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Article

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West African Journal of Monetary and Economic Integration

Provided in Cooperation with:

West African Monetary Institute (WAMI), Accra

Suggested Citation: Egbuna, Ngozi Eunice; Ujunwa, Augustine; Audu, Nathan Pelesai (2020) : Macroeconomic effect of COVID-19 on West African Monetary Zone (WAMZ): A fan chart probability forecast analysis, West African Journal of Monetary and Economic Integration, ISSN 0855-594X, West African Monetary Institute (WAMI), Accra, Vol. 20, Iss. 1b, pp. 38-76

This Version is available at:

<https://hdl.handle.net/10419/264265>

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MACROECONOMIC EFFECT OF COVID-19 ON WEST AFRICAN MONETARY ZONE (WAMZ): A FAN CHART PROBABILITY FORECAST ANALYSIS

Ngozi E. Egbuna (PhD), Augustine Ujunwa (PhD) and Nathan Pelesai Audu (PhD)¹

Abstract

The outbreak of COVID-19 pandemic presents an unprecedented and synchronized disruption of the economies of the West African Monetary Zone (WAMZ). This study uses the Conditional Fan Chart based on Vector Error Correction Model (VECM) to forecast the effects of the pandemic on three key macroeconomic variables that include consumer price index, gross domestic product, and external reserves. Annualized data spanning from 2000Q1 to 2020Q2 were used to forecast the macroeconomic effects of COVID-19 on the economies of WAMZ Member States from 2020Q3 to 2022Q4. The result forecast general deterioration in the selected macroeconomic variables. The pessimistic scenario further reveals that heightened uncertainty, the prominence of downside side risks from the second wave will worsen economic conditions in the WAMZ.

JEL Classification: C01, E65, F45, F62

Keyword: COVID-19, Macroeconomic Effect, Fan chart, WAMZ

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1.0 INTRODUCTION

The outbreak of the novel corona virus pandemic (COVID-19) resulted in global health crises and a synchronized slowdown in global economic activities. The disruptive effects of the COVID-19 influenced policy makers and scholars to describe the pandemic as a 'black swan' or 'world war 3' (Ferneini, 2020). COVID-19 was first announced in the Wuhan City of China by the World Health Organization's (WHO) Beijing Office on the 31st of December 2019. The speed and intensity of the spread precipitated global panic. For instance, the first overseas case was in Thailand on 13th January 2020, barely two weeks after the announcement. By 7th March 2020, the virus had already spread to over 100 countries and transmitted to more than 100,000 people globally. WHO declared it a Public Health Emergency of International Concern (PHEIC) on 30th January, 2020, coded it COVID-19 on the 11th of February 2020, and declared the virus a global pandemic in March 2020 (Shaw et al., 2020; and Carico-Jr et al., 2020).

As at 9th June 2020, the virus has been transmitted to 215 countries, with a total of 7,225,990 (seven million, two hundred and twenty-five thousand, nine hundred and ninety) confirmed cases, 409,299 (four hundred and nine thousand, two hundred and ninety-nine) deaths and 3,559,624 (three million, five hundred and fifty-nine thousand, six hundred and twenty four) recovered cases. This brings the fatality rate to 5.7% and recovery rate to 49.26%, globally (CNNhealth, 2020). To slowdown the spread of the virus, a number of measures were recommended by the WHO, such as social or physical distancing (maintain a distance of 1 – 2 metres away from others), remote work policy, frequent washing of hands, avoid touching of the face, nose and mouth, frequent use of alcohol-based sanitizer, and wearing of facemask (Nicola et al., 2020; and Carico-Jr et al., 2020). Person-to-person contact is identified as the most effective transmission channel, while the high rate of mobility of people due to globalization and global interconnectedness accounted majorly for the high rate of spread globally (Shaw et al., 2020).

There is extensive effort to develop a vaccine, disseminate information on the insightful properties of the virus, and develop effective techniques to reduce the infection rate. As of June 9, 2020, none of the hypothetical vaccine for the COVID-19 had completed clinical trials. For instance, 6 hypothetical vaccines had commenced Phase 1 trials, and 5 are in Phase I–II safety and efficacy studies. Scholars are also studying the epidemiology and clinical characteristics of the virus (Huang et al., 2020), the psychological affects (Thakur & Jain, 2020), epidemic surveillance strategies and response (Buckee, 2020), and virtual health care application (Webster, 2020).

Owing to its recent origin, scholars and practitioners are also trying to demystify the overall impact of COVID-19 on the global environment. Specifically, the outbreak of COVID-19 has stimulated plethora of empirical studies on the effects of COVID-19 on crime rate (de la Miyar et al., 2020; and Hodgkinson & Andresen, 2020), health and economic policies (Firano & Fatine, 2020; Fouda et al., 2020), banking sector and systemic risk (Zheng & Zhang, 2020; and Rizwan et al., 2020), financial cost (Sivakanthan et al., 2020), financial market volatility (Baek et al., 2020; and Albulescu, 2020), commodity market (Shruthi & Ramani, 2020; Salisu et al., 2020; Narayan et al., 2020; and Mensi et al., 2020), electricity

consumption (Prol & Sungmin, 2020); stress level (Barrafrem et al., 2020); and the macroeconomic consequences (Firano & Fatine, 2020; and Caggiano et al., 2020).

