Centre for Studies in Economics and Finance (CSEF)* Working paper No. 118.
- Gujarati, Porter, 2009 – Gujarati, D.N., Porter, D.C. (2009). (Fifth ed.). New York: McGraw-Hill.
- Jalilian, Kirkpatrick, 2007 – Jalilian, H., Kirkpatrick, C. (2007). Does financial development contribute to poverty reduction? *Journal of Development*. 41 (4): 636-656.

[Kalemli-Ozcan, Manganelli, 2008](#) – Kalemli-Ozcan, S., Manganelli, S. (2008). Financial integration and risk sharing: The role of the monetary union. In *5th European Central Banking Conference on The Euro at Ten: lessons and challenges*. Frankfurt: European Central Bank.

[Levine, 2003](#) – Levine, R. (2003). Stock market liquidity and economic growth: theory and evidence. In L.P. Phelps. *Finance, Research, Education and Growth* (pp. 1-24). New York: Palgrave MacMillan.

[Levine et al., 2000](#) – Levine, R., Loayza, N., Beck, T. (2000). Financial intermediation and growth: causality and causes. *Journal of Monetary Economics*. 46 (1): 31-77.

[Odhiambo, 2010a](#) – Odhiambo, N.M. (2010). Are banks and stock markets positively related? empirical evidence from South Africa. *Journal of Applied Business Research*. 26(6): 17-26.

[Odhiambo, 2010b](#) – Odhiambo, N.M. (2010). Financial deepening and poverty reduction in Zambia: An empirical investigation. *International Journal of Social Economics*. 37(1): 41-53.

[Pesaran et al., 2001](#) – Pesaran, M., Shin, Y., Smith, R. (2001). Bounds testing approaches to the analysis of level of relationship. *Journal of Applied Economics*, 289-326.

[Prasad et al., 2003](#) – Prasad, E., Kose, M.A., Terrones, M. (2003). Financial integration and macroeconomic volatility. *IMF Staff Paper No.50*.

[Westerlund, 2007](#) – Westerlund, J. (2007). Testing for error correction in panel data. *Oxford Bulletin of Economics and Statistics*. 69: 709-748.

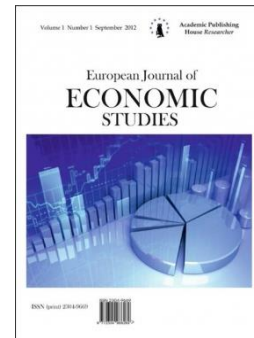
[Tressel, Detragiache, 2008](#) – Tressel, M.P., Detragiache, E. (2008). Do financial sector reforms lead to financial development? Evidence from New Dataset. *International Monetary Fund, Business and Economic Working paper*. Pp. 1-44.

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Empirics of Exchange Rate Explosiveness/Overshooting in Sub-Saharan African Countries: Implications for Foreign Exchange Markets

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Abstract

The study estimated conditional explosiveness or volatility of exchange rate for twelve SSA countries from January 1, 2006 to June 29, 2019 using Maximum Likelihood estimator (MLE). The study motivation is deeply rooted on the fact that volatility in exchange rate exposes importers and exporters to exchange rate risk. Consequently, we became desirous to econometrically estimate degree of volatility persistence in exchange rate of selected SSA countries in relation to the United States of America and its implications for forex markets in SSA. Our empirics reveal that in South Africa, Burkina Faso and Equatorial Guinea, exchange rate volatility is covariance stationary indicating certainty of convergence after perturbation to exchange rate equilibrium. Also, shocks of volatility in exchange rate are explosive and highly persistent in Nigeria, Ghana, Botswana, Mali, Togo, Cote d' Ivoire, Rwanda, Cape Verde, and Mauritius. We so remark the necessity for exercise of healthy control in managing and monitoring guiding principles of foreign exchange markets constantly in Nigeria, Ghana, Botswana, Mali, Togo, Cote d' Ivoire, Rwanda, Cape Verde, and Mauritius in line with global code of forex market conduct to guarantee non-volatile behaviour of local currencies.

Keywords: explosiveness/overshooting, exchange rate regimes, I-GARCH model, sub-Saharan African countries (SSA).

