

Jarju, Ismaila et al.

Research Report

Vulnerability of WAMZ member countries to external shocks and implications on the convergence process

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**VULNERABILITY OF WAMZ MEMBER COUNTRIES TO
EXTERNAL SHOCKS AND IMPLICATIONS ON THE
CONVERGENCE PROCESS**

WAMI OCCASSIONAL PAPER SERIES NO. 13

*Prepared by Ismaila Jarju, Sani Bawa, Ibrahima Diallo, Olukayode S. Odeniran,
Nkenchor Neville Igue, Isatou Mendy, Thomas Basseh Wreh, and Kormay Adams*

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VULNERABILITY OF WAMZ MEMBER COUNTRIES TO EXTERNAL SHOCKS AND IMPLICATIONS ON THE CONVERGENCE PROCESS

Ismaila Jarju, Sani Bawa, Ibrahima Diallo, Olukayode S. Odeniran, Nkenchor Neville Igue, Isatou Mendy, Thomas Basseh Wreh, and Kormay Adams

EXECUTIVE SUMMARY

The West African Monetary Zone (WAMZ) member countries are predominantly low income countries, and exhibit certain characteristics, which make them very susceptible to macroeconomic vulnerability. These characteristics include, among others, heavy dependence on imports of food and fuel products, concentration of exports on few primary commodities, heavy reliance on foreign sources of finance (foreign aid, debt and capital inflows), economic size, peripherality, political crises, corruption and incidence of natural disasters. The vulnerability of these economies to external shocks increases the risks of adverse effects on economic growth and imposes costly setbacks on the performance of other key macroeconomic indicators, invariably slowing the progress on economic convergence and integration among Member States. The economic integration process, thus, requires appropriate understanding of the degree of vulnerability of Member States to various kinds of shocks as well as identification of appropriate measures to mitigate the impact of these shocks on macroeconomic performance.

Against this background, this study seeks to measure the degree of vulnerability of WAMZ member countries to external shocks by computing economic vulnerability indices for each Member State and for the zone as a whole, utilizing data spanning over the period 2004 – 2016. The paper employs the Briguglio-type economic vulnerability index (EVI) in which the EVI is composed of three components – trade openness, export concentration and dependence on strategic imports. The paper computes the indices by taking a weighted average of the three components. Three different EVI indicators were computed for each country and the WAMZ, by assigning weights to each of the components in the first two EVI indicators, and generating the component weights for the third indicator utilizing principal component analysis. The EVI3 was chosen as the preferred index in view of the usage of a statistical methodology in generating the component weights.

The computed EVI values and the component indices ranged between 0 and 1, with a high score in the index corresponding to a high level of vulnerability and vice versa. Results from the empirical analysis show that the average EVI for the

Zone is 0.581, implying that the Zone, as a whole, is vulnerable to external shocks. Specifically, Liberia, Ghana and Guinea were found to be most vulnerable in the Zone, while The Gambia is the least. In addition, the trade openness indicator shows that Liberia is the most open economy while Nigeria is the least. On the other hand, export concentration is highest in Nigeria and lowest in The Gambia, while dependence on strategic imports is highest in The Gambia and lowest in Ghana.

Being highly vulnerable to external shocks has profound implications for the attainment of the macroeconomic convergence criteria and sustenance of regional economic integration. It triggers wider fiscal deficits in countries with no adequate fiscal frameworks to control volatility in government revenues, increases in gross public debts arising from the financing of higher budget deficits, lead to lower international reserves emanating from lower foreign exchange inflows, exchange rate instability and higher inflationary pressures.

Macroeconomic vulnerability could be mitigated in the WAMZ economies by implementing a number of measures aimed at building economic resilience – enhancing countries' ability to withstand economic vulnerability emanating from external shocks. The emphasis on resilience is important because of the huge success achieved by the South-East Asian economies in building economic resilience through appropriate economic policies to mitigate macroeconomic vulnerability and achieve high level of economic development. Ensuring macroeconomic stability with a healthy fiscal position, among others, would assist in building resilience against external shocks. In addition, member countries need to make concerted efforts aimed at diversifying their export base; promote savings and create stabilization funds both of which could come handy in periods of commodity price falls. They could also explore using market-based instruments such as forwards, futures and options to manage commodity price risks.

Keywords: *Commodity dependence, external shocks, vulnerability index, export concentration, macroeconomic convergence*

JEL Classification: *C38, C43, O13*

1.0 INTRODUCTION

Economies of the WAMZ have registered considerable progress in recent years with average growth of real GDP of 7.2 percent between 2010 and 2013, compared with 5.7 percent during the period 2005 to 2009. However, apart from being mostly low income countries, these economies are characterized by other features, which render them highly vulnerable to macroeconomic shocks. The inherent features of these countries include dependence on strategic imports, export concentration, dependence on foreign sources of finance and prevalence of civil and political crises, among others. These features significantly weigh down economic progress of the individual countries as well as the entire zone.

Generally, vulnerability increases the risks to economic growth particularly by restraining investment. Economic instability engendered by the vulnerability of an economy could trigger precautionary savings as economic agents become highly risk averse with severe impact on private investment. In another dimension, being small economies limit their abilities to withstand trade-related shocks. Moreover, it has equally been established that the impact of government on economic activities is high in small countries, such that shocks to government revenues could have adverse effects on growth trajectories. Among other adverse

effects, vulnerability of these economies constitutes a drawback to the attainment of macroeconomic convergence in the Zone.

It has been argued that an adverse outcome of vulnerability like volatile growth is damaging because the downswings are not automatically compensated for by episodes of equal upswings, in view of the fact that the harmful effects of negative growth are not cancelled by an equally positive growth rate based on neo-classical theory of diminishing factor inputs (Cordina 2009). Following the same line of argument, Briguglio (2011) stresses that downside shocks in the real world could lead to decline in real GDP of poor countries and are difficult to recover from, even when they are accompanied by positive growth rates. Beside the well-entrenched adverse consequences, economic downturns associated with vulnerability could spark off sub-optimal policy choices by policy makers. For instance, in response to strains on the macroeconomic environment due to vulnerability, policy makers particularly in developing and emerging economies usually embark on excessive level of borrowing, maintain an overvalued exchange rate, repressive capital market and domestic financial market, pro-cyclical fiscal and monetary policies and trade liberalization.

Regional economic communities (REC) generally impose convergence criteria to guide the economic policies of Member States, and the States are required to adopt sound macroeconomic policies and to commit to low inflation and prudent fiscal policies. The rationale for imposing convergence criteria on all Member States of a REC is to avoid the distortionary negative economic effects that may arise from Member States pursuing variant and inconsistent policies (UNECA, 2008). Studies have shown that African countries experience enormous difficulties in meeting the desired macroeconomic convergence criteria set by regional economic communities, as most countries struggle to achieve the desired single digit inflation targets. In addition, most countries were not able to achieve the desired fiscal targets due to negative external shocks, large budget deficits, lack of reliable statistics and poor growth performance. Thus, the pernicious effects of vulnerability in these economies not only constrain sustainable growth and development, but also act as considerable drag on an enduring economic and monetary integration among member countries. This is largely due to the fact that the underlying vulnerability has great potential to amplify the impact of exogenous shocks and thereby weaken key macroeconomic fundamentals which, ultimately, would have severe consequences on the attainment of

convergence criteria in a monetary union.

Issues revolving around economic vulnerability particularly on developing economies have elicited huge research interest. However, not much has been done on determining the extent of vulnerability of these economies to external shocks, and this study will contribute to filling this gap. Among other reasons, a study that examines the implication of vulnerability of WAMZ Member States for the prospect of a monetary union is not only appropriate at the initial phase of the convergence process, but it should also be taken as a continuous exercise with a view to flagging threats, which could inform timely and robust measures to address the challenges. Therefore, the relevance of this study is underscored by the fact that the global environment is becoming more integrated due to increasing trade and financial linkages, such that contagion and spillovers have become a common occurrence. This, in essence, requires that countries build safeguards in order to increase resilience and insulate themselves against adverse shocks. Not surprisingly, addressing vulnerability issues has become an integral part of economic and monetary integration processes.

The objective of the study is to assess the degree of vulnerability of Member States of the WAMZ to exogenous shocks, by computing economic vulnerability indices. The study also

aims to examine the implications of Members States' vulnerability to external shocks on the macroeconomic convergence process. The remainder of the paper is organized as follows: section two examines the economic performance of the WAMZ countries, while section three reviews relevant

literature and theoretical issues. Section four dwells on the methodological framework and data sources. Section five presents analysis of empirical results and draws policy implications emanating from the findings. Section six concludes and makes recommendations.

2.0 ECONOMIC PERFORMANCE OF THE WAMZ MEMBER COUNTRIES AND THE CONVERGENCE PROCESS

2.1 Recent Commodity Price Shocks

The economies of the WAMZ Member States are heavily reliant on the export of primary commodities for fiscal revenues and foreign exchange earnings. Dependence on primary commodities such as agriculture and natural resource products could heighten a country's vulnerability to external shocks since prices are determined in the global market. The market witnessed a global commodity price slump beginning from 2014 that disrupted macroeconomic fundamentals of commodity-dependent countries. International market prices of all the major export commodities in the WAMZ countries declined during the period. For instance, the price of Nigeria's main export commodity – crude oil, declined by 7.5 percent and 47.3

percent in 2014 and 2015, respectively, relative to its previous year's price levels. Gold, currently exported by Ghana, Guinea and Liberia also witnessed price declines to the tune of 10.3 percent and 8.4 percent, respectively, during the same period. Of all the major primary export commodities in the WAMZ, only cocoa beans witnessed price increases. The recent shock adversely affected most economies of the WAMZ.

In addition to the fall in groundnut prices, The Gambia witnessed drought in 2011 and 2014 that affected agricultural production. These shocks led to loss of foreign exchange earnings, depletion in international reserves, poor fiscal performance and growth reversals.

Table 1: WAMZ Primary Export Commodities

Main Commodities	2012	2013	2014	2015
Crude Oil (US\$/bbl)	105.01	104.07	96.25	50.77
Iron ore (US\$/mt)	128.53	135.36	96.84	55.21
Cocoa Beans (US\$/mt)	2,377.07	2,439.09	3,067.77	3,135.17
Rubber (cts/lb)	153.19	126.76	88.75	70.73
Groundnuts (US\$/mt)	1,688.20	2,318.16	2,148.26	1,746.21
Logs (US\$/m)	360.51	305.34	282.04	246.14
Bauxite (\$/T)	53.50	54.30	68.90	48.40
Diamond (US\$/Carat)	94.20	183.60	172.90	112.10
Gold (\$/oz)	1,668.80	1,411.10	1,266.20	1,160.10

Source: Index Mundi, World Bank, IMF, BCRG and the Bauxite Index

2.2 The Convergence Criteria

The West African Monetary Zone (WAMZ) was established by the Authority of Heads of State and Government of five West African Member States (The Gambia, Ghana, Guinea, Nigeria and Sierra Leone) in December 2000, with the objective of establishing a common central bank and the introduction of a single currency. After a decade of being on observer status, Liberia became a full-fledged member of the WAMZ in February 2010. The West African Monetary Institute (WAMI), which was also established by the Authority, was primarily mandated to undertake technical preparations for the launch of a monetary union for the West African Monetary Zone (WAMZ) and the establishment of a West African Central Bank (WACB). As a prerequisite to the launch of the WAMZ, Member States are required to satisfy the following four primary criteria: single-digit inflation, fiscal deficit (including grants) of not more than 3.0 percent of GDP, central bank financing of fiscal deficit of not more than 10 percent of previous year's tax revenue, and gross external reserves of not less than 3.0 months of import cover. The two secondary criteria required were exchange rate variation (appreciation/depreciation) of not more than 10 percent per annum and public debt to GDP ratio of not more than 70 percent.

An examination of the performance of WAMZ countries on the convergence

criteria in the period 2011 – 2016 revealed that only two countries – The Gambia and Liberia – met the inflation criterion on average. The other four countries missed the criterion on the average due to a number of factors including exchange rate depreciation, increased fiscal deficits and its subsequent financing and disruptions in domestic food supplies. Consequently, the average rate of inflation for the Zone during this period was at 10.5 percent, marginally surpassing the single digit criterion.

The fiscal deficit criterion, however, was attained by three countries – Guinea, Liberia and Nigeria. The Gambia and Ghana recorded average fiscal deficits of 7.4 percent and 6.0 percent of GDP, respectively, while Sierra Leone slipped the required criterion by 1.3 percentage points on the average. The zone wide average fiscal deficit stood at 3.9 percent of GDP for the review period. Available data for Liberia and Nigeria shows that the two countries' central banks have not financed government deficits, while the other four countries' central banks financed government budget deficits exceeding the required threshold. Overall, aggregate deficit financing by the central banks for the Zone stood at 5.8 percent.

Member States central banks are required to have a buffer of gross official reserves that can cover at least three months of their imports. All Member States attained this criterion

during the period. The WAMZ average reserve level would be able to finance 4.1 months of its imports.

Table 2: Average Performance in Attaining Macroeconomic Convergence Criteria (2011-2016)

	Inflation Rate (%)	Fiscal Deficit (% of GDP)	Central Bank financing of Fiscal Deficit	Gross External Reserves (Months of Imports)	Exchange Rate Variation (%)	Public Debt (% of GDP)
The Gambia	6.2	-7.4	26.0	4.0	13.9	89.8
Ghana	13.5	-6.0	11.3	3.7	15.5	58.2
Guinea	11.2	-2.4	-13.1	3.0	7.1	47.9
Liberia	9.3	-2.1	0.0	3.0	5.9	34.1
Nigeria	11.1	-1.1	0.0	7.4	19.8	14.2
Sierra Leone	11.8	-4.3	10.3	3.6	8.6	39.0
WAMZ	10.5	-3.9	5.8	4.1	11.8	47.2

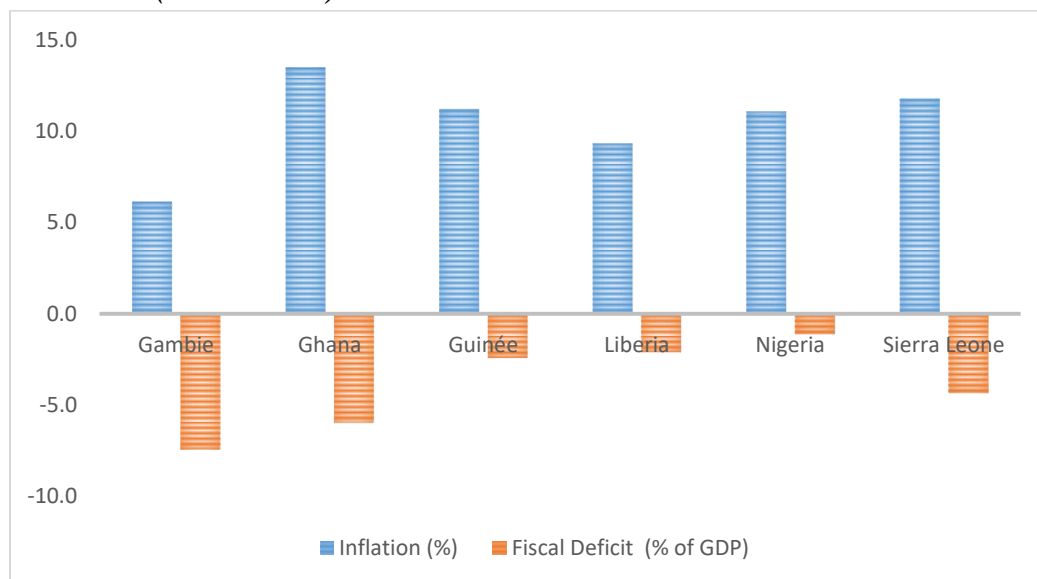
Source: WAMI Macroeconomic Developments and Convergence Reports

On the secondary convergence criteria, three countries – Guinea, Liberia and Sierra Leone met the required 10 percent exchange rate variation while The Gambia, Ghana and Nigeria witnessed various degrees of exchange rate instability.