On the social impact of COVID-19, Lemke et al., (2020) established a strong correlation between the increasing rate of COVID-19 infections and threat to the health, safety, and stress of commercial drivers. de la Miyar et al., (2020) used event data methodology and crime data from the Mexico City's Attorney General's Office that covered extortion, kidnapping, homicides, assault-battery, vehicle theft, robbery, burglary and domestic violence across 16 districts in Mexico city from 2019 to 2020 to examine the effect of COVID-19 on crime rate, and found sharp decline in conventional crimes such as “domestic violence, burglary, assault, battery, extortion and vehicle theft”, but no significant difference in organized crimes such as “robbery, kidnapping, and homicides”. Hodgkinson & Andresen (2020) also examine the effect of COVID-19 on crime rate in Vancouver, Canada, and found changes in crime pattern and varying frequencies, due restriction of movement, which they attributed to shifted opportunity structure and economic activities. Prol & Sungmin (2020) established cumulative decline in electricity consumption within the five months following restriction of movements in Germany and Great Britain, while Italy, France, Spain, California, Austria and New York recorded slight increases.

On the health and economic policy responses, Kennelly et al., (2020) attributed the low rate of COVID-19 in Ireland to the existing robust health policies and stable economy before the outbreak of the virus. Fouda et al., (2020) also reviewed the health policies and economic impact of COVID-19 in Greece, Iceland, New Zealand, and Singapore, because of the success story of low infection rate in the countries, and attribute the success story to the countries’ ability to leverage on previous experience on communicable diseases and the early, proactive, and strict interventions, by the authorities. Barrafrem et al., (2020) examined the influence of personal and contextual factors of financial wellbeing during stressful and turbulent times of COVID-19 in the US and Sweden, and found evidence of “financial better-than-average” effect - significant household believe that personal economies will perform better than the global and national economies, - and that financial ignorance is driving decreased financial wellbeing.

Goodell (2020) documented the direct and indirect impact of COVID-19 on the financial market and institutions and highlight the huge economic cost on the transmission channel. On the associated financial cost due to COVID-19, Sivakanthan et al., (2020) investigated the financial impact of COVID-19 on an academic neurosurgery department before and after the declaration of COVID-19 as a global pandemic in 2020, and found significant decrease of 51.4% in weekly average daily work relative value units. The author argues that the decline in the number of inpatient and outpatients in hospitals amount to huge productivity and revenue loss. Zheng & Zhang (2020) and Rizwan et al., (2020) highlight the systemic risks COVID-19 impose on the banking system and the Microfinance in particular.

Studies have also documented the effects of COVID-19 on the stock market. For instance, Baek et al., (2020) used a Markov AR model with machine learning features to examine regime change from lower to higher volatility in the stock market. The authors established that positive and negative news about COVID-19 were the predictors of market volatility, with strong presence of negativity bias, that is, negative news being more impactful than positive news. Albulescu (2020) used the COVID-19 infection and death rate to model global and the US sanitary crises and examined the effect of COVID-19 on S&P 500 volatility. Albulescu (2020) results revealed that prolongation of the pandemic is a major

source of financial volatility in the US. Salisu & Vo (2020) also examine the importance of health news (COVID-19 pandemic) in predicting stock returns, using data from top-20 worst-hit countries, and found models that incorporate health news to performed better than the benchmark historical average model. Narayan et al., (2020) examined the relationship between the Japanese Yen and stock returns in Japan from August 2010 - January 2020 using different econometric models, and found 71% improvement in stock returns due to the depreciation of the Yen-to-the US Dollars during COVID-19. Mensi et al., (2020) used the Asymmetric Multifractal Detrended Fluctuation Analysis (A-MF-DFA) approach to 15-min interval intraday data to examine the impact of COVID-19 on the multifractality of gold and oil prices based on upward and downward trends, and found strong evidence of asymmetric multifractality that increases as the fractality scale increases.

On the effect of COVID-19 on commodity prices and stock returns, Salisu et al., (2020) examined the response of oil price and stock returns shocks during the COVID-19 pandemic, using a panel Vector Autoregressive (pVAR) model and a panel Logit model. Their PVAR result revealed that during pandemic, oil price and stock market returns may experience initial and prolonged impacts of own and across shocks, than period before it, and the panel logit re-enforced their PVAR result by suggesting that uncertainty associated with relevant markets account for the higher probability of negative oil and stock returns during the pandemic. Shruthi & Ramani (2020) examined the source of volatility transmission for oil price and agricultural products before and during the COVID-19 Pandemic. The authors used daily data and variance causality test, to establish zero transmission among agricultural products, but oil market volatility spills on the markets for agricultural products.

Scholars also investigated the adverse effect of COVID-19 outbreak on the global and individual country economies (Atkeson, 2020, Fouda et al., 2020; Firano & Fatine, 2020; and Caggiano et al., 2020). The results from empirical studies suggests adverse effect of COVID-19 pandemic on the macroeconomic environment of developed and developing economies. The studies, however, reveal varying degrees of the severity of the impact of the COVID-19 on different economies, a strong justification for further enquiries on other economies largely neglected by scholars. For instance, Goodell (2020) comparative analysis of the enormous economic and social impact of COVID-19 with previous outbreak of other epidemics and pandemics, showed similar pattern, in terms of the disruptive effects. Firano & Fatine (2020) examined the economic consequence of COVID-19 in Morocco using a combination of Ramsey's and epidemiological propagation models and found moderate economic consequence of the effect of COVID-19. Caggiano et al., (2020) used the VAR technique and world-level data to simulate the effect of COVID-19-related uncertainty shock on global output and found negative response to output. Similarly, the findings of Kennelly et al., (2020) in the case of Ireland revealed significant output loss during the restriction of movement and partial lockdown of the economy.

This study contributes to the debate on macroeconomic effect of COVID-19, using the WAMZ economies (The Gambia, Ghana, Guinea, Liberia, Nigeria, and Sierra Leone) as the case study and for two main reasons. First, the health crises, border closure, slowdown of economic activities, and uncertainties associated with the COVID-19 outbreak may have dislocated the fragile economies in the WAMZ. Forecasting the macroeconomic effect of COVID-19 on the WAMZ economies is extremely important because of the paucity of empirical studies on the Zone, and more importantly, for policy design.