1. Introduction

Overshooting so provides that prior to a long-run rate, exchange rate in response to an economic tremor in macroeconomic aggregates, at the outset explodes beyond the new level to which it ultimately relax. The explosiveness in exchange rate which is on basis of flexibility and presence of official commitments or otherwise to exchange rate paths had mostly be the driver of currency crises in the world, distorting production patterns beside severe depletion in foreign reserves as well as divulging importers and exporters to exchange rate risk. Volatility in exchange rate is the instability in the rate at which a given currency exchanges for another currency. The higher explosiveness in exchange rate, the higher the currency risk and the riskier it becomes for potential investors to invest in a foreign location as expected returns may not be sufficient to cover for currency risk.

Our inspiration is deeply rooted on the fact that overshooting in exchange rates exposes importers and exporters to exchange rate risk. Also, most studies of exchange rate overshooting/explosiveness focused on developed economies, hence, countries of SSA have received petite consideration. This present study fills this identified empirical gaps. Besides,

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an exploration of the occurrence or otherwise of exchange rate explosiveness may perhaps explicate exchange rate impulsiveness in SSA. Additionally, our study interprets the configuration and behavior of exchange rates in SSA within the framework of explosiveness/overshooting. The stochastic spread of the global financial crisis of 2008 gave birth to international imbalance which today became a fundamental disturbance to gains from international trade. Such imbalance could be link to volatility in exchange rate. The nexus is that value of a nation's currency is a determinant of output price in line with market forces taking into cognizance economic theory.

Hence, the study estimated conditional explosiveness of exchange rate often referred to as overshooting for sample of sub-Saharan African (SSA) countries from January 1, 2006 to June 29, 2019 using Maximum Likelihood estimator (MLE). We became desirous to econometrically estimate degree of explosive or volatility persistence in exchange rate of selected SSA countries in relation to the United States of America and its implications for forex markets in SSA within the space of 2006 through to 2019. The selected SSA countries include South Africa, Equatorial Guinea, Nigeria, Ghana, Botswana, Mali, Togo, Cote d' Ivoire, Rwanda, Cape Verde, Mauritius and Burkina Faso where data were available. We present next some stylized facts on sub-Sahara countries. The study is structured in such a way that after introduction, we have section for materials and methods where theory and methodology are discussed and results and discussion follows and finally we have conclusion.

With Africa being the world's poorest continent, majority of sub-Sahara countries are highly indebted low income countries as made manifest in low per-capita income together with low economic diversification. These culminates in inadequate gains from trade. Such infinitesimal specialization and diversification constitutes a hindrance to Africa's manufactured export (World Data Atlas, 2000).

There is significant variation in SSA in terms of economic performance. Botswana once had 3 % per capita GDP and grew at 6 percent per annum until the late 1980s, Cape Verde and Mauritius surpassed 2 % and somenamely, Cote d'Ivoire, Gabon, Togo, and Nigeria have had high-growth periods. The uproar experienced in world markets in recent times alongside deep-rooted economic problems and incapacitating effects of political turmoil had severe effects on Africa.

Additionally, there is increasing implementation of untimely economic policies, and low level of private investment which has contributed to SSA's poor overall economic performance since the 1990s. The foregoing analysis highlight the fact that enormous instability in economic performance of African countries is such that better performing countries have gone through periods of relatively declining growth.

So, even the fastest growing countries in SSA are yet to activate their recoveries from protracted periods of economic decline. Countries that achieved positive growth rates during 2011 to 2017 reveals that these countries also made progress in the area of inadequate human capital development. The data available at World Bank (2005) showed that annual growth rate of GDP per capita real GDP of SSA was negative (-2.2) through most period of the 1980s. Though per capita real GDP increased in some Africa countries namely, Rwanda, Mali, Congo, Gabon, Nigeria, South Africa and Mauritius, per-capita incomes in Uganda, Bukina Faso, Cote d' Ivoire, Niger and Angola are today less than half their level in 1970 and these countries are yet to catch up with their 1970 level of per-capita GDP notwithstanding ample economic gains since the mid-1990s (World Economic Outlook, 2013).