Consequently, the average WAMZ variation stands at 11.8 percent.

However, five Member States attain the public debt to GDP criterion of 70 percent while The Gambia surpassed that threshold by 19.8 percentage points. Consequently, WAMZ’s public debts remain sustainable during the period, with the average ratio at 47.2 percent during the period.

Figure 1: Average Fiscal Balance (% of GDP) and Inflation Rates in WAMZ Economies (2011 – 2016)



Source: Computed from WAMI Database

2.3 Macroeconomic

Performance of WAMZ Countries

Despite the setbacks suffered by WAMZ Member countries, significant progress has been recorded over the years in macroeconomic performance. With the 2014 global commodity price shocks and the outbreak of the Ebola Virus Disease (EVD) in the region, however, some of the gains were eroded, as the WAMZ economies experienced fluctuations in economic activities, which caused derailment on the convergence process.

The Gambia

The Gambia is the least endowed in natural resources among the WAMZ member countries. The economy is characterized by traditional subsistence agriculture, a historic reliance on peanuts or groundnuts for export earnings, a re-export trade built around its ocean port and a vibrant tourism industry. Growth in the agricultural sector has been volatile over the years, due to inadequate rainfall and rudimentary farming practices, leaving large portions of arable land untapped.

Table 3: Selected Macroeconomic Indicators for The Gambia (2011 – 2016)

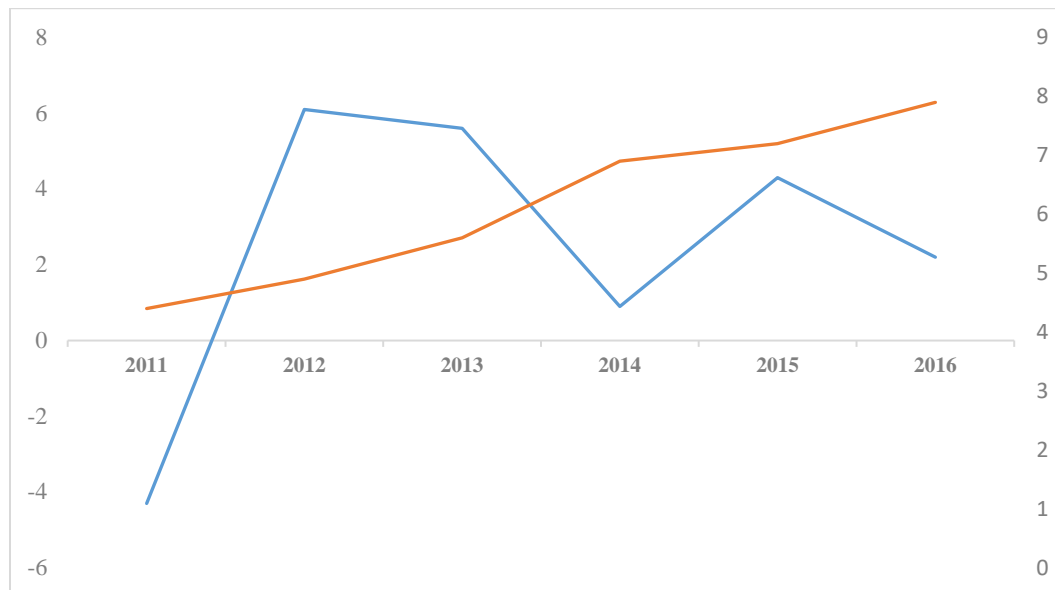
Indicator	2011	2012	2013	2014	2015	2016
Real GDP Growth	-4.3	6.1	5.6	0.9	4.3	2.2
Inflation Rate (end Period)	4.4	4.9	5.6	6.9	7.2	7.9
Fiscal Deficit (% of GDP)	-4.2	-4.6	-8.7	-9.1	-6.6	-11.2
Central Bank Financing (% of previous year tax revenue)	0.0	0.0	48.3	33.3	41.5	33.1
Gross External Reserves (Months of import cover)	6.1	4.8	4.6	3.7	2.5	2.4
Exchange Rate Variation (%)	-2.2	8.7	18.3	31.6	-12.6	9.7
Public Debt (% of GDP)	67.4	75.5	85.6	93.8	101.4	114.9

Source: WAMI Database

Groundnut production in the 70s and early 90s was The Gambia's main source of foreign exchange and volatility of groundnut prices had deleterious effects on the performance of some macroeconomic variables and real output. The drastic fall in groundnut production made the thriving tourism sector to now become the main foreign exchange earner for the country. The Gambia's export base is relatively narrow, leaving the country to rely heavily on tax revenues to finance government fiscal operations. The industrial sector that is expected to add value to agricultural sector is limited to light manufacturing, sand and gravel mining and construction.

Erratic and uneven rains in 2014 affected an estimated 20.0 per cent of crop production resulting to real GDP growth declining to 0.9 per cent, from 5.6 percent in 2013. This development coupled with the global commodity price fall and the effect of the EVD in 2014 that severely affected tourism receipts limited the central bank's efforts in building reserve buffers to intervene in the domestic foreign exchange market. Gross external reserves declined to barely 2.5 months and 2.4 months of import cover in 2015 and 2016, respectively, which is less than the 3 months of imports prescribed by WAMZ.

Figure 2: Real GDP Growth and Inflation Rates in The Gambia (2011 – 2016)



Source: WAMZ Database

In addition, the fall in export receipts affected revenues with government resorting to heavy financing from the domestic money market. As a result, interest rates picked up due to increased government borrowing and to curb inflationary pressures, the central bank raised the policy rate. The overall fiscal deficit has been consistently above the prescribed threshold of 3.0 per cent of GDP for convergence. Similarly, growth in domestic debt has led to increases in the country's debt profile, with public debt as a percentage of GDP above 100 percent as at end-2015. In addition, Government deficit financed

by the central bank in 2014 was about one-third of previous year's tax revenue, thus breaching the 10 per cent threshold required for convergence. It went up further to 41.5 percent in 2015 before settling at 33.1 percent in 2016.

Overall, these vulnerabilities have impacted on The Gambia's economic performance in recent years, with the country attaining only two of the four primary convergence criteria in 2014, which declined to one in 2015 and 2016. Similarly, the growing public debt has led to the country missing the public debt to GDP ratio criterion since 2012.

Figure 3 Government Fiscal Balance in The Gambia (2011 – 2016) – (% of GDP)



Source: WAMZ Database

Ghana

Ghana has a diverse and rich resource base which includes gold, timber, cocoa, diamond, bauxite and manganese. It is the world’s second largest producer of cocoa and has commercial quantities of offshore oil reserves. Ghana’s economy has traditionally been dependent on the export of cocoa and minerals, especially gold. It has recently joined

the league of crude oil exporters, with crude exports accounting for an average of about 21.8 percent of its total exports for the period 2011 to 2016. The country has witnessed over two decades of rapid and sustained economic growth. However, it has recorded a sharp slowdown in growth in recent years, occasioned by the impact of external and domestic shocks following the global economic crises.

Table 4: Selected Macroeconomic Indicators for Ghana (2011 – 2016)

Indicator	2011	2012	2013	2014	2015	2016
Real GDP Growth	15.0	8.8	7.6	4.0	3.8	3.5
Inflation Rate (end Period)	8.6	8.8	13.5	17.0	17.7	15.4
Fiscal Deficit (% of GDP)	-0.9	-5.7	-7.6	-6.4	-4.7	-10.4
Central Bank Financing (% of previous year tax revenue)	28.3	9.4	9.2	10.9	0.0	10.0
Gross External Reserves (Months of import cover)	3.2	3.4	3.6	4.2	3.6	4.2
Exchange Rate Variation (%)	5.0	17.5	14.6	31.3	15.7	9.2
Public Debt (% of GDP)	39.3	46.7	55.2	64.5	70.8	72.8

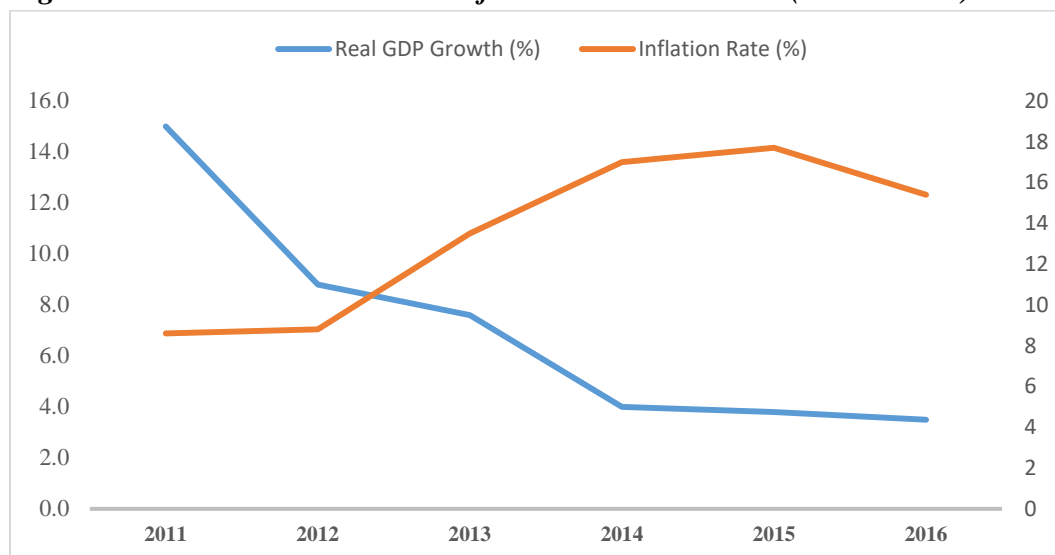
Source: WAMI Database

The country has witnessed large fiscal deficits occasioned by revenue shortfalls and large expenditure overruns. The fiscal deficit as a percentage of GDP was 7.6 percent in 2013, but increased to 10.4 percent in 2016. The fiscal slippages has led to significant increases in public debt, reaching 70.8 percent of GDP in 2015, slightly above the convergence threshold. It increased further to 72.8 percent of GDP in 2016. In addition, the country has faced rising inflationary pressures with consumer prices consistently rising above the WAMZ single digit threshold since 2013. The inflation rate recorded 17.0 percent in 2014, and rose to 17.7

percent in 2015, before moderating to 15.4 percent in 2016. The rise in inflationary pressures emanated largely from government fiscal operations, supply-side bottlenecks and weaknesses in the external sector.

However, external reserve levels remain consistently above the 3 months of imports thresholds, with the increase in 2016 partly accounted for by a sharp increase in gold exports, FDI and domestic debt market inflows. This decreased the pressure on the exchange rate in 2016, with the cedi depreciating by only 9.2 percent in 2016, compared to 31.3 percent in 2014.

Figure 4: Real GDP Growth and Inflation Rates in Ghana (2011 – 2016)

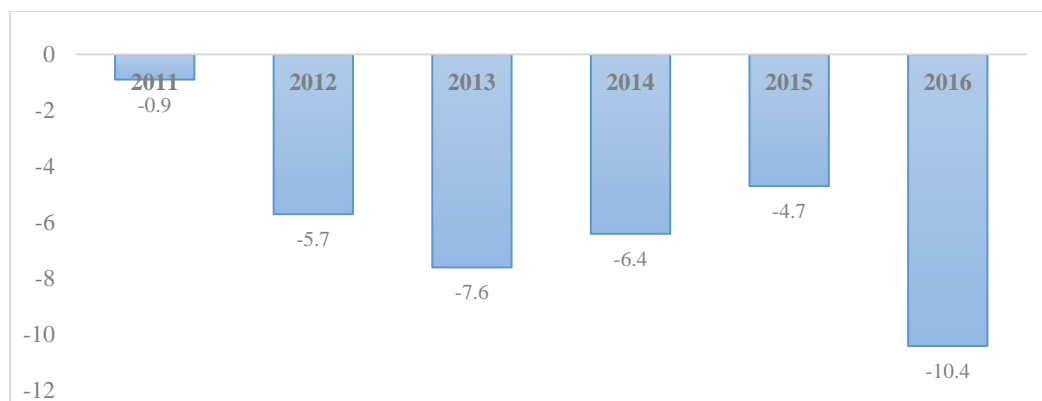


Source: WAMZ Database

Consequently, Ghana attained only one primary convergence criterion in 2014, but increased to two in 2015 and 2016, respectively. In addition, growth

in public debt surpassed the threshold of 70 percent of GDP in 2015 and 2016. It attained one secondary criterion in 2014 but none in 2015.

Figure 5: Government Fiscal Balance in Ghana (2011 – 2016) - (% of GDP)



Source: WAMZ Database

Guinea

Guinea is richly endowed with natural resources, possessing about a quarter of the world's proven bauxite reserves. It also has significant diamond, gold and iron ore deposits. Guinea, like other economies of the zone, is also a primary commodity export dependent economy. Available data indicate that the top three export

products (bauxite, diamond and gold) accounted for an average of 81.1 percent of total export earnings between 2011 and 2016. It also has considerable potential for growth in agriculture and fishing. The country experienced modest growth in recent years but is now slowly emerging from the EVD scare and low commodity price shocks that ravaged it in 2014 and 2015.