Secondly, epidemiologists are already predicting a second wave, due to the recent increase in infection rate and the likelihood of another lockdown of economic activities. Forecasting the macroeconomic effect of the second wave in the WAMZ could be extremely useful for policy formulation response. The remainder of the paper is structured as followed: Section 2 reviews the macroeconomic developments in the WAMZ during the pandemic and policy responses by Member States to reduce the spread of the virus, and cushion the adverse effect of the pandemic, section 3 forecasts the macroeconomic effect of COVID-19 on three key variables – consumer price level, gross domestic product and external reserves; while section 4 concludes the paper and offers policy recommendations.

2.0 MACROECONOMIC EFFECT OF COVID-19 AND POLICY RESPONSES IN THE WAMZ

2.1 Macroeconomic Effect of COVID-19 in the WAMZ

Prior to the outbreak of COVID-19, the economies of WAMZ Member State were fragile, and generally classified among the 28 poorest countries in world (CGTN Africa, 2020), except for Nigeria and Ghana. Due to the outbreak of the pandemic and the unexpected impact on global economies, multilateral institutions have presented several projections of macroeconomic conditions. Table 1 presents a summary of IMF forecast of growth, consumer price index and current account balances for 2020 and 2021 in the WAMZ.

The Gambian has consistently achieved the single-digit inflation criterion from 2015 to end-December 2019. End-period inflation increased by 1.3 percentage point from 6.4% in 2018 to 7.7% in 2019. The Gambia external reserves improved significantly to 4.3 months of import cover in 2019 from 3.1 in 2018. Real GDP growth moderated by 0.8 percentage point from 7% in 2018 to 6.2% in 2019. Due to the outbreak of COVID-19, the macroeconomic performance of the Gambian economy was mixed. The Gambian Bureau of Statistics projected negative growth of 1.2% in the first half of 2020, as the Central Bank's Composite Index of Economic Activity (CIEA), reveal economic slowdown in economic activities in the second quarter of 2020 (Central Bank of the Gambia, 2020).

External sector development in the Gambian indicates adverse effect of COVID-19 as current account balance as at end-June 2020 deteriorated to a deficit of US\$62.9 million (3.5 percent of GDP) from a deficit of US\$23.9 million (1.4 percent of GDP) in the corresponding period of 2019 due to wider decline in services account balance and trade deficit. Import amounted to US\$336.4 million from January to June 2020, higher than US\$275.5 million in the same period in 2019, while exports decreased to US\$52.1 million in June 2020 from US\$70.1 million in the corresponding period of 2019. The gross international reserves are approximately above 5 months of import cover and stood at US\$325.4 million (Central Bank of the Gambia, 2020). Dalasi depreciated by 1.4% and 4.6% against the US dollar and euro, respectively, but appreciated against the pound sterling by 1.1% from January to July 2020. Price development marked decelerated inflationary pressure from January to July, as headline inflation decline from 7.3% in July 2019 to 4.8% percent in July 2020.

The performance of Ghana's economy was mixed during the first half of 2020, as the first quarter real GDP grew by 4.9% in 2020 compared to 6.7% in the same period in 2019, before contracting by 3.2% in the second quarter compared to 5.7% growth in the corresponding period of 2019 (Bank of Ghana,

2020a). Headline inflation edged up sharply to 11.4% in July 2020 from 7.8% in January-March 2020 due to partial lockdown and panic buying in the two major cities - Accra and Kumasi (Bank of Ghana, 2020a and 2020b). Ghana trade surplus contracted from 2.1% of GDP in the first eight months of 2019 to 2.0% of GDP in 2020, due to contraction in total exports and imports. Despite the contraction in trade surplus, gross international reserves position improved from US\$8,418.1 million at end-December 2019 to US\$8,561.9 million in August 2020, which is equivalent to 4 months of import cover.

In Guinea, real GDP growth is projected to significantly drop by 1.3% in 2020, against 6.2% in 2019, due to the impact of COVID-19 on the real sector. Inflation pressure accelerated during the second quarter of 2020 as end-period inflation stood at an average of 11.5% during the quarter, as compared to 9.6% in the corresponding quarter of 2019. Average inflation also rose to 9.7% during in 2020Q1. The Guinean franc depreciated, year-on-year, against both US dollar and euro during the review period. On the official market, the GNF depreciated against the US dollar exchange rate by 4.6 percent to GNF 9594.2 at the end of June 2020, compared to GNF 9154.0 a year ago. The euro exchange rate was 10758.0 by end-June 2020, corresponding to a depreciation of 3.3% as compared to the corresponding period of 2019.

According to the Central Bank of Liberia (2020a), Liberian real GDP is projected to contract by 2.5% in 2020 due to the adverse effects of COVID-19 and subdued activities in the economy. In the first half of 2020, inflationary pressure moderated by 5.7 percentage points to 18%, while remittances inflow stood at US\$48.4 million in the second quarter of 2020. The depreciation of Liberian dollar moderated by 0.2% in May 2020 compared to 8.7% in May 2019, while the gross external reserves improved marginally by 1%, due to fall in demand for foreign exchange to facilitate payments for imports. The gross external reserves stood at US\$253.8 million, representing 2.4 months of import cover. Liberia reported trade surplus of US\$4 million from US\$55.3 million (1.9% of GDP) reported in April 2020 (Central Bank of Liberia, 2020b).

Nigeria's real Gross Domestic Product contracted by 6.10 per cent in the second quarter of 2020 compared with an expansion of 1.87% in the second quarter of 2019. Headline inflation remained uptick (year-on-year) to 13.22% in August, from 12.82% in July 2020, largely driven by the persistent increase in the food prices (CBN, 2020a). The COVID-19 and partial economic lockdown continued to undermine the external sector as aggregate foreign exchange inflow, capital importation and external reserves declined by 43.2%, 21.0% and 0.7% to US\$5.52 billion, US\$0.25 billion and US\$36.19 billion in May 2020, below their respective levels in the preceding month (CBN, 2020b). Nigeria recorded a surplus trade of US\$0.10 billion in May 2020, and average exchange rate were N361.00/US\$, N443.33/US\$ and N386.25/US\$, at the inter-bank rate, the bureau de change (BDC) segment of the foreign exchange market, and the I&E window, respectively.