2. Discussion

Some Literatures

Exchange rate explosiveness or overshooting provides a description of exchange rate behavior following a shockwave in the economy that affects income, employment and prices (see [Dornbusch, 1976](#)). Though, empirical estimates of monetary flex-price exchange rate model was validated for Nigerian economy ([Umoru, 2013](#)), volatility in exchange rates in relation to its explosiveness is well documented in the sticky-price model of Rudiger Dornbusch. What this implies is that exchange rates are highly explosive compared to prices and interest rates. Theoretically, exchange rate explosiveness/overshooting ascends under the assumptions of an uncovered interest parity, demand for money being in relation to interest rate and national output growth, fixity of prices in short-run with possibility of adjustment in long-run to offset monetary

shocks, and flexibility in exchange rates. In effect, rise in money stock would eventually translate to rise in price level and cost of foreign currency.

Some economists had argued that volatility was induced by speculators besides inefficiencies such as asymmetric information and adjustment complications in foreign exchange market. For example, while measuring volatility in terms of variance, Manuelli and Peck (1990) developed an overlapping generation model with stochastic endowments and found many exchange rate processes that are equilibrium processes and thus demonstrated existence of equilibria under flexible exchange rates regime.

Bergin and Tchakarov (2003) found welfare costs to be extremely small on the demand of one tenth of one percent of consumption in relation volatility. Koren and Szeidl (2003) developed an interactive model and found that unconditional volatility as risk measure was not the most germane theoretical issue but what matters most was the determination of trade volume by volatility via covariances of the exchange rate. Bacchetta and Van Wincoop (2000) advanced a two-country general equilibrium uncertainty model to unravel the fact that no strong correlation between trade level and exchange rate regime type.

Others have measured volatility in exchange rate as standard deviation of percentage changes in periodic exchange rates, mean of percentage exchange rate changes, standard deviation of percentage of exchange rate changes, square root of sum of square of the mean of percentage exchange rate and its variance (Ghosh et al., 2003).

Narrowing to IMF's De Facto classification of exchange rate regimes following Bubula and Ötker-Robe (2002), we have the exchange arrangements with no separate legal tender regime. Also, is currency board arrangements. Another classification is the conventional fixed peg arrangements. There is the crawling pegs and managed float. Lastly, is the independent float which defines the market-determined exchange rate management.

The empirical literature on exchange rate explosiveness is enormous but with mixed findings. Amongst the enormous literature are Bahmani-Oskooee & Kara (2000); Goldfajn & Gupta (2001); Rogoff (2002); Dornbusch (2004); Pierdzioch, (2004); Nieh & Wang (2005); and Pratomo (2005); and Bahmani-Oskooee & Panthamit (2006). Authors such as Rogoff (2002) and Dornbusch (2004); Bahmani-Oskooee & Kara (2000), Goldfajn & Gupta (2001), Rogoff (2002), Dornbusch (2004) and Nieh & Wang (2005) upholds the explosiveness/volatility model, Kim & Roubini (2000) contradict such empirical result. For Turkish economy, Bahmani-Oskooee and Kara (2000) found empirical evidence of exchange rate long-run explosiveness in exchange rate of Lira in relation to USD. In 2005, Nieh & Wang's validation of exchange rate overshooting for the Taiwan economy.

According to Rogoff (2002), with explosiveness in exchange rates the predicted forward exchange rate falls short of the spot rate. In effect, explosiveness affects behaviour of both spot and forward rates. Pratomo (2005) obtains evidence of exchange rate long-run explosiveness in Indonesia with Rupiah as official currency, together with some structural changes in the exchange rate of the Rupiah in relation to USD. Nevertheless, Kim & Roubini (2000) only found a delayed explosiveness. Other studies conducted by Mungule (2004); Kustra (2005); Heinlein & Krolzig (2011) found no such proof of exchange rate explosiveness as propounded by Dornbusch.