Table 5: Selected Macroeconomic Indicators for Guinea (2011 – 2016)

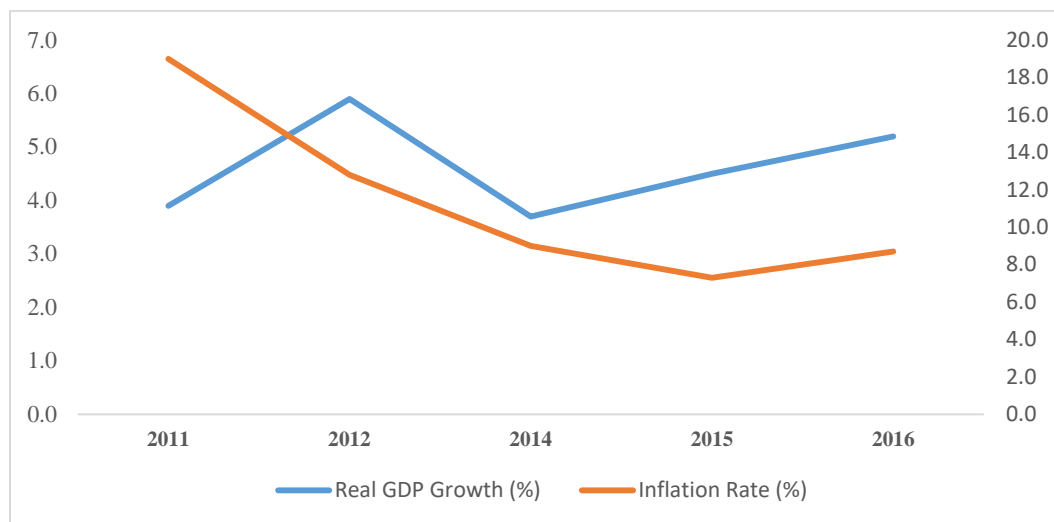
Indicator	2011	2012	2013	2014	2015	2016
Real GDP Growth	3.9	5.9	3.9	3.7	4.5	5.2
Inflation Rate (end Period)	19.0	12.8	10.5	9.0	7.3	8.7
Fiscal Deficit (% of GDP)	-0.9	-0.9	-2.4	-3.2	-6.9	-0.2
Central Bank Financing (% of previous year tax revenue)	-17.0	-51.8	-24.5	-12	25.0	1.9
Gross External Reserves (Months of import cover)	4.3	3.0	3.5	3.2	2.3	1.4
Exchange Rate Variation (%)	14.2	-1.7	0.5	-3.1	9.7	13.2
Public Debt (% of GDP)	80.0	39.5	37.5	39.9	43.9	46.6

Source: WAMI Database

Export receipts contracted in 2015 on account of lower bauxite and gold prices. Consequently, external reserves could only finance 2.3

months of imports during the year, relative to 3.2 months of imports in 2014 and the WAMZ threshold of 3.0 months.

Figure 6: Real GDP Growth and Inflation Rates in Guinea (2011 – 2016)



Source: WAMZ Database

Gross reserves declined further in 2016, as it could only finance 1.4 months of imports, owing to significant jump in import levels during 2016 amid reduced external inflows. The fiscal position deteriorated in 2015, with a deficit of 6.9 percent of GDP relative to 3.2 percent in 2014. It however, improved to a deficit of 0.2 percent of GDP in 2016 on account of increase in tax revenues and decline in public expenditure. The inflation rate declined to 7.3 percent in 2015 due to a slight reduction in the pump prices of petroleum products. However, inflation increased to 8.7 percent in 2016 on account of increase in VAT

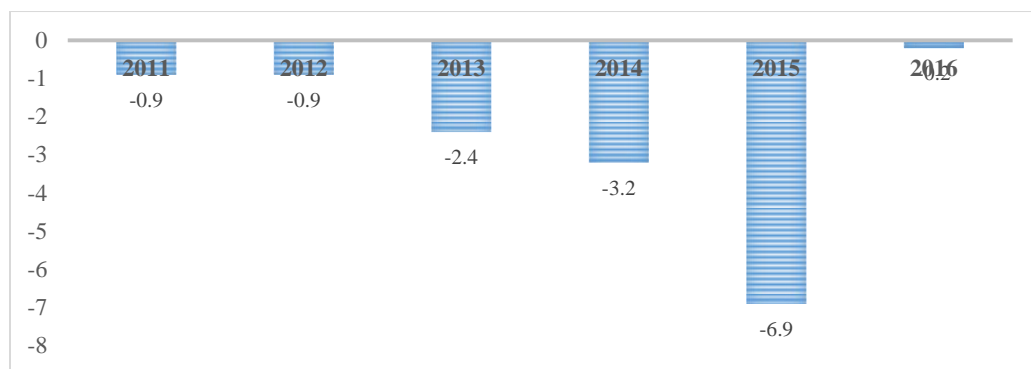
rate and depreciation of the Guinea Franc. Gross public debt was on the increase over the 2013 to 2016 period but remained well below the WAMZ threshold for convergence. The fall in external reserves put pressure on the exchange rate, partly resulting in a 13.2 percent depreciation of the Guinea Franc in 2016.

The vulnerabilities in 2014 and 2015 severely impacted on Guinea’s economic performance and its attainment of the macroeconomic convergence criteria. The country attained only two of the four primary convergence criteria in 2014, and declined further to one in 2015. However, it attained three criteria in

2016, slipping on the gross reserves position due to significant increase in imports. In addition, the country

attained the two secondary criteria in 2014 and 2015, but dropped to one in 2016.

Figure 7: Government Fiscal Balance in Guinea (2011 – 2016) - (% of GDP)



Source: WAMZ Database

Liberia

Liberia is richly endowed with water, mineral resources, forests and a climate favourable to agriculture. Its exports are dominated by primary commodities including rubber and iron ore. The country relied heavily on the mining of iron ore prior to the civil war, which accounted for more than half of Liberia’s export earnings.

Export earnings from its top primary commodities constitute about 82.4 percent of total export earnings between 2011 and 2016. Consequently, weak commodity prices in the export market coupled with the outbreak of the EVD have led to a third straight year of drop in economic activities. The economy contracted by 1.6 percent in 2016, from zero growth in 2015.

Table 6: Selected Macroeconomic Indicators for Liberia (2011 – 2016)

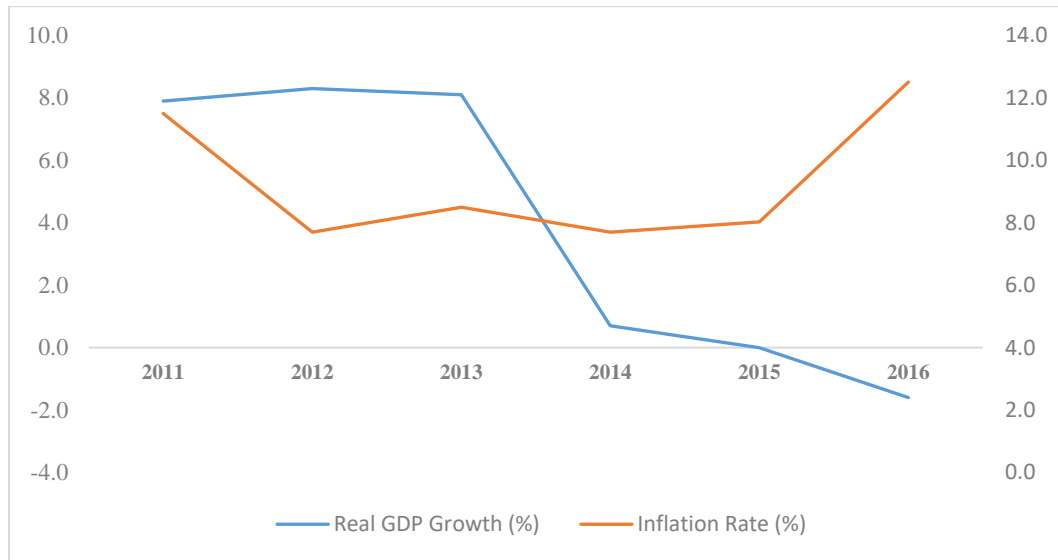
Indicator	2011	2012	2013	2014	2015	2016
Real GDP Growth	7.9	8.3	8.1	0.7	0.0	-1.6
Inflation Rate (end Period)	11.5	7.7	8.5	7.7	8.0	12.5
Fiscal Deficit (% of GDP)	-0.5	-7.5	-0.5	-0.2	-1.6	-2.3
Central Bank Financing (% of previous year tax revenue)	0.0	0.0	0.0	0.0	0.0	0.0
Gross External Reserves (Months of import cover)	3.3	2.8	2.8	2.5	2.4	4.1
Exchange Rate Variation (%)	0.7	1.8	12.1	0	6.8	13.7
Public Debt (% of GDP)	32.4	34.1	30.5	37.9	32.3	37.2

Source: WAMI Database

Commodity price falls prompted a significant fall in export earnings, as it declined by 20.5 percent in 2014. This trend continued as Liberia's earnings

declined further by 40.3 percent and 36.1 percent in 2015 and 2016, respectively.

Figure 8: Real GDP Growth and Inflation Rates in Liberia (2011 – 2016)

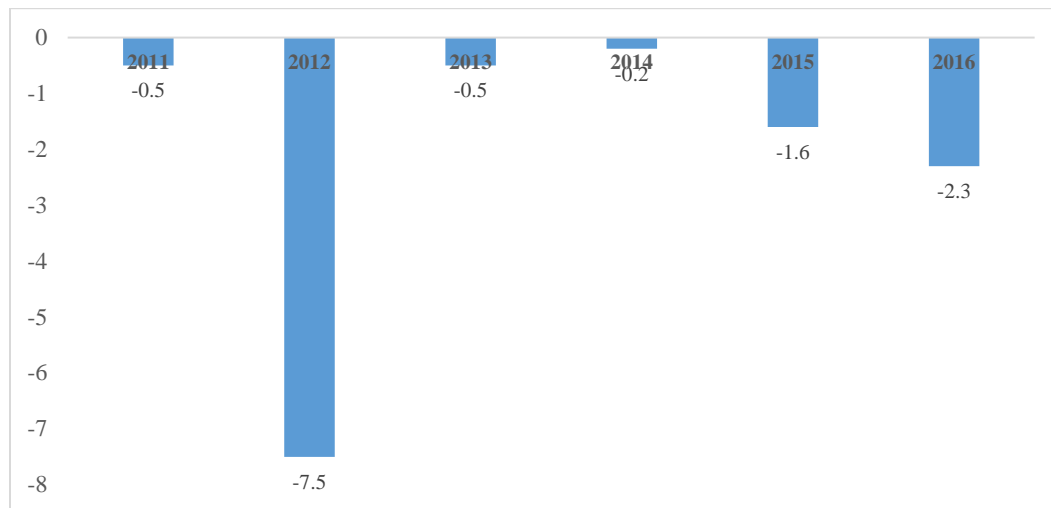


Source: WAMZ Database

Declines in tax revenues in 2015 and 2016, precipitated by substantial declines in export taxes in those years relative to their 2014 levels resulted in fiscal deficits of 1.6 percent and 2.3 percent of GDP in 2015 and 2016, respectively. Meanwhile, gross

external reserves in months of import cover declined in 2014 and 2015, but rose to 4.1 months in 2016 due to the Government of Liberia's policy on reserves accretion under the Extended Credit Facility (ECF) program.

Figure 9: Government Fiscal Balance in Liberia (2011 – 2016) - (% of GDP)



Source: WAMZ Database

Inflation rose to 8.0 percent and 12.5 percent in 2015 and 2016 respectively, from 7.7 percent in 2014. Total public debt, however, rose from 32.3 percent of GDP in 2015 to 37.2 percent in 2016 due to the ratification of previously signed loan agreements by the country’s national legislature. The level of public debt, however, remain within the WAMZ threshold of 70.0 percent of GDP.

Despite the adverse effects of the EVD which severely impacted on Liberia’s economic performance over the period, the country was able to attain three primary convergence criteria during 2014 – 2016, and all the secondary criteria in 2014 and 2015, respectively.

Nigeria

Nigeria has about 37.2 billion barrels of proven crude oil reserves, ranking the country as the largest oil producer in Africa. In addition, it has about 197 trillion cubic feet of proven natural gas reserves. The country depends heavily on the export of crude oil and natural gas for foreign exchange earnings and government revenues. Available data indicated that export earnings from crude oil and natural gas alone constituted about 93.0 percent of foreign exchange earnings between 2011 and 2016. In addition, the sector contributed more than half of government revenues (about 63.7 percent in 2016). Consequently, the commodity price fall that started in mid-2014 sent the economy into recession in 2016.

Table 7: Selected Macroeconomic Indicators for Nigeria (2011 – 2016)

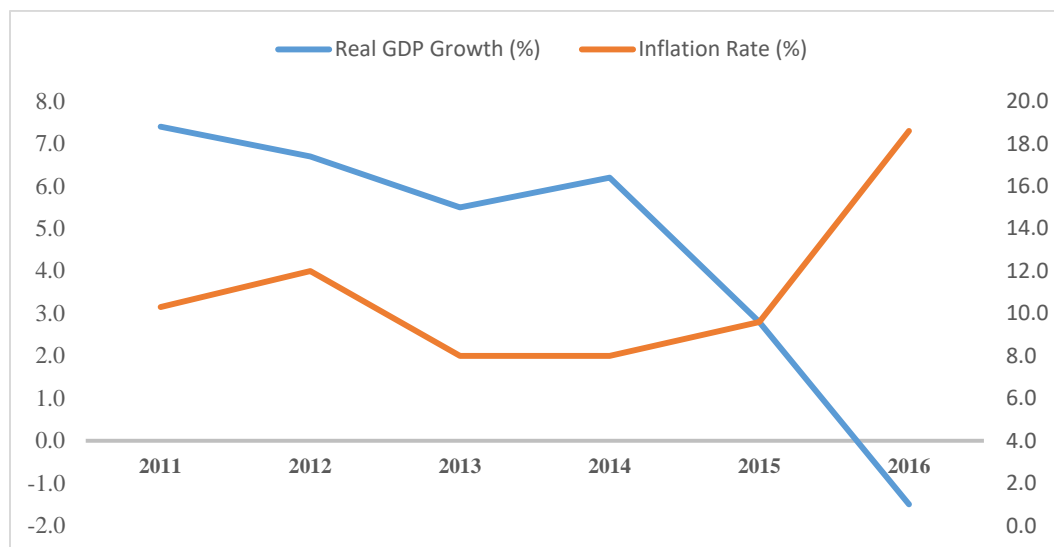
Indicator	2011	2012	2013	2014	2015	2016
Real GDP Growth	7.4	6.7	5.5	6.2	2.8	-1.5
Inflation Rate (end Period)	10.3	12.0	8.0	8.0	9.6	18.6
Fiscal Deficit (% of GDP)	-1.1	-1.4	-1.4	0.9	-1.6	-2.2
Central Bank Financing (% of previous year tax revenue)	0.0	0.0	0.0	0.0	0.0	0.0
Gross External Reserves (Months of import cover)	6.3	8.5	8.9	6.5	5.8	8.2
Exchange Rate Variation (%)	14.2	12.9	12.8	7.9	16.1	54.8
Public Debt (% of GDP)	17.5	19.4	10.1	11.0	10.9	16.0

Source: WAMI Database

The fall in oil prices and disruptions in oil and gas production by insurgents in the oil producing region led to a gradual decline in non-tax revenues (oil revenues). Consequently, the

country’s fiscal position deteriorated from a surplus of 0.9 percent of GDP in 2014 to deficits of 1.6 percent and 2.2 percent of GDP in 2015 and 2016, respectively.