The outbreak of COVID-19 is exerting negative pressures on Sierra Leone's macroeconomic environment, prompting the government to revise the 2020 real GDP projection from -2.2% to -3.1% (Johnson-Sirleaf et al., 2020). Inflationary pressure which stood at 13.9%, is projected to rise to 15.6% in 2020, due to lockdown and depreciation of the Leone. Government revenue was adversely affected as total revenue collected in the first quarter of 2020 amounted to Le2.65 trillion, 13% less than the target of Le3.04 trillion. The decline in revenue is attributable to the restriction of movement and partial economic lockdown. Similarly, fiscal deficit is expected to worsen from estimated increase of -2.8% in

2019 to -3.3% in 2020, and recently revised to -6% due to the pandemic. Leone is forecast to depreciate to Le10,717 in 2020 due to COVID-19 as against the December 2020 initial estimate of Le10,510.

2.2. WAMZ Member States Policy Responses to COVID-19 Outbreak – June 2020

The declaration of the novel corona virus as a global pandemic jolted many countries into adopting policies to either prevent its spread into their economies and/or limit the rate of local transmission. The generic responses in the Zone include social distancing, border closure and movement restrictions. WAMZ Member States designed stimulus package, accommodative monetary policy, and loan restructuring, to alleviate the impact of the macroeconomic impact. This section highlights individual country responses between February and June 2020.

2.2.1 The Gambia

The Gambian government confirmed the first COVID-19 case on the 17th of March 2020, and as of June 6, 2020 the country had recorded 26 confirmed cases, a total recovery of 21 persons and 1 confirmed death. To contain spread of the deadly disease, the country declared state of emergency and closed all non-essential services for 21 days, including international borders on March 27, 2020. The emergency power was also used to freeze prices of essential commodities such as cement, cooking oil, rice, beans, fish, meat, sanitizers, and soap.

The government enforced the social distancing rule by limiting public gathering and funeral to a maximum of 10 persons, while allowing commercial vehicles to carry half of the licensed passengers. Tourism, trade, and remittances, that constitute major source of foreign earnings dropped drastically due to border closure. In terms of fiscal response, 500million Dalasi was reallocated from the 2020 budget to the Ministry of Health in addition to the US\$9 million obtained as grant. The amount of US\$15.8 million was set aside for nation-wide food distribution programme to 84 percent of the households, while 2000 tons of fertilizer was distributed to farmers. To safeguard nutrition, ensure food security, and improve communication among the vulnerable groups impacted by COVID-19, donor agencies provided cumulative financial assistance of about US\$1.5 million, in addition to the US\$10 million World Bank grant for the country's COVID-19 Response and Preparedness Project. IMF also approved US\$21.3 million under the Rapid Credit Facility (RCF), in addition to debt relief under the catastrophe containment window of the Catastrophe Containment and Relief Trust (CCRT) approved on April 13, 2020. The monetary authority reduced monetary policy rate by 50 basis points to 12 percent in February 2020.

2.2.2 Ghana

Ghana confirmed the first two COVID-19 cases on the 12th of March 2020. As of June 6, 2020, there were 9,462 confirmed cases, 3,547 persons recovered with 44 deaths. Policy responses dates back to March 16, 2020, when the government issued a comprehensive guideline to contain the spread. Specific responses include 14-day mandatory self-quarantine for any Ghanaian resident who has been to a country with at least 200 confirmed cases of COVID-19, restriction of all public gatherings to 25 people for four weeks and suspension of religious gatherings and schools indefinitely. The government closed all international borders on the 23rd of March and partially locked down major urban areas on the 30th of March. The partial lockdown of major cities was lifted on the 23rd of April 2020.

The fiscal policies include the setting aside of US\$100 million to support health sector preparedness in combating the virus, and US\$210 million stimulus packages under its Coronavirus Alleviation

Programme to support SMEs and pharmaceutical sector supplying COVID-19 drugs and equipment. The government announced the waiver of water and electricity bills, the upgrade of 100 regional and district hospitals, plans to borrow up to GHc 10 billion from the Bank of Ghana (BoG) and draw US\$218 million from the stabilization fund. The monetary policy measures include reducing policy rate by 150 basis points, lowering the cost of mobile payments, revising provisioning and classification rules for specific loan categories, lowering the capital conservation buffer from 3% to 1.5%, and primary reserve requirement from 10% to 8% on March 18, 2020. On May 15, 2020, the MPC announced the purchase of a 10-year bond with a face value of GHc 5.5 billion (1.4% of GDP), while indicating that future purchases may increase up to GHc 10 billion to provide emergency financing for the fiscal authorities.

2.2.3 Guinea

Guinea recorded the first case of COVID-19 on the 13th of March 2020. The total number of confirmed cases stood at 4,117 with 23 deaths, while a total of 2857 persons recovered as of June 6, 2020. To reduce the risk of contagion, the government undertook similar policies such as prohibition of public and religious gatherings, closure of internal airports and land borders, closure of schools, and suspension of visa issuance to travelers from countries with more than 30 cases. The government collaborated with international development partners in preparing the National Emergency Preparedness and Response Plan for the COVID-19 outbreak and the implementation cost was estimated at US\$47 million. In a bid to mitigate the adverse effects of the pandemic on the most vulnerable people, small and medium enterprises and the health sector, the government further announced the COVID-19 economic recovery plan of US\$290 million.