Theoretical framework and model estimation

The fundamental theory is the exchange rate overshooting theorem which explains high levels of volatility in exchange rates (Dornbusch, 1976). We recall the general framework of GARCH (p, q) model which allows current conditional variance to depend on first p -past conditional variances together with q -past squared residuals:

$$\sigma_t^2 = a + \sum_{j=1}^q \delta_j e_{t-j}^2 + \sum_{i=1}^p \theta_i \sigma_{t-i}^2 \quad [1]$$

$$\Rightarrow \sum_{j=1}^q \delta_j + \sum_{i=1}^p \theta_i \leq 1 \text{ (volatility persistence)} \quad [2]$$

Impact of conditional volatility shocks leaves endlessly in I-GARCH model and hence persistence will be high when the sum ≥ 1 . In effect, the persistence of σ_t^2 is established by $(\theta + \delta)$ and covariance stationarity is conditioned by $(\theta + \delta) < 1$. The degree of volatility determination was determined through the I-GARCH model which is integrated in variance having restricted the

parameters of general GARCH (p,q) model to sum up to unity and simultaneously omitting nuisance parameter. This is given as:

$$1 = \sum_{i=1}^p \theta_i \sigma_{t-1}^2 + \sum_{j=1}^q \delta_j e_{t-1}^2 \quad [3]$$

$$\sum_{i=1}^p \theta_i \sigma_{t-1}^2 + \sum_{j=1}^q \delta_j e_{t-1}^2 \geq 1 \quad [4]$$

$$\sum_{i=1}^p \theta_i \sigma_{t-1}^2 + \sum_{j=1}^q \delta_j e_{t-1}^2 < 1 \quad [5]$$

(a) If sum of ARCH effect and the GARCH effect ≥ 1 , then volatility shock is explosive,

(b) Similarly, if sum of ARCH effect and the GARCH effect < 1 , then GARCH course is covariance stationarity.

The study examined residuals of exchange rate series for evidence of heteroskedasticity using LM test as demonstrated with the following equations. Firstly, we estimated an AR exchange rate equation:

$$E_t = \alpha_0 + \sum_{i=1}^q \alpha_i E_{t-i} + u_t \quad [6]$$

Secondly, we generated regression residuals and regress the squares of the residuals on a constant and on q lagged values of the residuals as follows:

$$e_t^2 = d_0 + \sum_{i=1}^q d_i e_{t-i}^2 + \varepsilon_t \quad [7]$$

The next step was that we calculated LM statistic from the regression of squares of residuals as nR^2 . The decision rule was to accept $H_0: d_1 = d_2 = \dots = d_q = 0$ that there are no ARCH effects up to order q iff LM statistic was lesser than the Chi-square critical value, that is, $nR^2 < X_{(n-1)}^2$ while H_0 was to be rejected and $H_1: d_1 \neq d_2 \neq \dots \neq d_q \neq 0$ accepted if LM statistic exceeded the Chi-square critical value $nR^2 < X_{(n-1)}^2$, where n is number of observations.

The variables used in the study include,

Exchange rate is the rate at which unit(s) of local currencies are traded in exchange for US dollars, exchange rate volatility (σ_t^2) was calculated as the variance of the weighted average of the squares of past values of residuals from the mean regression of daily exchange rate.

- Our research data which were principally exchange rates of selected SSA countries in relation to US dollar were collected from the sources below for various years and ranged from January 1, 2006 to June 29, 2019.

- IMF database, www.oanda.com/currency/realtime series and World Economic Outlook (WEO).

The study adopted MLE estimation method in estimating volatility persistence in an innovative multivariate I-GARCH model with corrections for non-standard errors. The log-likelihood function (LLF) given in equation (12) was computed from the product of all conditional densities of the prediction errors.

$$l = \sum_{t=1}^N \frac{1}{2} \left[-\ln(2\pi) - \ln(\sigma_t^2) - \frac{e_t^2}{(\sigma_t^2)} \right] \quad [8]$$

where $e_t^2 = y_t - X_t' \beta - \delta \sqrt{\sigma_t^2}$ and σ_t^2 is the conditional variance, the LLF for the conditional Student's t distribution is:

$$t = \sum_{t=1}^N \left[\log \left(\Gamma \left(\frac{\nu+1}{2} \right) \right) - \log \left(\Gamma \left(\frac{\nu}{2} \right) \right) - \frac{1}{2} \log \left(\Gamma(\nu-2) \sigma_t^2 \right) \right] \quad [9]$$

where $\Gamma(\cdot)$ is the gamma function and ν is degree of freedom. The LLF for conditional t distribution converges to LLF of the conditional normal GARCH model as $(1/\nu) \rightarrow 0$.