Figure 10: Real GDP Growth and Inflation Rates in Nigeria (2011 – 2016)

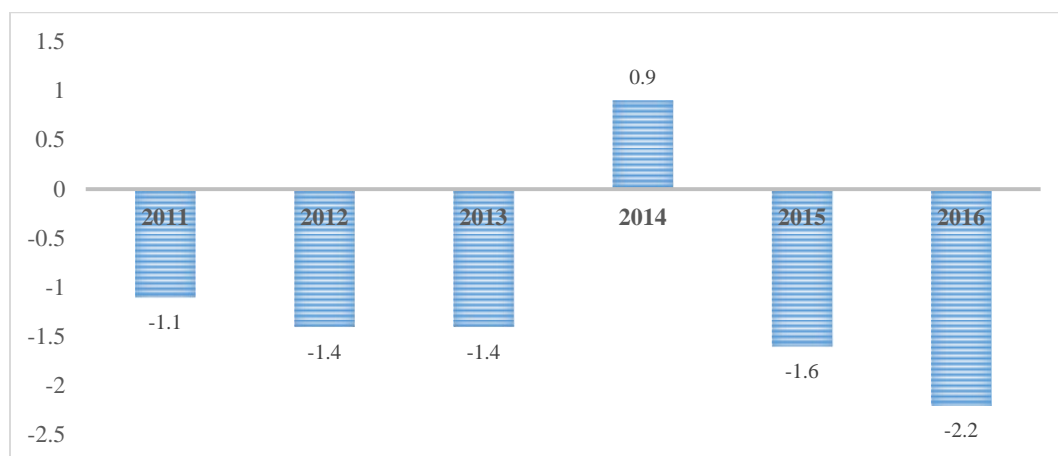


Source: WAMZ Database

In addition, reduced export earnings led to declines in gross external reserves, as the reserves could only finance about 6.5 months and 5.8 months of imports in 2014 and 2015, respectively, from 8.9 months in 2013. However, it increased to 8.2 months in

2016 partly due to a significant decline in imports following the contraction in economic activities. Consequently, the domestic currency depreciated by 16.1 percent and 54.8 percent in 2015 and 2016, respectively.

Figure 11: Government Fiscal Balance in Nigeria (2011 – 2016) - (% of GDP)



Source: WAMZ Database

Consumer price inflation almost doubled in 2016, from 9.6 percent in 2015, and the increase was partly accounted for by structural factors and exchange rate pass-through effects. Gross public debt declined marginally to 10.9 percent of GDP in 2015, but increased to 16.0 percent of GDP in 2016. The outstanding stock of public debt, however, remains way below the WAMZ threshold throughout the period.

Even though the recent commodity price shocks had a drastic impact on Nigeria’s economic performance, the country was able to attain all the WAMZ primary and secondary

convergence targets in 2014. However, it slipped on the exchange rate variation target in 2015 and 2016 respectively as well as the inflation target in 2016.

Sierra Leone

Sierra Leone is rich in mineral resources including diamonds, rutile, bauxite, iron ore and gold. It was one of the top producers of diamond and rutile in the world. Its largest commodity exports were in diamonds and, recently, rutile. Export receipts from its top four commodity exports accounted for about 78.7 percent of its total export receipts between 2011 and

2016. In addition, a significant percentage of the population are involved in subsistence agriculture. Even though it achieved commendable economic growth rates in the post-war

period, peaking at 20.1 percent in 2013, it faced a severe contraction in growth amounting to 20.5 percent in 2015 following the cessation of iron ore mining.

Table 8: Selected Macroeconomic Indicators for Sierra Leone (2011 – 2016)

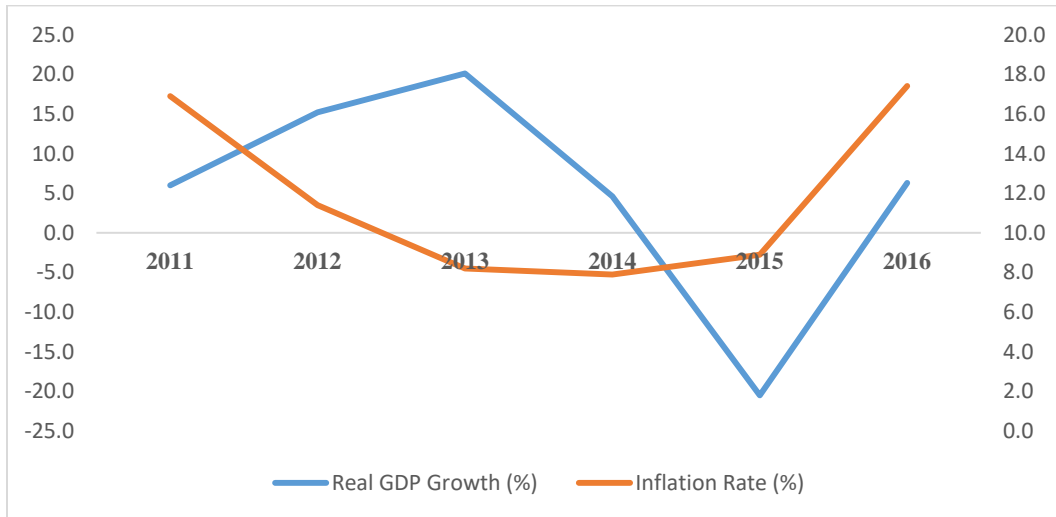
Indicator	2011	2012	2013	2014	2015	2016
Real GDP Growth	6.0	15.2	20.1	4.6	-20.5	6.3
Inflation Rate (end Period)	16.9	11.4	8.2	7.9	8.9	17.4
Fiscal Deficit (% of GDP)	-4.3	-5.1	-1.5	-3.3	-4.3	-7.5
Central Bank Financing (% of previous year tax revenue)	1.1	0.0	1.7	8.1	20.1	30.6
Gross External Reserves (Months of import cover)	2.5	3.4	3.2	3.6	4.6	4.0
Exchange Rate Variation (%)	4.1	-1.0	0.5	12.0	12.2	21.6
Public Debt (% of GDP)	38.0	33.2	28.4	35.2	45.1	53.9

Source: WAMI Database

A sharp rise in iron ore exports in 2013 prompted an increase in export receipts by 56.0 percent compared to its 2012 levels. Iron ore exports constituted about 70.9 percent of the country's total export receipts that

year. However, recent commodity price shocks in addition to the cessation of mining led to declines in export receipts by 20.5 percent and 57.2 percent in 2014 and 2015, respectively.

Figure 12: Real GDP Growth and Inflation Rates in Sierra Leone (2011 – 2016)



Source: WAMZ Database

The country’s fiscal position deteriorated to a fiscal deficit of 7.5 percent of GDP in 2016, from a deficit of 4.3 percent in 2015. Inflation almost doubled in 2016 relative to

2015, on account of the continued depreciation of the Leone and upward adjustments of domestic fuel pump prices and electricity tariffs.

Figure 13: Government Fiscal Balance in Sierra Leone (2011 – 2016) - (% of GDP)



Source: WAMZ Database

Higher fiscal deficits led to increased government borrowing from the domestic money market including the central bank. Consequently, the level of public debt rose to 53.9 percent of GDP in 2016, from 45.1 percent in 2015. However, gross external reserves could finance 4.6 months of imports in 2015, up from 3.6 months in 2014. The increase was largely attributable to a reduction in EVD-related imports and increased donor

inflows to fund government's capital projects.

Overall, Sierra Leone attained three primary and one secondary convergence criteria in 2014. However, it deteriorated to two primary and one secondary criteria in 2015. The country met only one primary and one secondary criterion as the effects of the growth contraction of 2015 lingered into 2016.

3.0 LITERATURE REVIEW AND THEORETICAL ISSUES

The concept of economic vulnerability emerged from the study of the specific weaknesses of small island states that would account for increased risks to economic growth and performance without being necessarily reflected in per capita output levels (Cordina, 2004). Guillaumont (2000) defines vulnerability as the risk of being harmed, wounded (negatively affected) by unforeseen events, in general and in economics, in particular. He referred to the 'unforeseen events' in economics as shocks, and sees economic vulnerability as susceptibility to exogenous shocks.

According to Guillaumont (2009), economic vulnerability of a country can be defined by the risk that a (poor) country sees its development hampered by the shocks that it faces, be they natural or external. The study identifies two main kinds of exogenous shocks to be the main sources of vulnerability: one, natural shocks, namely, natural disasters, such as earthquakes or volcanic eruptions, and the more frequent climatic shocks, such as typhoons and hurricanes, droughts, floods, etc. two, external (trade and exchange related) shocks, such as slumps in external demand, world commodity price instability (and correlated instability of terms of trade), etc. Briguglio (2014) sees economic vulnerability as a country's

susceptibility to being harmed by external economic forces as a result of exposure to such forces.

Guillaumont (2009) identifies three main components of economic vulnerability to include: the size and frequency of exogenous shocks; the exposure to these shocks; and resilience or the capacity to react to the shocks. The first two mostly depend on the country's structural features (size, location and structure of the economy), while resilience relies heavily on the country's current economic policy. Pace (2006) distinguishes between inherent vulnerability, which is relatively fixed, and contingent or self-inflicted vulnerability resulting from wrong policy choices and failures. Factors determining inherent vulnerabilities include location, geo-strategic importance, dependence on key imports (especially food and energy), population density, and economic specialization and diversification. Contingent vulnerabilities normally result from bad governance.

Cordina (2004) documents some characteristics that are most likely to result in vulnerability to include: economic smallness, which constrains a country's production possibilities and ability to reap economies of scale as well as a high degree of economic openness that increases susceptibility

to economic conditions in the rest of the world, Lack of diversification of productive activities, especially in the export sector, a strong dependence on imports with low price elasticities and limited import substitution possibilities. Insularity, peripherality and remoteness, leading to high transport costs and reduced attractiveness for business and investment are also recognized as important determinants of economic vulnerability. The absence of competitive markets, the relatively large size of public sector activity engendered by smallness and the lack of absorption capacity for technology, investment and international development initiatives are other important sources of economic vulnerability. Cordina (2004) suggests other factors that can be viewed to give rise to economic vulnerability to include dependence on exports with relatively high income and price elasticities as well as openness to vulnerable markets.

Economic vulnerability indices (EVI) have been constructed in an attempt to measure economic vulnerability. The most frequent variables used in the economic vulnerability indices relate to economic openness, export concentration, dependence on imports of energy and peripherality. Other approaches attempt to measure vulnerability in terms of the variability of output and similar indicators. For instance, Briguglio (1995) computes the economic vulnerability index,

covering 114 countries comprising three components; exposure to external economic conditions measured by the ratio of imports and exports to GDP, remoteness and insularity measured by the ratio of transport and freight costs to export proceeds and disaster proneness measured by disaster damage in relation to GDP. The study utilized a Max-Min formula to standardize the variables to render the index insensitive to the scale of measurement used. The study computed the EVI utilizing two sets of weights – an equally weighted index for all the three components and assigning the following weights to the sub-indices in the second option; 50 percent to economic exposure, 40 percent to remoteness and insularity and 10 percent to the disaster proneness index. However, Briguglio (1997) modified the index by including three new variables (export concentration, dependence on strategic imports and dependence on foreign sources of finance) and excluded the variable measuring proneness to natural disasters.

Briguglio and Galea (2003) measure economic vulnerability using four components – economic (trade) openness, dependence on a narrow range of exports, dependence on strategic imports and peripherality. The paper standardized the values of the components using a max-min formula and computed the vulnerability composite index by

averaging out the sub-indices using equal weights, and later varied the weights to check for robustness by assigning 40 percent to the openness index and 20 percent to each of the three other indices.

Briguglio (2014) index is composed of four components; trade openness, export concentration, dependence on strategic imports and proneness to natural disasters. The paper measures trade openness as the average of exports and imports of goods and services as a percentage of GDP, averaged over the 2009 – 2011 period. Export concentration was measured using the sum of the three broad group of exports of goods and services which together take the highest percentage of total exports of goods and services, expressed as a percentage of total exports of goods and services. Dependence on strategic imports was proxied using the import of food and fuel as a percentage of total merchandise imports. The amount of damage caused by natural disasters as a percentage of GDP over the period 1980 – 2012 sourced from the EM-DAT database was used to measure proneness to natural disasters. The study assigns an equal weight of 25 percent to each sub-index initially, and generated an alternative EVI weighting scheme by assigning different weights to sub-indices across the four other schemes, which produced different EVI indicators. The study set a threshold of 0.332 between high and low vulnerability scores.

The United Nations Committee for Development Policy (CDP) (UN, 2015) develops and includes an EVI from 2000 as one of the three broad criteria for determining whether a country should retain its LDC status in line with the mandate from the UN General Assembly and the Economic and Social Council. Countries are eligible to enter or leave the LDC category if they meet the defined inclusion or graduation thresholds of the criteria. Different versions of the CDP-EVI have been produced since 2000, and the most recent were published in the 2015 handbook on the LDC category. The CDP-EVI index consist of the shock and exposure indices. The shock index was made up of natural shock and trade shock sub-indices while the exposure index compose of the size, location, economic structure and environment sub-indices.

The index was composed of eight indicators, grouped into the various sub-indices, with a lower EVI indicating lower economic vulnerability. The indicators include population, remoteness, merchandise export concentration, share of agriculture, hunting, forestry and fishing, share of population in low elevated coastal zones, instability of exports of goods and services, victims of natural disasters and instability of agricultural production. The indicators are converted into index scores between 0 and 100 using the max-min procedure, and the EVI threshold for

inclusion into the LDC category was set at 36 in the 2015 triennial review.

Guillaumont (2009) adopts the 2006 edition of the CDP-EVI computation methodology and computed the Economic Vulnerability Index (EVI) from seven component indices, made up of three shock indices and four exposure indices, giving equal weights to the sum of both the shock and exposure indices. The shock component compose of the natural shocks including homelessness due to natural disasters and instability of agricultural production as well as trade shock measured by the instability of exports of goods and services. A weight of 50 percent each was assigned to both shocks to arrive at the shock index. The exposure indices included an index of the population size in logs, merchandise export concentration coefficient, the share of agriculture, forestry and fishing in GDP and an index of remoteness from world markets. However, the exposure index assign a 50 percent weight to population to account for small states.