Other fiscal measures include waiver on the payment of utilities for the most vulnerable, cash transfers, social contributions and payment of utilities for firms in the most affected sectors, introduction of temporary exonerations on taxes, and the implementation of labor-intensive public works, in addition to supporting agricultural value chain such as potatoes, pineapple and cashew. The monetary authority reduced the policy rate and reserve requirement by 100 basis points to 11% and 15% respectively. The Central Bank of Guinea suspended NPL classification for individuals and businesses affected by the pandemic, relaxed net open position in foreign exchange to capital from 20% to 25%, and from 10% to 12.5% percent for each currency. Financial institutions were directed to limit to the barest minimum, technical assistance fees paid to their parent companies, as they enjoy three months postponement of contribution to the deposit insurance scheme and payment of supervision related-fees, in addition to reducing identification requirement for e-money and e-money transfer fees.

2.2.4 Liberia

Liberia recorded the first COVID-19 case on 16th March 2020. As of June 6, 2020, Liberia had 345 confirmed cases and 30 deaths, 185 persons fully recovered from the Corona virus. To reduce the speed of spread, the government implemented several social distancing policies such as limiting the maximum number of people in public gatherings to 10 persons, admittance to restaurants and banks to five persons kept six feet apart, and closure of schools, religious gathering and banning of street selling. The government allocated US\$25 million to be supplemented by donor fund to combat the adverse effects of the pandemic on households.

The World Bank approved US\$17 million off-budget project funding for the health sector, of which US\$7.50 million was new investment financed by the COVID-19 Fast Track Facility; and virement of \$9.5 million from existing projects. The African Development Bank approved significant budget support on April 8, 2020 for the COVID-19 Response Facility. The Central Bank is striving to resolve the shortage of Liberian Dollar notes and has allowed commercial banks practice limited forbearance on asset classification, provisioning, and lending policies in hard-hit sectors of the economy. The Central Bank further suspended charges and fees on electronic transfers and increased the allowable daily transactions/withdrawal limit.

2.2.5 Nigeria

Nigeria recorded the first confirmed case of COVID-19 on 28th February 2020. The total number of confirmed cases was 12,233 and 342 deaths, while 3,826 persons recovered as of June 6, 2020. To contain the spread of the virus, the government adopted series of measures such as closure of all international borders, banning public and religious gatherings, schools, and interstate movement. The government disbursed US\$2.7 million to the Nigeria's Center for Disease Control, with additional US\$18 million for personnel training and purchase of kits, and US\$28 million released to the Lagos State government. The Nigerian Solidarity Support Fund which is to assist the existing social investment programme and health centres in Local Government was established with a targeted fund of US\$50 million.

The Central Bank introduced series of policy measures such as regulatory forbearance to restructure loans affected by pandemic outbreak, N3.6 trillion liquidity injection into the banking system, dedicating US\$139 million credit facility, reduction of interest rate of its intervention fund from 9% to 5% with one year moratorium, support fund of N100 billion for the health sector, Naira1.5 trillion for the real sector, Naira2 trillion for the manufacturing sector, and Naira1 trillion for agricultural sector. The monetary authority is the coordinator of targeted US\$333 million private sector special intervention to fight COVID-19.

2.2.6 Sierra Leone

Sierra Leone confirmed first case of COVID-19 on the 31st of March 2020, and has recorded 969 confirmed cases, 608 persons recovered and 48 deaths as of June 6, 2020. Some of the policy responses to contain the spread of the virus include border closure, social distancing, partial lockdown of the economy and special bus service for health workers. International Development Association grant of US\$7.5 million was approved by the World Bank to support the health system, and the monetary authority at an extra-ordinary Monetary Policy Committee meeting reduced monetary policy rate by 150 basis points from 16.5% to 15%, created special credit facility of Le500 billion to support the production and distribution of essential goods, and doubled the reserve requirement maintenance period from 14 to 28 days.

3.0 DATA AND METHODOLOGY

3.1 Data

To forecast the effects of the COVID-19 pandemic on the WAMZ macroeconomic environment, the first step is identifying the underlying drivers of variables of interest. To capture the most important determinants of gross external reserves, real GDP, and consumer price index, we select variables that previous studies considered as best available proxies (Alberola, 2016; Park, 2019; and Cogoljevic, 2018). The sets of variables are as follows: natural logarithm of real Gross Domestic Product (lnGDP), natural

logarithm of real broad money supply ($\ln M2$), natural logarithm of consumer price index ($\ln CPI$), natural logarithm of local currency to US dollar exchange rate ($\ln EXCHR$), domestic interest rate (DR), natural logarithm of gross external reserves ($\ln RES$), natural logarithm of current account balance ($\ln CAB$), and Equity Market Volatility ($\ln EMV$) was used to proxy uncertainty due to the COVID-19 pandemic. We use quarterly data spanning from 2000Q1 to 2020Q2, collated from the International Financial Statistics (IFS) database.

All WAMZ Member States closed their international borders, restricted public gathering and partially lockdown their economies to slow the spread of the COVID-19, to protect lives. Accordingly, these measures are expected to have adverse effect on macroeconomic environment. Table 2 summarises the cumulative number of confirmed cases, recovery, and deaths in the Zone as of June 6, 2020.