We maximized the likelihood function using the dual Quasi-Newton which approximates the Hessian matrix that was used to estimate the variance-covariance matrix such that autoregressive parameters in the model, were obtained as Yule-Walker estimates. The choice of MLE derived from it theoretical property of point estimation plus that MLE of σ^2 is unbiased (Green, 2008). In what follows, we maximized the log likelihood function by Marquardt numerical iterative algorithm to evaluate asymptotically normal and efficient parameter estimates. The Eviews package was utilized in estimation.

3. Results

According to Table 1, real exchange rate volatility have tendency of becoming maximum under managed floats and lowest under horizontal bands and crawling pegs and crawling bands.

Table 1. Standard deviation of exchange rate regime

Regime(s)	Episodes	Standard deviation of real exchange rate level
Regimes altogether	209	7.93
Independent float	28	5.42
Managed float	49	5.86*
Crawling pegs/Crawling bands	23	2.93
Horizontal bands	20	2.56
Exchange arrangements with no separate legal tender regime/currency board	29	5.24

Note: * maximum volatility

In Table 2, we regress volatility measures on the length of the episode and a dummy for sub-Saharan Africa countries. As shown, this dummy is significantly different from zero implying a remarkably high volatility in exchange rate in sub-Saharan Africa. The episode length which is shorter than four quarters in length also passes the test of significance. Figures in parentheses are heteroscedasticity-robust t -statistics.

Table 2. Regression results for real effective exchange rate volatility

Regressors	Volatility Measure		
	Mean absolute change in REER	Standard deviation of change in REER	Standard deviation of level in REER
Constant	0.039a (16.542)	0.976a (11.529)	0.052a (19.647)
Regression error	0.005	0.004	0.007
R-bar squared	0.390	0.782	0.390
SSA dummy	0.056a (9.372)	0.084aa (2.269)	1.092aa (2.376)
Episode length (quarters)	-1.182aa (-2.137)	-0.025a (-7.639)	0.009 (0.586)

Note: a(aa) denotes significantly different from zero at 1 % (5 %) level

Table 3 shows the results of dummy for each regime. Accordingly, the F-test shows that they are jointly significant at the 1 % level. However, it worth noting that, only the dummies for a crawling pegs/crawling bands, managed float and independent float. Going by the coefficient sign, it implies that managed float suggestively reduces volatility at a given inflation rate while independent float significantly increases it. By implication, volatility is significantly higher for a market determined exchange rate while volatility is significantly lower for crawling pegs and crawling bands. Lastly, SSA countries tend to have more volatile real effective exchange rates.

Table 3. Regression results of regime effects

Regressors	Volatility Measure		
	Mean absolute change in REER	Standard deviation of change in REER	Standard deviation of level in REER
Constant	0.237a (3.04)	1.579 (1.326)	0.752a (3.264)
R-bar squared	0.596	0.453	0.568
Regression error	0.035	0.0298	0.029
F-test of regime dummies F(6, 262)	5.493a [0.000]	5.372a [0.000]	11.294a [0.001]
Independent float	0.238aa (2.579)	0.026a (3.791)	0.325aa (1.968)
Managed float	-0.001aa (-2.193)	-0.137aa (-2.521)	-0.931aa (-2.054)
Crawling pegs/ Crawling bands	1.923aa (3.567)	0.125a (3.098)	0.359aa (1.876)
Horizontal band	-0.279 (-0.642)	0.024 (1.287)	0.135 (0.965)
Conventional fixed pegs	0.137 (1.465)	0.001 (0.113)	0.034a (9.125)
Exchange arrangements with no separate legal tender regime	0.005 (1.462)	0.002 (0.736)	0.942 (1.354)
SSA dummy	0.239a (6.924)	0.0233aa (2.260)	1.756a (6.289)
Episode length (quarters)	-0.079 (-0.92)	0.004 (1.530)	0.036a (9.052)

Note: a(aa) denotes significantly different from zero at the 1 % (5 %) level

The volatility persistence as estimated with I-GARCH model is reported in Table 4. The persistence coefficient is 1.048 for Nigeria, 0.089 for South Africa, 1.132 for Togo, 1.189 for Ghana, 1.189 for Rwanda, 1.056 for Botswana, 1.093 for Mali, 0.334 for Equatorial Guinea, 0.015 for the Cape Verde, 0.144 for Burkina Faso and 1.258 for Mauritius. In effect, the coefficients of volatility determination are statistically significant for Nigeria, Ghana, Rwanda, Botswana, Mali, Cote d' Ivoire, cape Verde and Mauritius. This degree of persistence which exceeded one was obtained as the sum of θ and δ in the I-GARCH model.