Cariolle (2011), builds on Guillaumont (2009) on the main components of vulnerability and computes the EVI as an arithmetic average of the exposure index and the shock index. The exposure index is a weighted average of population size (50 percent), remoteness from world markets (25 percent), exports concentration (12.5 percent), and the share of agriculture, forestry and

fishery in GDP (12.5 percent). The shock index, however, is a weighted average of the annual mean share of homelessness due to natural disasters in the population (25 percent), instability in agricultural production (25 percent), and instability in exports of goods and services (50 percent). Cariolle and Goujon (2013) modify the exposure index in Cariolle (2011) to include five components with the share of the population living in low elevated coastal zones (25 percent) and the weight of population size reduced to 25 percent.

EVI computations are, however, subject to some limitations. These include the subjectivity in their computation, in particular with regards to the choice of variables, the method of measurement and the averaging procedure. Cordina (2004) indicates that measurement problems arise because of the absence of data for certain variables/countries, different methods of statistical compilation across countries and errors in measurement of the variables. On the averaging procedure, there was the problem of whether to adopt a simple or a weighted average, and in the latter case, which weights are to be assigned to the different variables.

Countries across the world are susceptible to various vulnerabilities and this could emanate from either within the country or external environment. IMF (2011) indicates that Low Income Countries (LICs) are

particularly vulnerable to sharp swings in commodity prices, natural disasters, and variable external financing flows—as the ensuing high output, price, and fiscal volatility imposes large growth and welfare costs. Obadan and Adegboye (2013) investigates the linkages between oil price fluctuations, fiscal operations and the pursuit of macroeconomic stabilization in Nigeria utilizing the SVAR approach and quarterly data covering the period 1981 – 2012. The study shows that oil price fluctuations exerted strong negative short run effects on the fiscal balance, weak negative impact on output growth and a strong positive impact on inflation in the long run. The paper attributed the poor performance of fiscal stabilization to the unstable revenue inflow resulting from high volatility in oil prices over the years.

Some studies argue in favour of participating in economic integration arrangements to reduce vulnerability to external shocks. Even though SIDA (2004) states that countries that belong to a monetary union lose an instrument of economic policy – exchange rate policy, which can be very useful if participating countries are exposed to different shocks that require adjustments in the exchange rate to minimize the impact of asymmetric shocks on growth and employment. The adverse impact of asymmetric shocks on growth and employment can be mitigated in a monetary union if there is sufficient

mobility of labour; labour moving out of the country hit by the shock.

Pace (2006) shows that micro-states exhibit inherent and contingent vulnerabilities, which can be addressed by policies aimed at building their resilience and by positioning themselves strategically in the international global system. He added that economic union offers micro-states with more opportunities to help them overcome their vulnerabilities and strengthen their resilience. He indicates that the EU membership has led Malta to tackle its macroeconomic fundamentals, restructure its economy, strengthen internal competition through liberalization, increase efficiency through privatization, protect its citizens by tightening environmental regulations and management, and open new avenues to its exporters of goods and services, both within the EU and beyond, thus giving incentive to diversification. In addition, Malta had to achieve some macroeconomic targets of strengthening public finances and reducing public debt in preparation for the introduction of the Euro, which not only made it comply with European Monetary Union but strengthened its resilience to external shocks.

Nnanna (2006) provides evidence that expanded trade, macroeconomic stability, measured by: low rate of inflation and exchange rate stability, sustained growth and narrowing of

fiscal balances, have become more entrenched in the regional groupings that have firmly established their economic and monetary union arrangements. Moreover, Velde (2011) found that regional integration impacts on growth through its effects on increasing trade and investment and infrastructural links in member countries.

Edwards (2006), however, shows that the negative effects of external crises on GDP growth tends to be more severe in currency union countries than in countries with a currency of their own and flexible exchange rates, indicating that countries that belong to a currency union had suffered a greater impact from external shocks than countries with a national currency. In addition, Didier, Hevia and Schmukler (2012) argues that even though integration tends to be associated with higher growth and other positive spillover effects, it also makes economies susceptible to foreign shocks and contagion effects.

To mitigate this, emerging economies will have to keep improving their external positions, expanding their fiscal space, reducing credit mismatches, building buffers in the financial system, and gaining credibility in their monetary policy. Metzger (2008) identifies the factors that hampered trade integration in Africa to include insufficient price competitiveness, high dependence on primary commodity exports, in particular minerals and fuels, similar production structures and an inadequate transport infrastructure.

Overall, this study would estimate the economic vulnerability indices for the WAMZ countries by adopting three components. The study would generate alternative weights for the component indices by utilizing principal component analysis to mitigate problems arising from subjectivity in the averaging procedure.

4.0 METHODOLOGICAL FRAMEWORK AND DATA SOURCES

4.1 Components of the EVI

Briguglio (2014) computes the EVI for 183 countries on the basis of four components – trade openness, export concentration, dependence on strategic imports and proneness to natural disasters. This study adopts a modified version of the Briguglio (2014) computation methodology to compute the EVI for the WAMZ countries by utilizing only three of the four components - trade openness, export concentration and dependence on strategic imports.

The study excludes the proneness to natural disasters from the index due to unavailability of data and the fact that Member countries are less prone to natural disasters. In addition, the indices for all WAMZ countries in Briguglio (2014) were insignificant¹, indicating that they were not prone to natural disasters.

4.1.1 Trade Openness

David Ricardo's classical theory of comparative advantage and the Heckscher–Ohlin theory assert that countries stand to benefit immensely from international trade. The theories indicated that countries should export

goods which they have comparative advantage in, and import other goods, providing support for engagement in trade across countries. Cavallo and Frankel (2008), indeed, found that openness to trade makes countries less vulnerable to crises. However, it is widely acknowledged that an economy's vulnerability to exogenous economic shocks is largely determined by its degree of exposure to the global economy—that is, by its degree of trade openness (Briguglio 2009, World Bank 2010). Since economic openness is measured as the ratio of international trade to GDP, a terms of trade shock could emanate from a shock to either imports or exports or both.

Briguglio (2014) indicates that the magnitude of a country's exposure to external economic shocks is determined by its relative dependence on international trade. Similarly, Montalbano, Federici, Triulzi and Pietrobelli (2005) and Loayza and Raddatz (2007) provide evidences that greater trade openness tends to magnify economic vulnerability. Yanikkaya (2003) also states that trade barriers are positively associated with growth. Thus, we include trade openness as one of the components of economic vulnerability. In line with the trends in the literature, we measure trade openness as the sum of exports

¹ It was 0.000 for The Gambia, 0.001 for Ghana, 0.000 for Guinea, 0.029 for Liberia, 0.002 for Nigeria and 0.000 for Sierra Leone.

and imports of goods and services as a ratio of GDP.

4.1.2 Export Concentration

Export concentration reflects the degree to which a country's exports are concentrated on a small number of products or a small number of trading partners. A country that exports one product to only one trading partner has a perfectly concentrated export portfolio. Conversely, a country whose exports are comprised of a larger number of products and that trades with a larger number of trading partners has a lower export concentration ratio, that is, it has more diversified exports (UNDP, 2011). The impact and likelihood of economic shocks are expected to be higher when countries export a limited number of goods (Cariolle, 2011). Foxley (2009) asserts that more diversified economies should be less vulnerable to external shocks.

Some studies use the merchandise export concentration index compiled by UNCTAD as a proxy for export concentration (for example, Guillaumont, 2009 and Cariolle, 2011). However, this study measures export concentration as the sum of a maximum of four (4) largest export commodities by export earnings as a ratio of total merchandise exports. The commodities are groundnuts, cashew nuts and fish and fishery product exports for The Gambia; cocoa products, gold and crude oil for Ghana; bauxite, diamond and gold for

Guinea; rubber, iron ore, diamonds and gold for Liberia; crude oil and natural gas for Nigeria; and diamonds, bauxite, rutile and iron ore for Sierra Leone.

4.1.3 Dependence on Strategic Imports

Strategic imports refer to essential products, which tend to be price and income inelastic and therefore the demand for such products does not decline in response to price increases. Briguglio (2014) shows that countries depending heavily on imported fuel for production and on imported food for consumption were vulnerable to shocks. Earlier, UNDP (2011) also asserts that economies that are highly import dependent, especially on strategic imports, appear to be more vulnerable to the availability and cost of such imports. As in Briguglio (2014), we measure this indicator as the value of imports of food and fuel products as a ratio of total merchandise imports.

4.2 Sources of Data

The EVI and its component indices were computed using annual data for the period 2004 to 2016. All international trade data including exports and imports of goods and services, and the value of the four highest export commodities were obtained from the respective central banks of WAMZ Member countries. The ratio of food imports to total merchandise imports obtained from

the World Development Indicators (WDI) database were used to compute the value of food imports for The Gambia, Ghana and Nigeria.

The value of fuel imports were calculated using similar ratios from WDI for The Gambia, while the rest sourced from their respective central banks. Nominal GDP data (in US Dollars) for The Gambia, Ghana, Liberia and Sierra Leone were obtained from WDI, and the other two countries obtained from their central banks.

4.3 Constructing the EVI

We compute the EVI by taking an average of the three components, namely trade openness, export concentration and dependence on strategic imports. The study constructed three different EVI indicators for each Member country and the WAMZ aggregate by assigning weights to each of the components of the EVI. It assigned equal weights to each of the components by taking an arithmetic average in EVI1.

Meanwhile, the WAMZ countries depend heavily on exports of primary commodities, which contribute significantly to the maintenance of both internal and external balance in these economies (WAMI, 2017). For economies that are highly dependent on exports, the volatility in both export earnings and economic growth associated with economic shocks

makes them extremely vulnerable. Exports constitute a significant and growing share of GDP for most developing economies (as over 66 percent of developing economies have an export share exceeding 20 percent). Thus, an increased dependence on exports results in significant fluctuations in export earnings, leading to fluctuations in growth (UNDP, 2011). Similarly, a country's exposure to external economic shocks generally depends on its reliance on exports because export earnings finance imports and also contribute directly to investment and growth. Production structures primarily oriented towards export-led growth, expose countries to external shocks more than production structures reliant on domestic demand (Foxley 2009). In line with this argument, EVI2 assigned a higher weight to export concentration relative to the other components.

We employ principal component analysis (PCA) to derive the weights of each of the components in EVI3. PCA partitions the variance in a set of variables and uses it to determine weights that maximize the resulting principal component variation. The derived principal component is the variable that capture variations in data to the maximum extent possible.

Suppose a data vector comprises three variables, that is $X = (x_1, x_2, x_3)$. The principal component, Z_i , $i = 1, 2, 3$, is defined as;

$$Z_1 = \alpha'_1 X = \alpha_{11}x_1 + \alpha_{21}x_2 + \alpha_{31}x_3$$

$$Z_2 = \alpha'_2 X = \alpha_{12}x_1 + \alpha_{22}x_2 + \alpha_{32}x_3$$

$$Z_3 = \alpha'_3 X = \alpha_{13}x_1 + \alpha_{23}x_2 + \alpha_{33}x_3$$

Where the coefficient α_{ij} represent the weight for the i th variable and j th principal component, and

$$\sum_{i=1}^3 \alpha_{i1}^2 = \sum_{i=1}^3 \alpha_{i2}^2 = \sum_{i=1}^3 \alpha_{i3}^2 = 1$$

(Normalization).

Let data vector X have a correlation matrix with eigenvalue-eigenvector pairs $(\lambda_1, e_1), (\lambda_2, e_2), (\lambda_3, e_3)$, where $\lambda_1 \geq \lambda_2 \geq \lambda_3$. The variance for each principal component is given by the eigenvalue ($\text{Var}(Z_j) = \alpha'_j \Sigma \alpha_j = \lambda_j$). PCA seek linear combinations of the original variables with maximum variance. Thus, the eigenvector corresponding to the largest eigenvalue λ_1 determines $e_1 = (\alpha_{11}, \alpha_{21}, \alpha_{31})$, and the first principal component $Z_1 = e'_1 X$ explain the largest possible variation in the data. Similarly, the second principal component is constructed using the eigenvector corresponding to the second largest eigenvalue λ_2 , that is $Z_2 = e'_2 X$.

All principal components are orthogonal to previous components, and each captures additional but progressively smaller variations in the data. Since total data variance is three (corresponding to the number of variables) and equals the sum of

eigenvalues, the proportion of total data variance accounted for by the j th principal component is $\lambda_j/4$.

Suppose that the first two principal components (Z_1 and Z_2) are sufficient to characterize the data variation. Correlation coefficients between X and Z are called loadings and are given as $\text{Corr}(x_i, Z_j) = \rho_{ij} = e_{ij} \sqrt{\lambda_j}$, $i = 1, 2, 3$, and $j = 1, 2$, where e_{ij} is the i th element of the eigenvector j . The square of loadings ρ_{ij}^2 represents the proportion of variance in variable x_i explained by the principal component Z_j . Owing to the normalization equation above, the sum of squared loadings of Z_1 and Z_2 are λ_1 and λ_2 , which are the variances of Z_1 and Z_2 , respectively. Thus, we normalized the squared loadings to unity sum, that is, $\bar{\rho}_{ij}^2 = \rho_{ij}^2 / \lambda_j$. We

then construct $\theta_j = \lambda_j / (\lambda_1 + \lambda_2)$,

where $j = 1$ and 2 , to measure the proportion of explained variance in the data when considering only the first two principal components. θ_1 and θ_2 would be the weights assigned to the respective principal components for aggregation.

The vulnerability indices ranged between 0 and 1, with index values closer to 1 regarded as highly vulnerable to external shocks and values towards 0 considered as low vulnerability. Trade openness indices for Liberia were found to be greater

than 1 indicating that its total trade was higher than its GDP. Consequently, those indices were capped at 1 to reduce the distorting

effect of outliers (see Briguglio, 2014). The study adopt EVI3 as the preferred index since the weights were obtained using a statistical procedure.

5.0 ANALYSIS OF THE WAMZ ECONOMIC VULNERABILITY INDICES

5.1 Index Weights

This study computed three different EVI indicators for WAMZ economies. EVI1 assigned equal weights to all components by taking an arithmetic average of the three component indices to obtain the EVI. Since WAMZ Member States rely heavily on the export of primary commodities which are subject to excessive price

shocks in the international market subjecting the economies to high vulnerability to external economic shocks, EVI2 assign a higher weight of 50 percent to export concentration index (ECI), and assign 30 and 20 percent to dependence on strategic imports index (DSI) and trade openness index (TOI), respectively.