3.2 Methodology

We use a Vector Error Correction model (VECM) to assess the macroeconomic effect of COVID-19 in the WAMZ. We estimated the following VECM:

$$\Delta X_t = \alpha \beta' X_{t-1} + \sum_{i=1}^p A_i \Delta X_{t-i} + C + \varepsilon_t \quad (1)$$

Where $X_t \equiv [\ln GDP, \ln EMV, \ln EXCHR, \ln M2, \ln CPI]'$ for GDP model

$X_t \equiv [\ln EMV, \ln EXCHR, \ln M2, DR]'$ for CPI model, and

$X_t \equiv [\ln RES, \ln EMV, \ln EXCHR, \ln M2, DR, \ln CPI]'$ for RES model

X_t represents m-dimensional vector of endogenous variables; $\alpha \equiv [\alpha_{11}, \dots, \alpha_{1m}]'$ is a m-dimensional vector of short-run adjustment coefficients; β' is a (m x 1) matrix of coefficients for the 1 cointegrating relationships among the m endogenous variables; A is a (m x m) matrix of coefficients determining the short-run dynamics of the endogenous variables; C is a vector of constants; ε is a vector of error terms. Model (1) permits to decompose the forecast-error variance of all the endogenous variables. We estimate the reduced form version of the model (1) and use a standard Cholesky decomposition to make the reduced-form errors orthogonal (Goes et al., 2017). Our preferred ordering allows the more contemporaneously exogenous variables of the model precede the endogenous ones. Since the variables are time series in nature, it is important to establish the appropriateness of VECM in the study. Hence, we test for the stationary properties of the variables with Augmented Dickey-Fuller (ADF) and Philip-Perron (PP) tests. Thereafter, established the presence of cointegration among the variables using Johansen's tests (Johansen, 1991).

We employ the two-piece normal (TPN) fan chart in forecasting the macroeconomic effect of COVID-19 in the WAMZ (Elekdag and Kannan, 2009; and Blix and Sellin, 1997). Fan chart has become a popular visual communication device for forecasting macroeconomic variables, because it encourages the reader to recognize the degree of uncertainty surrounding a given forecast (Elekdag and Kannan, 2009). TPN is considered more relevant and realistic because it allows for the asymmetry of balance of risks surrounding the baseline forecasts (Blix and Sellin, 1997). The TPN fan chart enables us derive the upper and lower standard deviation (H and L or $\sigma 1$ and $\sigma 2$) and central projection (H0 and L0),

which holds everything constant prior to the outbreak of the pandemic. Finally, we determine the lower half of the normal distribution with parameters μ and σ_1 , and the upper half of a normal with parameters μ and σ_2 . These represent forecasts of probability density functions for a chosen macroeconomic variable – Consumer Price Index, Gross Domestic Product and External Reserves. It also reveals the most likely outcome surrounded by forecasts of prediction intervals at probability levels of 30, 60 and 90. Each interval is shaded, with the 30%-interval darkest and the shading becoming lighter as we move to broader intervals. These halves are scaled to give the same mode value, and the distribution is negatively (or positively) skewed if $1 > \sigma_2$ ($\sigma_1 < \sigma_2$).

3.3 Assumptions

To effectively assess the macroeconomic effects of COVID-19 in the WAMZ, we built three scenarios as follows:

Scenario 1 – Baseline Scenario

This scenario uses in-sample period of 2000Q1 to 2019Q4 to construct a model that forecast macroeconomic conditions of the selected countries if COVID-19 outbreak had not occurred. Essentially, we assume that macroeconomic economic conditions in the countries were unchanged, to effectively isolate the direct impact of COVID-19.

Scenario 2—Optimistic Scenario

This scenario uses data from 2000Q1 to 2020Q2 to forecast the macroeconomic effects of COVID-19 in WAMZ economies. We assume that the effect of COVID-19 had manifested in our respective countries, and the rate of change will be sustained for the forecast period. Our second scenario sets all variables at their 2020Q2 values.

Scenario 3—Pessimistic Scenario

Our third scenario assumes that the second wave of COVID-19 may lead another economic lockdown, heighten uncertainty, with adverse effect on the WAMZ economies. We further assume that the macroeconomic conditions of 2020Q2 will deteriorate by 5% because of the associated uncertainties.

4.0 ESTIMATION AND DISCUSSION OF RESULTS

4.1 Pre-estimation Tests

This study is set-out to examine the macroeconomic effect of COVID-19 in the WAMZ. The descriptive statistics results of the variables used are presented in Table 3, and we observed apparent degree of variation in the variables across the countries. Table 4 presents the ADF and PP unit root results, and the results reveal that all the series under consideration either stationary at level or first difference. This justifies our decision to use VECM. According to Sohaili (2010), the anxiety of spurious result is eliminated once the variables are $I(0)$ and others are $I(1)$, and there is presence of cointegration among the variables.

The choice of selected lag length also determines the stability of VECM. For instance, too long lag length may lead to loss of degree of freedom, while too short a lag length may exclude relevant information, thus, parsimony should apply in the selection of lag length. Table 5 presents the lag length selection criteria using the Schwarz information criterion (SC). The stability of VECM is extremely

important in predicting the future direction of key variables. Figure 1a -1f present the autoregressive roots and graphs of the respective countries along the three models for each of the countries., and the graphs indicate that models are stable as all the eigenvalues lies within the unit root circle. To establish the presence of a long run equilibrium relationship among the variables, the Johansen Cointegration test based on trace values test statistics was conducted and the results presented in Table 6. The results of trace test statistics show that at least one test statistic which are greater than the 5% critical value thereby, rejecting the null hypothesis of no cointegrating variables.

4.2 Fan Chart Forecast

The forecast period is 2020Q1 to 2022Q4 for the baseline scenario and 2020Q3 to 2022Q4 for the realistic and pessimistic scenarios. Figures 2a to 4c present the fan chart forecast for consumer price index, gross domestic product, and external reserves. The tiny blue line shows the baseline projection. The three different prediction intervals including 30, 60 and 90 are represented with shades of green. 30% prediction interval is displayed with the darkest band and 90% band is in the lightest band. Our preferred band for analyzing the fan chart forecast is the 90% confidence interval, the widest band of the fan chart usually reflects the 90% confidence interval, while the remaining 10% that is not captured by the fan chart represents the likelihood of tail-end risks events. These risks are the outlier events that are assessed to occur with very low likelihood (Razi & Loke, 2017).