Thus, volatility risk effect of exchange rate is extremely boundless in Nigeria, Ghana, Ethiopia, Botswana, Mali, Cote d' Ivoire, Cape Verde and Mauritius. Hence, foreign exchange markets in these countries are branded by explosive volatility which implies that volatility in exchange rate is boundless in these countries and hence exits for a longer period. Nevertheless, in other SSA countries namely, South Africa, Equatorial Guinea and Burkina Faso, exchange rate volatility is covariance stationary. This implies that high shocks of volatility in exchange rate in South Africa, Equatorial Guinea and Burkina Faso is temporary as it dies off gradually.

Table 4. Estimates of volatility persistence based on I-GARCH model

Variables	Nigeria	S/Africa	Togo	Ghana	Rwanda	Botswana
θ	0.592 (0.001)	0.021 (0.467)	0.883 (0.000)	1.037 (0.000)	0.462 (0.045)	1.097 (0.000)
δ	0.456 (0.001)	0.148 (0.001)	0.249 (0.001)	0.152 (0.001)	0.594 (0.001)	0.162 (0.001)
Persistence	1.048a	0.089	1.132a	1.189a	1.056a	1.259a
$ \theta + \delta < 1$	Explosive	Stationary	Explosive	Explosive	Explosive	Explosive
AIC	-7.034	-6.134	-9.834	-1.034	-1.834	-7.214
SC	-0.160	-1.260	-1.360	-0.260	-1.160	-1.360
HQC	-1.793	-3.493	-3.293	-3.290	-1.293	-3.295
Log-Likelihood	18.524	126.74	9.574	22.574	1.574	6.572
Variables	Mali	E/Guinea	Cote d' Ivoire	Cape Verde	Burkina Faso	Mauritius
θ	0.015 (0.002)	0.170 (0.000)	0.194 (0.022)	0.233 (0.000)	0.592 (0.001)	1.116 (0.000)
δ	1.078 (0.000)	0.164 (0.024)	1.803 (0.056)	0.782 (0.000)	0.031 (0.005)	0.142 (0.007)
Persistence	1.093a	0.334	1.997a	1.015a	0.623	1.258a
$ \theta + \delta < 1$	Explosive	Stationary	Explosive	Explosive	Stationary	Explosive
AIC	-5.092	-6.554	-2.837	-5.831	-2.839	-2.855
SC	-4.365	-0.260	-1.365	-2.362	-9.362	-7.361
HQC	-3.256	-4.916	-3.291	-5.292	-7.294	-1.293
Log-Likelihood	6.574	4.573	12.578	4.576	46.579	11.574

Note: "a" indicate volatility persistence is significant

Tables 5 and 6 reported the I-GARCH model summary statistics with the ARCH-LM test statistics for Nigeria, Ghana, Mali, Cote d' Ivoire, Rwanda, Cape Verde and Mauritius statistically significant at 5 % level but at 10 % level for South Africa, Togo, Benin Republic and Equatorial Guinea. The colossal values of skewness and kurtosis for standardized residuals of volatility in exchange rate of some SSA countries points to a superfluous nature which indicate departure from normality.

Also, with Jarque-Bera (J-B) statistics of 1795.241 for Nigeria, 1895.335 for Ghana, 1555.233 for Rwanda, 1456.003 for Mali, 1720.049 for Cote d' Ivoire, 1576.200 for Cape Verde and 12475.100 for Mauritius respectively, the J-B test reject normality even at 1 % significant level for Nigeria, Togo, Ghana, Mali, Cote d' Ivoire, Rwanda, Gambia, Botswana, Mauritius and Burkina Faso respectively. Indeed, evidence of heteroskedasticity exists in the I-GARCH model while same cannot be denoted for E-GARCH model. In effect, the standardized residuals are enormous and as such do not conform to normal distribution.