Table 9: EVI Weighting Options

Index	Weighting Options		
	EVI1	EVI2	EVI3
Trade Openness (TOI)	0.333	0.200	0.326
Export Concentration (ECI)	0.333	0.500	0.326
Dependence on Strategic Imports (DSI)	0.333	0.300	0.348
Total	1.000	1.000	1.000

Source: Authors' computations

We apply the PCA to derive the weights for EVI3. The results were reported in table 10. Results from the PCA indicate that the first two principal components together explain 95.4 percent of total variation in the component indices and have eigenvalues of 1.835 and 1.026

respectively. Loadings and squared loadings of indicators for the selected principal components were found to be high. The weights obtained from the analysis were 0.326, 0.326 and 0.348 for TOI, ECI and DSI, respectively.

Table 10: Principal Component Analysis Results

Variable	Loadings		Squared Loadings		Rho bar Squared		Weights
	PC1	PC2	PC1	PC2	PC1	PC2	
TOI	0.954	0.149	0.910	0.022	0.496	0.022	0.326
ECI	0.960	-0.099	0.922	0.010	0.503	0.010	0.326
DSI	-0.048	0.997	0.002	0.993	0.001	0.969	0.348
							1.000
Eigenvalue	1.835	1.026					
Proportion	0.612	0.342					
Cumm. Proportion	0.612	0.954					
Theta	0.641	0.359					

Source: Authors' computations

5.2 Trade Openness Index (TOI)

Empirical results from the analysis showed that the average TOI for the WAMZ was 0.436 during the period 2004 – 2016. The Zone recorded a highest TOI of 0.565 in 2005, but descended afterwards to 0.444 and 0.314 in 2010 and 2015, respectively. It declined further to 0.297 in 2016. This result confirms that WAMZ's openness to foreign trade is not high, as the indices were below 0.5 in most

years during the study period. The downward trend was largely influenced by Nigeria's index scores during the same period. Nigeria recorded the highest TOI index of 0.531 in 2005. The index declined gradually to 0.248 and 0.213 in 2015 and 2016, respectively. Ghana's TOI, however, increased to 0.992 in 2015, from 0.728 in 2010, but declined to 0.890 in 2016.

Table 11: Trade Openness Index

Period	The Gambia	Ghana	Guinea	Liberia	Nigeria	Sierra Leone	WAMZ	WAMZ (less Nigeria)
2004	0.724	0.991	0.497	1.000	0.452	0.402	0.495	0.870
2005	0.730	0.976	0.667	1.000	0.531	0.407	0.565	0.915
2006	0.784	0.657	0.814	1.000	0.431	0.383	0.462	0.727
2007	0.778	0.652	0.666	1.000	0.439	0.383	0.467	0.695
2008	0.713	0.688	0.738	1.000	0.464	0.365	0.492	0.737
2009	0.619	0.722	0.542	1.000	0.367	0.386	0.403	0.708
2010	0.622	0.728	0.735	1.000	0.410	0.534	0.444	0.743
2011	0.681	0.865	0.837	1.000	0.476	0.889	0.522	0.895
2012	0.738	0.925	0.855	1.000	0.397	0.860	0.454	0.926
2013	0.704	0.810	0.566	1.000	0.349	0.852	0.399	0.797
2014	0.855	0.894	0.562	1.000	0.305	0.838	0.355	0.870
2015	0.813	0.992	0.519	1.000	0.248	0.735	0.314	0.910
2016	0.704	0.890	0.829	1.000	0.213	0.692	0.297	0.872
AVERAGE	0.728	0.830	0.679	1.000	0.391	0.594	0.436	0.820

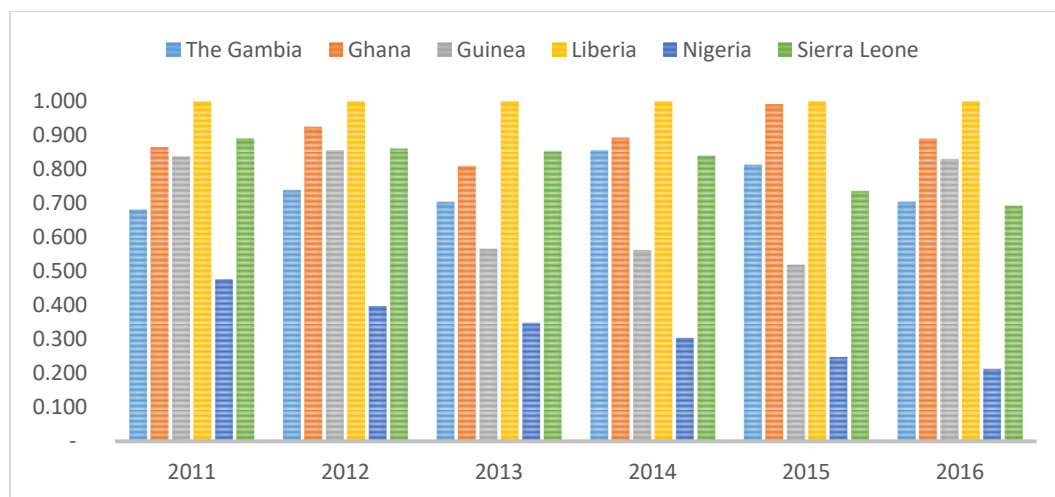
Source: Authors' computations

An examination of the trend in WAMZ TOI indicates that the index was driven largely by Nigeria, as the Zone and Nigeria's indices were found to be similar and moved in the same direction. To insulate this impact, the study computed the TOI for the other five WAMZ economies excluding Nigeria. The result shows that the index recorded 0.915 in 2005, but declined to 0.743 in 2010. It however increased to 0.910 in 2015, and stood at 0.820 on average during the whole period. Consequently, excluding Nigeria from the computation shows that other WAMZ countries were

highly vulnerable to shocks through foreign trade. The computed index were all above 0.5 during the study period. Liberia has the highest TOI averaging 1.000 during the period. This confirms the assertion that small countries are more open to trade than the big ones (see Alesina and Wacziarg, 1998).

The high degree of trade openness in most countries of the Zone as corroborated by the scores exacerbates member countries' vulnerability arising from external shocks through terms of trade shocks.

Figure 14: Trade Openness Index for WAMZ Countries (2011 – 2016)



Source: Authors' computations

5.3 Export Concentration Index (ECI)

The average ECI score for the WAMZ as a whole was 0.928 in the review period, which is close to unity, connoting a high concentration of

exports on few commodities across the Zone. These commodities were largely primary in nature and were subject to price volatility in the international market.

This implies that adverse shocks to the prices of these export items has

serious consequences on export earnings, fiscal revenues, output growth and macroeconomic stability, etc. An examination of the trend for the WAMZ shows that the index was consistently above 0.88 throughout the period. It recorded 0.964 in 2005, but declined to 0.920 and 0.883 in 2010 and 2016, respectively. The development in 2015 and 2016 was partly as a result of the decline in global economic activities, resulting in the fall of commodity prices and export earnings of Member countries.

Nigeria recorded the highest ECI averaging 0.952, and this was influenced by the significant proportion of crude oil and natural gas exports in Nigeria's total exports during the period. The Gambia, however, recorded the lowest index of 0.094.

The ECI for the other five WAMZ excluding Nigeria averaged 0.748 over the period 2004 to 2016. The index was above 0.60 throughout the period, and increased to 0.756 in 2010, from 0.674 in 2005.

Table 12: Export Concentration Index

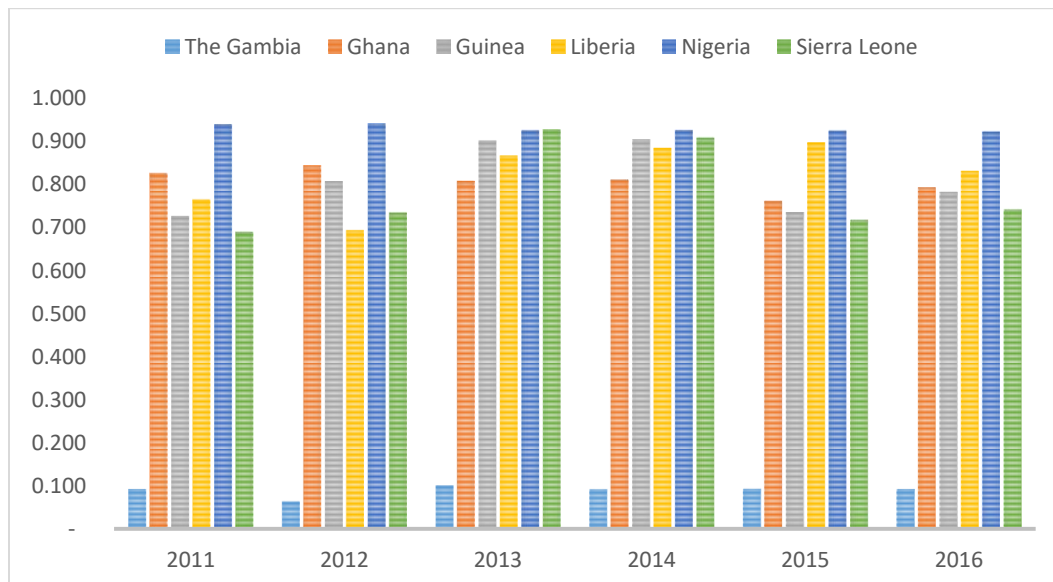
Period	The Gambia	Ghana	Guinea	Liberia	Nigeria	Sierra Leone	WAMZ	WAMZ (less Nigeria)
2004	0.163	0.608	0.665	0.900	0.975	0.931	0.940	0.626
2005	0.112	0.662	0.692	0.965	0.985	0.937	0.964	0.674
2006	0.153	0.661	0.750	0.958	0.982	0.874	0.957	0.686
2007	0.099	0.676	0.707	0.962	0.976	0.878	0.952	0.687
2008	0.039	0.708	0.802	0.954	0.975	0.814	0.955	0.719
2009	0.056	0.751	0.898	0.758	0.965	0.642	0.940	0.754
2010	0.068	0.757	0.838	0.879	0.941	0.583	0.920	0.756
2011	0.092	0.827	0.727	0.765	0.940	0.690	0.923	0.807
2012	0.063	0.845	0.808	0.694	0.942	0.735	0.924	0.824
2013	0.100	0.808	0.903	0.867	0.926	0.927	0.910	0.825
2014	0.091	0.812	0.905	0.885	0.926	0.908	0.909	0.826
2015	0.092	0.762	0.736	0.898	0.925	0.718	0.887	0.754
2016	0.092	0.793	0.783	0.832	0.923	0.742	0.883	0.785
AVERAGE	0.094	0.744	0.786	0.871	0.952	0.798	0.928	0.748

Source: Authors' computations

The countries with the highest scores show the degree of risk exposure of their exports to the vagaries of price developments at the international

markets for commodities. It suggests the need to diversify the export base of these economies from depending so much on limited export sources.

Figure 15: Export Concentration Index for WAMZ Countries (2011 – 2016)



Source: Authors' computations

Examining the trend in the respective countries show that while there was a decline in the trend for Nigeria, there was an increase in the index scores for Ghana and Guinea. For Nigeria, the index declined from 0.985 in 2005, to 0.941 in 2010, and declined further to 0.925 in 2015. Ghana's ECI, however, increased to 0.757 and 0.793 in 2010 and 2016 respectively, from 0.662 in 2005, reflecting the impact of crude oil exports in the country's main export basket. Similarly, the index for Guinea increased from 0.692 in 2005 to 0.838 in 2010, but declined to 0.783 in 2016, reflecting the decline in commodity prices around the period.

5.4 Dependence on Strategic Imports Index (DSI)

All member countries rely heavily on imported energy (fuel) for productive activities and food for consumption. The level of dependence on strategic imports is capable of raising the level of external sector risks faced by Member countries. In the period of analysis, the average score of the DSI in the WAMZ was 0.392. The index declined to 0.249 in 2010, from 0.354 in 2005. However, it increased to 0.389 in 2016, but still considered a medium risk.

Table 13: Dependence on Strategic Imports Index

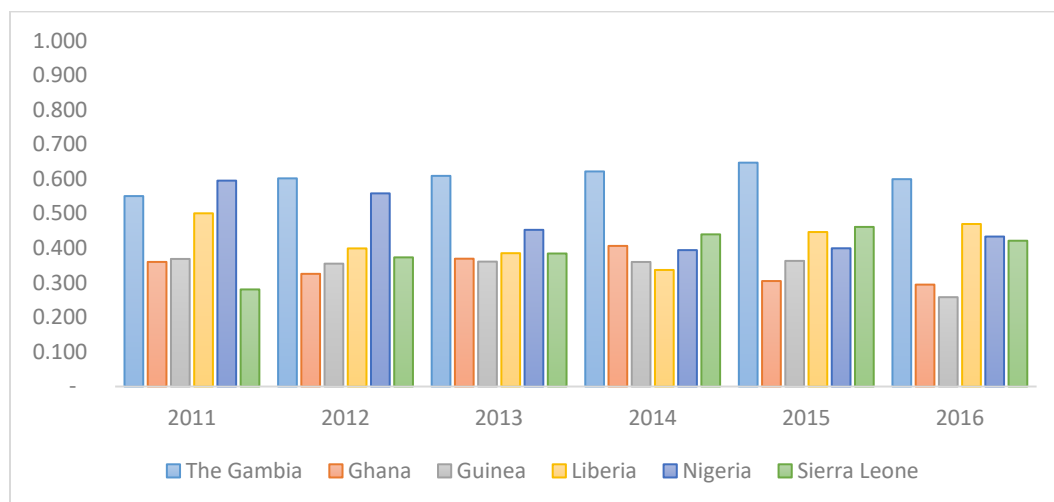
Period	The Gambia	Ghana	Guinea	Liberia	Nigeria	Sierra Leone	WAMZ	WAMZ (less Nigeria)
2004	0.551	0.378	0.425	0.481	0.313	0.436	0.337	0.398
2005	0.538	0.350	0.360	0.514	0.350	0.406	0.354	0.367
2006	0.486	0.378	0.378	0.512	0.408	0.454	0.403	0.391
2007	0.479	0.403	0.473	0.472	0.397	0.423	0.402	0.417
2008	0.497	0.377	0.465	0.435	0.365	0.532	0.373	0.398
2009	0.499	0.346	0.468	0.418	0.340	0.389	0.347	0.368
2010	0.567	0.358	0.388	0.474	0.211	0.314	0.249	0.368
2011	0.551	0.360	0.369	0.501	0.595	0.281	0.540	0.364
2012	0.602	0.326	0.355	0.399	0.559	0.373	0.496	0.339
2013	0.609	0.370	0.361	0.386	0.453	0.385	0.430	0.374
2014	0.622	0.407	0.360	0.337	0.394	0.440	0.396	0.401
2015	0.647	0.305	0.363	0.447	0.400	0.462	0.384	0.342
2016	0.600	0.295	0.258	0.470	0.434	0.422	0.389	0.309
AVERAGE	0.557	0.358	0.387	0.450	0.401	0.409	0.392	0.372

Source: Authors' computations

The Gambia has the highest DSI averaging 0.557, indicating that the country is more dependent on strategic imports than any other WAMZ Member country during the period. It recorded 0.538 in 2005, but increased to 0.567 and 0.647 in 2010 and 2015, respectively. However, Ghana has the lowest index score averaging 0.358. The results of the computed index is not surprising, given that Member countries depend heavily on strategic

imports of energy (fuel) and food, whose demand is price and income inelastic. This tends to amplify the vulnerable state of these economies to swings in the prices of these imported items, thereby increasing the economic risks in the face of external shocks. Smaller economies in the Zone tend to have higher scores on this index because of their weak manufacturing sector, exacerbated by structural and financial constraints.