4.2.1 Baseline Scenario

The baseline scenario uses historical data before the COVID-19 to forecast macroeconomic performance of the WAMZ. This objective is to gain insight on what would have been the performance of the economies in the absence of the COVID-19 outbreak.

The Gambia

Figure 2a presents the fan chart forecast of consumer price index (CPI), GDP, and gross external reserves. The central projection indicates that Gambia CPI may increase at subdued rate by 5.66%, 5.79%, and 5.87% in 2020Q4, 2021Q4 and 2022Q4, respectively. The 90% confidence interval also reveal higher probability that CPI will rise higher than the central projection, indicating an upside risk to inflation with respect to the forecast range. The central projection of fan chart forecast of gross domestic product revealed uptrend of 8.68% and 8.71% in 2020Q4 and 2021Q4, respectively, and gradual decline of 8.70% in 2022Q4 in the elasticity of gross domestic product. At 90% confidence interval, there is a higher probability that the future inflation falls below its modal forecast, due to larger downside risks for growth with respect to the forecast range. The central projection fans out accretion to reserves by 5.46% and 5.54% by 2020Q4 and 2021Q4, respectively, and gradual decline to 5.50% in 2022Q4. The forecast of probability density functions at 90% confidence interval indicates higher probability of gross external reserves falling below the central projection than increasing above the central projection, due largely to downside risks to the forecast range

Ghana

Figure 2b presents the fan chart forecast of CPI, GDP, and gross external reserves of Ghana. The central projection of CPI indicates that inflationary pressure for the forecast period as CPI is projected to increase by 6.89%, 7.05% and 7.19% in the last quarters of 2020, 2021 and 2022, respectively. More importantly, the probability of CPI increasing above the central projection larger than the probability of CPI being below the central projection. The central projection also indicate that GDP increase

gradually over the forecast horizon by 10.39%, 10.52% and 10.55% in the last quarters of 2020, 2021 and 2022, respectively. However, the probability of GDP falling below the central projection during the forecast horizon is larger than the probability of GDP being above the central projection with respect to the forecast range. The central projection also indicate that gross external reserves will increase marginally by 9.30% and 9.50% in the last quarters of 2020 and 2021, respectively, before deteriorating to 9.46% in the last quarter of 2022. The probability density function indicates higher probability of gross external reserves falling below the central projection.

Guinea

Figure 2c presents the fan chart forecast of Guinea's consumer price index, GDP, and gross external reserves. The central projection indicates that sustained inflationary pressure with the forecast horizon as CPI increases by 6.80%, 7.12% and 7.84% in the last quarters of 2020, 2021 and 2022, respectively. The probability density indicates higher probability of CPI rising above the central projection, than falling below. Similarly, the fan chart indicates that Guinea's GDP may increase by 9.45% and 9.49% in the last quarters of 2020 and 2021, and contract marginally by 9.46% in 2022Q4. However, the fan chart indicates that Guinea's gross external reserves could decline by 6.88%, 6.72% and 6.59% in the last quarters of 2020, 2021 and 2022, respectively. At 90% confidence interval, the probability density indicates higher probability of GDP and gross external reserves falling below the central projection during the forecast horizon.

Liberia

Figure 2d presents the fan chart forecast of CPI, GDP, and gross external reserves with the forecast horizon. The fan chart projects sustained inflationary pressure during the forecast period as CPI is expected to increase by 6.14%, 6.38% and 6.68% in the last quarters of 2020, 2021 and 2022, respectively. In the same vain, the fan chart indicates muted increasing trend in GDP in Liberia as GDP is projected to increase by 20.51%, 20.53% and 20.56% in the last quarters of 2020, 2021 and 2022, respectively. However, the fan chart project Liberia's gross external reserves to deteriorate by 5.32%, 5.41% and 5.59% during the last quarters of 2020, 2021 and 2022, respectively. The probability density indicates a higher probability that CPI will be higher than the central projection, while GDP and gross external reserves will be lower than the central projection.

Nigeria

Figure 2e presents the fan chart forecast for Nigeria's CPI, GDP and gross external reserves. The fan chart forecast indicates the presence of elevated inflation in Nigeria as CPI is projected to grow by 6.5%, 6.63% and 6.75% in the last quarters of 2020, 2021 and 2022. The fan chart forecast also indicates that Nigerian economy will grow at subdued rate as GDP is projected to grow by 11.03%, 11.04% and 11.05.% in the last quarters of 2020, 2021 and 2022. Nigeria's external reserves is projected improve by 10.71%, 10.73% and 10.74% in the last quarters of 2020, 2021 and 2022. The probability density indicates a higher probability that CPI will be higher than the central projection, while GDP and gross external reserves will be lower than the central projection.

Sierra Leone

Figure 2f presents the fan chart result of Sierra Leone's CPI, GDP, and gross external reserves. The fan chart forecast indicates that CPI may rise by 2.06%, 2.23% and 2.65% in the last quarters of 2020, 2021 and 2022, while GDP is projected to contract by 9.05%, 9.02% and 8.98% in the last quarters of 2020, 2021 and 2022. The gross external reserve is projected to deteriorate by 6.14%, 6.12% and 6.09% in the

last quarters of 2020, 2021 and 2022, respectively. The probability density indicates a higher probability that CPI will be higher than the central projection, while GDP and gross external reserves will be lower than the central projection.

4.2.2 *Optimistic Scenario*

This scenario fixed all variables at their changes between 2020Q1 and 2020Q2 values, while assuming the effects of the COVID-19 have already manifested in the first two quarters of 2020, and the trend will remain unchanged for the forecast period. The model predictions show that the COVID-19 had adverse effects on the Macroeconomic environment of the WAMZ relative to the baseline, which assumes the absence of COVID-19 outbreak.