Table 5. I-GARCH model summary statistics

Variables	Nigeria	S/Africa	Togo
ARCH-LM (N*R ²)	139.0274 (0.000)a	112.014 (0.040)aa	119.071 (0.023)aa
Skewness	1110.179	127.361	119.562
Kurtosis	1200.286	114.116	116.186
J. B. Stat	1795.241a	10.220aaa	15.112aa

Variables	Mali	E/Guinea	Cote d' Ivoire
ARCH-LM (N*R ²)	0.067 (0.000)a	101.573 (0.000)a	0.134 (0.000)a
Skewness	1124.267	181.369	1426.069
Kurtosis	1156.971	123.267	1315.286
J. B. Stat	1456.003a	132.548aa	1720.049a

Note: p-value are reported in parenthesis a(aa)(aaa) indicates significance @ 1 %, 5 % (10 %)

Table 6. I-GARCH model summary statistics

Variables	Ghana	Rwanda	Botswana
ARCH-LM (N*R ²)	145.055 (0.000)a	139.600 (0.000)a	113.0222 (0.000)a
Skewness	1123.065	1145.779	1113.095
Kurtosis	117.006	1100.331	147.552
J. B. Stat	1895.335a	1555.233a	11.345aaa
Variables	Cape Verde	Burkina Faso	Mauritius
ARCH-LM (N*R ²)	0.026 (0.000)a	163.027 (0.000)a	0.001 (0.000)a
Skewness	117.569	1410.161	1012.345
Kurtosis	138.186	1110.186	1119.286
J. B. Stat	1576.200a	162.000aaa	12475.100a

Note: p-value are reported in parenthesis a(aa)(aaa) indicates significance @ 1 %, 5 % (10 %)

Consequently, volatility in exchange rate rises absolutely pointing to high degree of abnormality in exchange rate market distribution in Nigeria, Togo, Ghana, Mali, Cote d' Ivoire, Rwanda, Cape Verde, Mauritius and Burkina Faso. This is further buttressed by the skewness and kurtosis statistics which are excessive in value and by implication reflecting that the foreign exchange markets in Nigeria, Togo, Ghana, Mali, Cote d' Ivoire, Rwanda, Cape Verde, Mauritius and Burkina Faso are branded by instability. In sum, our empirical distribution validates existence of high conditional volatility in Nigeria, Togo, Ghana, Mali, Cote d' Ivoire, Rwanda, Cape Verde, Mauritius and Burkina Faso.

The colossal values of skewness and kurtosis for standardized residuals of volatility in exchange rate series of some SSA countries points to a superfluous nature which indicate departure from normality. In effect, a highly leptokurtic distribution is observed for the aforementioned SSA countries.

5. Conclusion

This paper offers evidently that in SSA countries like South Africa, Burkina Faso and Equatorial Guinea, shocks of volatility in exchange rate are temporary and hence dies off gradually. Basically, in South Africa, Burkina Faso and Equatorial Guinea, the exchange rate volatility is covariance stationary indicating certainty of convergence after perturbation to exchange rate equilibrium. Specifically, evidence of high volatility shocks in exchange rate gradually dies off in South Africa, Burkina Faso and Equatorial Guinea.

Conversely, high shocks of volatility in exchange rate are explosive and highly persistent in some SSA countries namely, Nigeria, Ghana, Botswana, Mali, Togo, Cote d' Ivoire, Rwanda, Cape Verde, and Mauritius. This points to high degree of abnormality in exchange rate market distribution in the aforementioned SSA countries. Nonetheless, the study accordingly remark the requisite for exercise of dynamic control in management and monitoring of foreign exchange markets constantly in the aforesaid SSA in line with global code of forex market conduct to ensure

a non-volatile behavior of the local currencies. This would aid in damping exchange rate speculations. Also, African governments have to apply concerted policy efforts in eliminating external constraints facing SSA countries in conduct of forex policies.