Figure 16: Dependence on Strategic Imports Index for WAMZ Countries (2011 – 2016)



Source: Authors' computations

5.5 WAMZ Economic Vulnerability Index

Results from the economic vulnerability indices 1 (EVI1) shows that the WAMZ as a whole recorded an average index of 0.586 during the period 2004 – 2016. All EVI1 indices were higher than 0.5 and tended towards unity, indicating that the indices were within the highly vulnerable threshold. Liberia and Ghana exhibited the highest vulnerability to external shocks, which is attributable to their high vulnerability to trade shocks occasioned by higher TOI during the period. However, The Gambia has the lowest index at 0.460 owing largely to lesser dependence on export of primary commodities, as the country depends more on tourism services for its foreign exchange earnings.

The WAMZ, however, recorded a higher average index of 0.669 in the EVI2 results during the same period, when export concentration on few primary commodities was given a higher weight. Similarly, all EVI2 indicators for the WAMZ crossed the 0.5 mark and were higher than those of EVI1. Nigeria and Liberia experienced higher vulnerability to external shocks during the period, due to their higher ECI scores. EVI2 for the five other countries in the WAMZ excluding Nigeria, however, shows a relatively lower index score of 0.650, but all the scores still crossed the 0.5 mark. This reveals the inherent nature of all the WAMZ economies, which are susceptible to shocks arising from the external sector through huge dependence on primary commodities for their export earnings.

Table 14: WAMZ Economic Vulnerability Indices (EVI1)

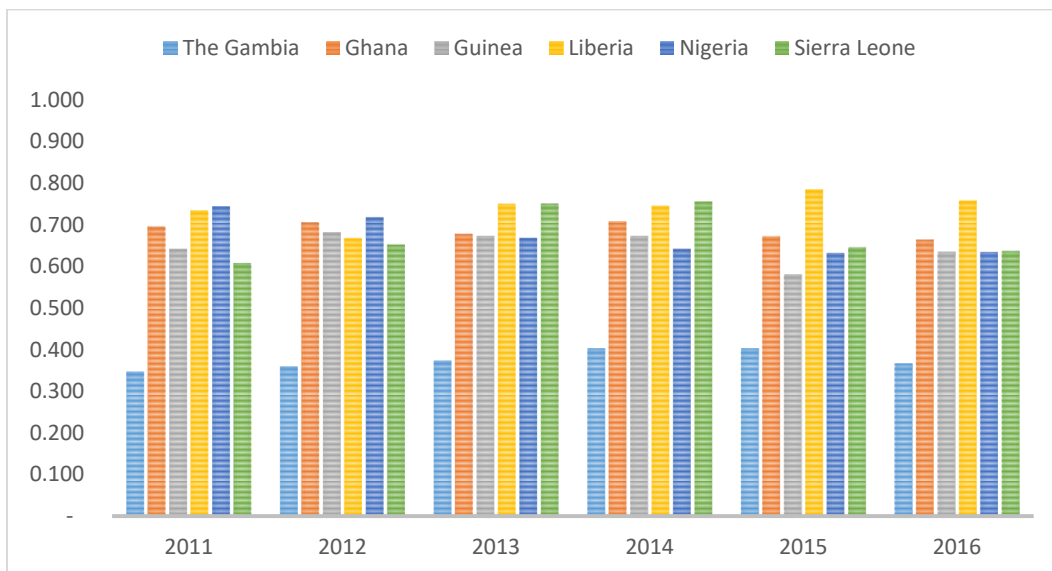
Period	The Gambia	Ghana	Guinea	Liberia	Nigeria	Sierra Leone	WAMZ	WAMZ (less Nigeria)
2004	0.479	0.659	0.529	0.794	0.580	0.590	0.591	0.631
2005	0.460	0.663	0.573	0.826	0.622	0.583	0.628	0.652
2006	0.474	0.566	0.647	0.823	0.607	0.570	0.608	0.601
2007	0.452	0.577	0.615	0.811	0.604	0.561	0.607	0.600
2008	0.416	0.591	0.668	0.796	0.601	0.570	0.607	0.618
2009	0.391	0.606	0.636	0.725	0.557	0.472	0.563	0.610
2010	0.419	0.614	0.654	0.784	0.520	0.477	0.538	0.623
2011	0.441	0.684	0.644	0.755	0.670	0.620	0.661	0.689
2012	0.468	0.699	0.673	0.698	0.633	0.656	0.625	0.697
2013	0.471	0.663	0.610	0.751	0.576	0.721	0.580	0.665
2014	0.523	0.704	0.609	0.741	0.542	0.729	0.554	0.699
2015	0.518	0.686	0.540	0.782	0.524	0.638	0.528	0.669
2016	0.465	0.659	0.624	0.767	0.523	0.618	0.523	0.655
AVERAGE	0.460	0.644	0.617	0.773	0.582	0.601	0.586	0.647

Source: Authors' computations

The EVI3 scores, which were computed by utilizing the weights generated from the PCA results, were found to be similar to EVI1 in magnitude, and this is attributable to the similarities in the weights between the two EVI indicators. The WAMZ EVI3 score averaged 0.581 during the same period. Similarly, all index scores indicate high vulnerability as

they crossed the 0.5 mark. The index declined to 0.531 and 0.520 in 2010 and 2016, from 0.622 in 2005. The score of the EVI and its components for the WAMZ mirrors that of Nigeria. This can be attributed to the weight of Nigeria, since the variables used in the computation of the composite index for the Zone were aggregated.

Figure 17: Economic Vulnerability Index (EVI2) for WAMZ Countries (2011 – 2016)



Source: Authors' computations

All Member countries, except The Gambia, have an average index score above 0.5, connoting high vulnerability. Liberia and Ghana have the highest index of 0.766 and 0.638, respectively, while The Gambia has the lowest index score at 0.462. The index reveals how exposed the WAMZ economies are to external

shocks because of the inherent nature and/or characteristics of their economies. This has implications on the WAMZ integration agenda. The high vulnerability index reveals why most member countries are unable to meet the macroeconomic convergence criteria for economic and financial integration on a sustained basis

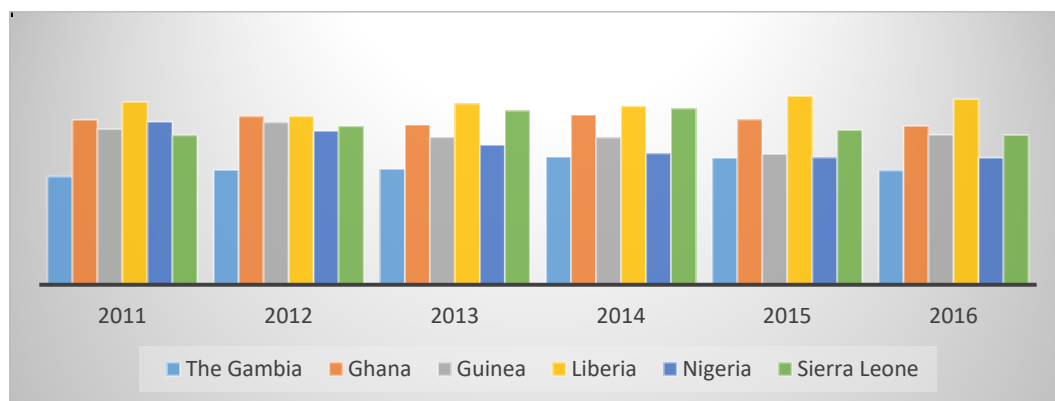
Table 15: WAMZ Economic Vulnerability Indices (EVI2)

Period	The Gambia	Ghana	Guinea	Liberia	Nigeria	Sierra Leone	WAMZ	WAMZ (less Nigeria)
2004	0.392	0.616	0.560	0.794	0.672	0.677	0.670	0.607
2005	0.363	0.631	0.588	0.837	0.704	0.671	0.701	0.630
2006	0.379	0.576	0.651	0.832	0.700	0.650	0.692	0.606
2007	0.349	0.590	0.628	0.823	0.695	0.642	0.690	0.608
2008	0.311	0.605	0.688	0.807	0.690	0.640	0.688	0.626
2009	0.302	0.624	0.698	0.704	0.658	0.515	0.655	0.629
2010	0.328	0.631	0.682	0.782	0.616	0.492	0.624	0.637
2011	0.347	0.694	0.642	0.733	0.744	0.607	0.728	0.692
2012	0.360	0.705	0.682	0.667	0.718	0.651	0.702	0.699
2013	0.374	0.677	0.673	0.749	0.669	0.750	0.664	0.684
2014	0.403	0.706	0.673	0.744	0.642	0.754	0.645	0.707
2015	0.403	0.671	0.581	0.783	0.632	0.644	0.622	0.662
2016	0.367	0.663	0.635	0.757	0.634	0.636	0.618	0.660
AVERAGE	0.360	0.645	0.645	0.770	0.675	0.641	0.669	0.650

Source: Authors' computations

A further examination of the EVI3 scores showed some interesting dynamics in the trend of the country scores overtime.

Figure 18: Economic Vulnerability Index (EVI3) for WAMZ Countries (2011 – 2016)



Source: Authors' computations

The index scores for Liberia and Nigeria reveal a declining trend as they declined from 0.819 and 0.616 in 2005 to 0.777 and 0.513 in 2010, respectively. Liberia's index score declined further to 0.761 in 2016, while that of Nigeria increased

marginally to 0.521 during the same period. The indices for Gambia, Ghana and Sierra Leone, however, exhibited initial declines before increasing. The global commodity price slump during 2014 – 2015 period had a drastic impact on the

WAMZ Member States, as they witnessed declines in their export earnings and total trade values in 2015 relative to their 2014 levels. Similarly, their import bills on fuel decreased

occasioned by the fall in crude oil prices. This led to declines in their vulnerability scores during the same period.

Table 16: WAMZ Economic Vulnerability Indices (EVI3)

Period	The Gambia	Ghana	Guinea	Liberia	Nigeria	Sierra Leone	WAMZ	WAMZ (less Nigeria)
2004	0.481	0.653	0.527	0.787	0.574	0.586	0.585	0.626
2005	0.462	0.656	0.568	0.819	0.616	0.579	0.622	0.646
2006	0.475	0.561	0.641	0.816	0.602	0.568	0.603	0.597
2007	0.453	0.573	0.612	0.804	0.599	0.558	0.603	0.596
2008	0.418	0.587	0.664	0.788	0.596	0.570	0.601	0.613
2009	0.394	0.600	0.632	0.718	0.552	0.470	0.558	0.605
2010	0.422	0.608	0.648	0.777	0.513	0.473	0.531	0.617
2011	0.444	0.677	0.638	0.750	0.669	0.613	0.659	0.682
2012	0.471	0.690	0.666	0.691	0.631	0.650	0.622	0.689
2013	0.474	0.656	0.605	0.743	0.573	0.714	0.576	0.659
2014	0.525	0.697	0.604	0.732	0.538	0.722	0.550	0.692
2015	0.520	0.678	0.536	0.774	0.521	0.634	0.525	0.661
2016	0.468	0.651	0.615	0.761	0.521	0.614	0.520	0.648
AVERAGE	0.462	0.638	0.612	0.766	0.577	0.596	0.581	0.641

Source: Authors' computations

5.6 Implications of Vulnerability of WAMZ Member States on the Convergence Process

Evidence indicated that WAMZ Member States and the entire zone have been vulnerable to external shocks over the years and this has far reaching implications on the macroeconomic convergence process. Most of these countries rely heavily on the export of primary commodities, whose prices are very volatile and extremely difficult to predict, for foreign exchange earnings and government revenues. Thus, commodity price booms are accompanied by rapid output growth, massive investments and increased fiscal space for commodity exporters,

among others. However, price falls put macroeconomic policies in commodity dependent countries, like WAMZ Member countries, to a serious test.

Commodity price falls usually induce substantial declines in government revenues in commodity-dependent countries. Countries with no adequate fiscal frameworks – fiscal rules or savings/stabilization funds to counter the volatility in revenues may find it difficult to meet their desired fiscal deficit levels, as governments have had difficulties in quickly adjusting their public investment programmes to lower expenditure outlays in line with the fall in revenues. Consequently, price volatility has made it difficult for WAMZ economies to attain the fiscal

deficit criterion of not more than 3 percent of GDP on a sustained basis. Countries that select public investment programmes and undertake those considered necessary to improve growth with a view to reducing expenditures in response to falling revenues tend to witness declines in income and employment.

Increased fiscal deficits have to be financed mainly by debt creation, giving rise to increases in debt profile of those countries. Domestic debt is usually financed either by the banking system, including the central bank, or the general public. Central bank financing may surpass the prescribed thresholds in periods of low commodity prices. In addition, financing through debt flows tend to increase the public debt profile and its accompanying debt ratios, making it difficult to satisfy the secondary convergence criteria requiring Member States to attain a public debt to GDP ratio of not more than 70 percent.

Substantial declines in foreign exchange inflows during commodity price shocks are accompanied by declines in international reserves of these economies, with the reserves falling below the prescribed minimum in some instances. In addition, lower prices and weaker capital inflows have the potential to trigger higher current account deficits and substantial currency depreciation. Widening fiscal deficits and currency depreciation has led to increase in inflation in some

instances, making it difficult to attain a single digit inflation criteria. Higher inflation has been followed by increases in policy interest rates by central banks, and the tighter monetary stance, combining with higher government borrowing, cause increases in borrowing costs, leading to deceleration of growth in credit to the private sector and its attendant consequences on economic growth.

In addition, vulnerability of Member States to external shocks would reinforce the differential growth paths, which would create divergence in standard of living across the countries. Given that free mobility of goods and persons is one of the core elements of the proposed WAMZ monetary union, movement of people, in particular, would skew towards countries with higher standard of living thereby putting pressure on resources in these countries.

Experience from all continents indicated that governments have had difficulties in putting in place a macroeconomic framework that safeguards the stability of economic growth during commodity price swings (IMF, 2015). Thus, high vulnerability to external shocks emanating largely from huge dependence on commodity exports tends to exacerbate economic downturn in WAMZ countries and making it difficult to attain the agreed macroeconomic convergence criteria on a sustained basis.

6.0 CONCLUSION AND RECOMMENDATIONS

WAMZ Member States are mostly low income countries and exhibit characteristics which make them susceptible to macroeconomic vulnerability. The small size of most of these economies, huge dependence on strategic imports of food and fuel products, concentration of exports on few primary commodities, dependence on foreign sources of finance (foreign aid) and to a lesser extent, prevalence of crises and natural disasters make them very susceptible to shocks and output growth volatility. This study sought to measure the degree of vulnerability of WAMZ member countries and the entire zone to external shocks and the implications of these on the convergence process. The paper adopted a modified version of Briguglio (2014) computation methodology to calculate the economic vulnerability indices for all the WAMZ countries. The computed EVI was made up of three components – trade openness, export concentration and dependence on strategic imports – and was arrived at by averaging the indices derived from the three components.

The paper computed three different EVI indicators by assigning distinguishing weights to each of the components, and selected EVI3 as the preferred vulnerability indicator. Results from the analysis indicated that the average EVI for the zone was 0.581, implying that the zone as a

whole was vulnerable to external shocks. Liberia, Ghana and Guinea were the most vulnerable countries during the period while The Gambia had the least indicator. The trade openness indicator for the zone averaged 0.436, with Liberia having the highest index averaging 1.000, while Nigeria was the least open. Nigeria had the highest export concentration index averaging 0.952, while the zone's index as a whole was 0.928. The Gambia had the highest dependence on strategic imports with an index averaging 0.557, indicating that it was highly vulnerable to external shocks through the importation of food and fuel products. The zone's DSI was, however, found to be lower than 0.5 implying lower vulnerability to shocks during the period.

Being highly vulnerable to external shocks may have profound implications on the achievement of the convergence criteria and the sustenance of the monetary union. High vulnerability may trigger wider fiscal deficits in countries with no adequate fiscal frameworks to control volatility in government revenues, increase in public debt arising from the financing of higher budget deficits, lower international reserves emanating from lower foreign exchange inflows, exchange rate instability and higher inflationary pressures.

The huge impact of macroeconomic vulnerability could be mitigated in WAMZ economies by implementing a number of measures aimed at building economic resilience – enhancing countries’ ability to economically cope with or withstand vulnerability emanating from external shocks. The emphasis on resilience was important because of the huge success achieved by countries such as Singapore in nurturing economic resilience through appropriate economic policies to neutralize risks emanating from macroeconomic vulnerability and achieve a high level of economic development. These measures include: ensuring macroeconomic stability with a healthy government fiscal position. Healthy foreign exchange reserve buffers can also help a country withstand the adverse impact of external shocks without significant welfare losses while a healthy fiscal position would allow the government to increase expenditures to cope with shocks.

Other measures to increase resilience include ensuring good governance, especially the rule of law and security of property rights; ensuring social development as it allows for an

effective functioning of an economy and limits the possibility of civil unrest when economic crises occur; and ensuring market efficiency so that such markets could adjust rapidly towards equilibrium following an external shock. In addition to building resilience, member countries need to make efforts in diversifying their export base; establish and adequately utilize savings and stabilization funds and implement fiscal rules to enable countries save a certain portion of earnings, and utilize the saved funds to augment government revenues in periods of commodity price falls; and use market-based instruments including forwards, futures and options to manage commodity price risks. This study was limited in that it only computed the EVI for the WAMZ Member countries, and the results showed that the zone was highly vulnerable to external shocks during the study period. However, there is need to compute the economic resilience index to examine the extent to which WAMZ Member countries are able to withstand such vulnerability in their economies. This is an area for further research.

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Table A1: Economic Vulnerability Indices of The Gambia

Period	Trade Openness Index (TOI)	Export Concentration Index (ECI)	Dependence on Strategic Imports Index (DSI)	Economic Vulnerability Indices (EVI)		
				EVI1	EVI2	EVI3
2004	0.7235	0.1629	0.5514	0.4793	0.3916	0.4810
2005	0.7295	0.1118	0.5378	0.4597	0.3632	0.4615
2006	0.7844	0.1528	0.4857	0.4743	0.3790	0.4746
2007	0.7776	0.0990	0.4790	0.4519	0.3487	0.4525
2008	0.7126	0.0389	0.4973	0.4163	0.3112	0.4181
2009	0.6186	0.0563	0.4990	0.3913	0.3016	0.3938
2010	0.6221	0.0677	0.5666	0.4188	0.3282	0.4221
2011	0.6809	0.0919	0.5507	0.4412	0.3474	0.4437
2012	0.7381	0.0631	0.6019	0.4677	0.3597	0.4708
2013	0.7041	0.1001	0.6091	0.4711	0.3736	0.4742
2014	0.8546	0.0912	0.6220	0.5226	0.4031	0.5249
2015	0.8128	0.0924	0.6473	0.5175	0.4030	0.5205
2016	0.7042	0.0918	0.5996	0.4652	0.3666	0.4682
AVERAGE	0.7279	0.0939	0.5575	0.4598	0.3598	0.4620

Table A2: Economic Vulnerability Indices of Ghana

Period	Trade Openness Index (TOI)	Export Concentration Index (ECI)	Dependence on Strategic Imports Index (DSI)	Economic Vulnerability Indices (EVI)		
				EVI1	EVI2	EVI3
2004	0.9905	0.6082	0.3781	0.6589	0.6156	0.6527
2005	0.9764	0.6617	0.3499	0.6627	0.6311	0.6557
2006	0.6571	0.6614	0.3782	0.5656	0.5756	0.5614
2007	0.6519	0.6763	0.4033	0.5772	0.5895	0.5733
2008	0.6884	0.7084	0.3771	0.5913	0.6050	0.5865
2009	0.7217	0.7512	0.3460	0.6063	0.6237	0.6005
2010	0.7276	0.7567	0.3580	0.6141	0.6312	0.6084
2011	0.8652	0.8267	0.3603	0.6841	0.6945	0.6769
2012	0.9254	0.8447	0.3258	0.6986	0.7052	0.6903
2013	0.8096	0.8085	0.3696	0.6626	0.6771	0.6560
2014	0.8936	0.8115	0.4066	0.7039	0.7065	0.6973
2015	0.9918	0.7620	0.3050	0.6863	0.6709	0.6778
2016	0.8903	0.7935	0.2947	0.6595	0.6632	0.6514
AVERAGE	0.8300	0.7439	0.3579	0.6439	0.6453	0.6376

Table A3: Economic Vulnerability Indices of Guinea

Period	Trade Openness Index (TOI)	Export Concentration Index (ECI)	Dependence on Strategic Imports Index (DSI)	Economic Vulnerability Indices (EVI)		
				EVI1	EVI2	EVI3
2004	0.4968	0.6651	0.4255	0.5291	0.5595	0.5268
2005	0.6667	0.6923	0.3601	0.5731	0.5875	0.5683
2006	0.8137	0.7502	0.3783	0.6474	0.6513	0.6414
2007	0.6659	0.7067	0.4728	0.6152	0.6284	0.6120
2008	0.7378	0.8023	0.4648	0.6683	0.6881	0.6637
2009	0.5421	0.8982	0.4682	0.6362	0.6980	0.6324
2010	0.7354	0.8380	0.3880	0.6538	0.6825	0.6478
2011	0.8371	0.7272	0.3689	0.6444	0.6417	0.6383
2012	0.8549	0.8080	0.3553	0.6727	0.6816	0.6657
2013	0.5662	0.9030	0.3612	0.6101	0.6731	0.6045
2014	0.5624	0.9054	0.3602	0.6093	0.6733	0.6037
2015	0.5194	0.7362	0.3633	0.5397	0.5810	0.5357
2016	0.8293	0.7830	0.2583	0.6235	0.6349	0.6154
AVERAGE	0.6791	0.7858	0.3865	0.6171	0.6447	0.6120

Table A4: Economic Vulnerability Indices of Liberia

Period	Trade Openness Index (TOI)	Export Concentration Index (ECI)	Dependence on Strategic Imports Index (DSI)	Economic Vulnerability Indices (EVI)		
				EVI1	EVI2	EVI3
2004	1.0000	0.8998	0.4807	0.7935	0.7941	0.7865
2005	1.0000	0.9650	0.5137	0.8262	0.8366	0.8193
2006	1.0000	0.9576	0.5121	0.8232	0.8324	0.8163
2007	1.0000	0.9620	0.4723	0.8114	0.8227	0.8039
2008	1.0000	0.9539	0.4352	0.7963	0.8075	0.7883
2009	1.0000	0.7581	0.4175	0.7252	0.7043	0.7184
2010	1.0000	0.8793	0.4737	0.7843	0.7817	0.7774
2011	1.0000	0.7654	0.5009	0.7554	0.7330	0.7498
2012	1.0000	0.6938	0.3994	0.6977	0.6667	0.6911
2013	1.0000	0.8674	0.3856	0.7510	0.7494	0.7429
2014	1.0000	0.8855	0.3370	0.7408	0.7438	0.7319
2015	1.0000	0.8979	0.4468	0.7815	0.7830	0.7741
2016	1.0000	0.8320	0.4700	0.7673	0.7570	0.7607
AVERAGE	1.0000	0.8706	0.4496	0.7734	0.7702	0.7662

Table A5: Economic Vulnerability Indices of Nigeria

Period	Trade Openness Index (TOI)	Export Concentration Index (ECI)	Dependence on Strategic Imports Index (DSI)	Economic Vulnerability Indices (EVI)		
				EVI1	EVI2	EVI3
2004	0.4516	0.9754	0.3133	0.5801	0.6720	0.5741
2005	0.5312	0.9854	0.3502	0.6223	0.7040	0.6161
2006	0.4309	0.9818	0.4082	0.6069	0.6995	0.6024
2007	0.4389	0.9760	0.3970	0.6040	0.6949	0.5993
2008	0.4639	0.9751	0.3650	0.6013	0.6898	0.5960
2009	0.3666	0.9646	0.3403	0.5572	0.6577	0.5523
2010	0.4098	0.9408	0.2106	0.5204	0.6155	0.5134
2011	0.4760	0.9400	0.5954	0.6705	0.7438	0.6687
2012	0.3972	0.9419	0.5585	0.6325	0.7179	0.6308
2013	0.3487	0.9259	0.4531	0.5759	0.6686	0.5730
2014	0.3045	0.9264	0.3944	0.5418	0.6424	0.5384
2015	0.2484	0.9249	0.3997	0.5244	0.6321	0.5215
2016	0.2132	0.9229	0.4336	0.5233	0.6342	0.5211
AVERAGE	0.3909	0.9524	0.4015	0.5816	0.6748	0.5775

Table A6: Economic Vulnerability Indices of Sierra Leone

Period	Trade Openness Index (TOI)	Export Concentration Index (ECI)	Dependence on Strategic Imports Index (DSI)	Economic Vulnerability Indices (EVI)		
				EVI1	EVI2	EVI3
2004	0.4025	0.9308	0.4360	0.5897	0.6767	0.5862
2005	0.4069	0.9366	0.4055	0.5830	0.6714	0.5790
2006	0.3827	0.8741	0.4539	0.5702	0.6497	0.5675
2007	0.3830	0.8779	0.4229	0.5613	0.6424	0.5581
2008	0.3652	0.8139	0.5323	0.5705	0.6397	0.5695
2009	0.3856	0.6421	0.3891	0.4723	0.5149	0.4704
2010	0.5336	0.5826	0.3140	0.4767	0.4922	0.4731
2011	0.8894	0.6900	0.2808	0.6201	0.6071	0.6125
2012	0.8601	0.7346	0.3735	0.6561	0.6514	0.6498
2013	0.8521	0.9275	0.3846	0.7214	0.7496	0.7139
2014	0.8384	0.9084	0.4400	0.7289	0.7539	0.7225
2015	0.7350	0.7176	0.4615	0.6380	0.6443	0.6341
2016	0.6920	0.7417	0.4216	0.6184	0.6357	0.6140
AVERAGE	0.5943	0.7983	0.4089	0.6005	0.6407	0.5962

Table A7: Economic Vulnerability Indices of the WAMZ

Period	Trade Openness Index (TOI)	Export Concentration Index (ECI)	Dependence on Strategic Imports Index (DSI)	Economic Vulnerability Indices (EVI)		
				EV11	EV12	EV13
2004	0.4948	0.9404	0.3372	0.5908	0.6703	0.5851
2005	0.5654	0.9641	0.3538	0.6278	0.7013	0.6216
2006	0.4623	0.9570	0.4034	0.6076	0.6920	0.6030
2007	0.4672	0.9523	0.4025	0.6073	0.6903	0.6027
2008	0.4917	0.9551	0.3733	0.6067	0.6879	0.6014
2009	0.4027	0.9402	0.3472	0.5634	0.6548	0.5585
2010	0.4440	0.9202	0.2490	0.5377	0.6236	0.5312
2011	0.5216	0.9227	0.5398	0.6614	0.7276	0.6586
2012	0.4538	0.9243	0.4959	0.6246	0.7017	0.6217
2013	0.3987	0.9104	0.4299	0.5797	0.6639	0.5763
2014	0.3552	0.9093	0.3961	0.5535	0.6445	0.5499
2015	0.3139	0.8872	0.3844	0.5285	0.6217	0.5252
2016	0.2965	0.8835	0.3886	0.5229	0.6176	0.5198
AVERAGE	0.4360	0.9282	0.3924	0.5855	0.6690	0.5811

Table A8: Economic Vulnerability Indices of the WAMZ (Without Nigeria)

Period	Trade Openness Index (TOI)	Export Concentration Index (ECI)	Dependence on Strategic Imports Index (DSI)	Economic Vulnerability Indices (EVI)		
				EV11	EV12	EV13
2004	0.8696	0.6264	0.3985	0.6315	0.6067	0.6263
2005	0.9146	0.6741	0.3670	0.6519	0.6301	0.6456
2006	0.7273	0.6855	0.3915	0.6014	0.6056	0.5967
2007	0.6946	0.6874	0.4174	0.5998	0.6079	0.5957
2008	0.7373	0.7189	0.3984	0.6182	0.6265	0.6133
2009	0.7082	0.7544	0.3679	0.6102	0.6292	0.6047
2010	0.7434	0.7561	0.3681	0.6225	0.6371	0.6168
2011	0.8949	0.8073	0.3643	0.6888	0.6919	0.6816
2012	0.9262	0.8243	0.3392	0.6966	0.6992	0.6886
2013	0.7975	0.8247	0.3739	0.6653	0.6840	0.6588
2014	0.8701	0.8258	0.4012	0.6990	0.7073	0.6924
2015	0.9102	0.7536	0.3422	0.6687	0.6615	0.6614
2016	0.8723	0.7851	0.3089	0.6555	0.6597	0.6477
AVERAGE	0.8205	0.7480	0.3722	0.6469	0.6497	0.6408