References

- Bacchetta, Wincoop, 2000 – Bacchetta, P., Wincoop, E.V. (2000). Does exchange-rate stability increase trade and welfare? *American Economic Review*. 90(5): 23-56.
- Bahmani-Oskooee, Kara, 2000 – Bahmani-Oskooee, M., Kara, O. (2000). Exchange rate overshooting in Turkey. *Economics Letters*. 68: 89-93.
- Bahmani-Oskooee, Panthamit, 2006 – Bahmani-Oskooee, M., Panthamit, N. (2006). Exchange rate overshooting in East Asian countries. *Emerging Markets Finance and Trade*. 42(4): 5-18.
- Betts, Devereux, 1996 – Betts, C., Devereux, M.B. (1996). The Exchange rate in a model of pricing-to-Market. *European Economic Review*. 40(1): 1007-1021.
- Bergin, Tchakarov, 2003 – Bergin, P.R., Tchakarov, I. (2003). Does exchange rate risk matter for welfare? Department of Economics, University of California, USA.
- Dornbusch, 1976 – Dornbusch, R. (1976). Expectations and exchange rate dynamics. *Journal of Political Economy*. 84(6): 1161-1176.
- Dornbusch, 2004 – Dornbusch, R. (2004). Monetary policy under exchange rate flexibility. Massachusetts Institute of Technology (MIT), Working Paper.
- Ghosh et al., 2003 – Ghosh, A., Anne-Marie, G., Holger, W. (2003). Exchange rate regimes: choices and consequences. Cambridge, Massachusetts: MIT Press.
- Goldfajn, Gupta, 2001 – Goldfajn, I., Gupta, P. (2001). Overshootings and Reversals: The role of monetary policy. Central Bank of Chile working paper. 126: 279-302.
- Greene, 2008 – Greene, W.H. (2008). Econometric analysis. 6th ed., New York, Pearson Education, Inc.
- Gujarati, 2009 – Gujarati, N. D. (2009). Basic econometrics, 5th ed., New York. McGraw-Hill.
- Heinlein, Krolzig, 2011 – Heinlein, R., Krolzig, H. (2011). Effects of monetary policy on the \$/£ exchange rate. Is there a 'delayed overshooting puzzle'? School of Economics, University of Kent, Canterbury.
- Koren, Szeidl, 2003 – Koren, M., Szeidl, A. (2003). Exchange rate uncertainty and export prices. Mimeo, Harvard University.
- Kim, Roubini, 2000 – Kim, S., Roubini, N. (2000). Exchange rate anomalies in the industrial countries: A solution with a structural VAR approach. *Journal of Monetary Economics*. 45: 561-586.
- Kustra, 2005 – Kustra, T. (2005). Overshooting and the Canadian exchange rate. [Electronic resource]. URL: <http://qed.econ.queensu.ca/pub/students/rodrigue/826/kustra8262.pdf> (date of access: 19.08.2020).
- Manuelli, Peck, 1990 – Manuelli, E.R., Peck, J. (1990). Exchange rate volatility in an equilibrium asset pricing Model. *International Economic Review*. 31(2): 559-574.
- Mungule, 2004 – Mungule, K.O. (2004). The determinants of the real exchange rate in Zambia. AERC Research Paper. 146.
- Obstfeld, Rogoff, 1998 – Obstfeld, M., Rogoff, K. (1998). Risk and exchange rates. NBER working papers series, WP 6694, Cambridge, Massachusetts: National Bureau of Economic Research.
- Pierdzioch, 2004 – Pierdzioch, C. (2004). Productivity shocks and delayed exchange-rate overshooting. Kiel Institute for World Economics. *Kiel working paper*, 1199.
- Pratomo, 2005 – Pratomo, W.A. (2005). Exchange Rate of Indonesia: Does Rupiah Overshoot? [Electronic resource]. URL: <http://mpira.ub.uni-muenchen.de/7381/> (date of access: 19.08.2020).
- Rogoff, 2002 – Rogoff, K. (2002). Dornbusch's overshooting model after twenty-five years. Unpublished paper, Washington: IMF Working Paper.
- Umoru, 2013 – Umoru, D. (2013). Monetary Models and Exchange Rate Determination: The Nigerian Evidence. *International Journal of Development and Management Review, Development and Management Study Group*. Federal University of Technology, Owerri, Imo State, Nigeria. 8(1): 172-197, June.