Figure 3a presents the CPI forecast of the six WAMZ countries. The Gambian CPI is projected rise by 5.69%, 5.74% and 5.76% in first quarters of 2020, 2021 and 2022, which implies that the effect of COVID-19 on prices is minimal compared to the baseline forecast of 5.66%, 5.79%, and 5.87% in the same period. In Ghana, inflation remained elevated as CPI is projected to rise by 6.72%, 6.74% and 6.83% in the last quarters of 2020, 2021 and 2022, respectively. This implies subdued inflationary pressure compare to the baseline forecast of 6.89%, 7.05% and 7.19% in the same period. Guinea's CPI is projected to rise by 7.0%, 7.14% and 7.23% in the last quarters of 2020, 2021 and 2022 due to the outbreak of COVID-19. The forecast is slightly higher than the baseline forecast, except for the last quarter of 2022. The fan chart projects sustain inflationary pressure in Liberia during the forecast period as CPI is expected to increase by 5.91%, 6.06% and 6.13% in the last quarters of 2020, 2021 and 2022, respectively. In Nigeria, the optimistic scenario forecast elevated inflationary pressure since the elasticity of CPI is slightly higher than the baseline results, as Nigerian CPI is projected to rise by 6.58%, 6.73% and 6.84%, respectively, compare to the baseline scenario of 6.5%, 6.63% and 6.75% in the same period. In Sierra Leone, the fan chart projects severe inflationary pressure within the forecast period due to the outbreak of COVID-19. For instance, CP1 is projected to rise by 6.83%, 6.91% and 7.06% in the last quarters of 2020, 2021, and 2022, respectively, compare to 2.06%, 2.23% and 2.65% in the same period. At 90% confidence interval, there is higher probability of CPI rising higher than the central projection with respect to the forecast range for the respective countries.

Figure 3b presents the GDP forecast of the six WAMZ countries. The fan chart forecast projects a fragile rebound in economies of the WAMZ, given the assumption that the effect of COVID-19 manifested in the first two quarters of 2020. Gambian GDP is projected to grow by 20.09%, 20.17% and 20.25%, in the last quarters of 2020, 2021 and 2022, respectively. Similarly, GDP is projective to expand by 23.74%, 23.92% and 24.09% in Ghana in the last quarters of 2020, 2021, 2022, respectively. Guinea's GDP is also projected to expand by 21.75%, 21.76%, and 21.82% in the last quarters of 2020, 2021 and 2022, respectively. Liberia's GDP is also projected to rebound in the last quarters of 2020, 2021 and 2022 by 20.49%, 20.52% and 20.57%, respectively. Output sustained the same trend in Nigeria, the fan chart result forecast Nigeria's GDP to expand by 25.42%, 25.46% and 25.53% in the last quarters of 2020, 2021 and 2022, respectively. Growth in Sierra Leone is projected to remain fragile as GDP is expected to rebound marginally by 21.01%, 21.16% and 21.29% in the last quarters of 2020, 2021 and 2022. At 90% confidence interval, there is higher probability of GDP falling lower than the central projection with respect to the forecast range in the respective countries.

The gross external reserves position display mixed performance in the last two quarters of 2020 due closure of international borders that suppressed import. Between the last quarters of 2020, 2021 and

2022, Gambia's external reserves is projected to improved marginally by 5.23%, 5.27% and 5.32%, respectively. In Ghana, however, external reserve is projected to deteriorate with the forecast period by 8.33%, 8.14% and 8.03% in the last quarters of 2020, 2021 and 2022, respectively. Guinea's external reserve is projected to improve marginally by 6.10%, 6.16% and 6.25% in the last quarters of 2020, 2021 and 2022, respectively. Liberia's external reserve is projected to improve within the forecast period by 6.29%, 6.72% and 7.03% in the last quarters of 2020, 2021 and 2022, respectively. Improvement in Nigeria's external reserve is muted as the fan chart forecast gross external reserve to improve by 10.50%, 10.59 and 10.69% in the last quarters of 2020, 2021 and 2022, respectively. The fan chart also forecast marginal improvement Sierra Leone's gross external reserves by 6.05%, 6.09% and 6.19% in the last quarters of 2020, 2021 and 2022, respectively.

4.2.3 Pessimistic Scenario

In the event of a second wave of the COVID-19 pandemic, government debt is expected to rise rapidly, as deficit financing widens and government revenue shrinks. Similarly, the improvement in gross external revenue observed in the WAMZ countries in the first and second quarters of 2020, which could be attributed to the extensive foreign supports and loans received from development partners and multilateral institutions will deteriorate. These developments are expected to culminate into heightened inflationary pressure compare to the forecast of the optimistic scenario. However, the pessimistic scenario indicates similar trend in inflationary with the optimistic scenario in the Gambia. Figure 4a indicates increasing trend in CPI, as the fan chart forecast that CPI in the Gambia will increase by 5.65%, 5.70% and 5.76% in the last quarters of 2020, 2021 and 2022, respectively, compare to 5.69%, 5.74% and 5.76% in the same period under the optimistic scenario. In Ghana, moderation in inflationary pressure is also observed under the pessimistic scenario, which is consistent with the inflationary trend and the ineffectiveness of the exchange rate passthrough in Ghana. Ghana CPI is projected to rise gradually by 6.64%, 6.73% and 6.82% in the last quarters of 2020, 2021 and 2022, respectively. This is moderately lower than the projected 6.72%, 6.74% and 6.83% in the same period under the optimistic scenario. Guinea CPI is also projected to rise by 7%, 7.11% and 7.24% in the last quarters of 2020, 2021 and 2022, respectively. Liberian CPI is also projected to rise by 5.85%, 6.01% and 6.14%, respectively, in the last quarters of 2020, 2021 and 2022, respectively. The fan chart forecast indicated heightened inflationary pressure during the second wave as Nigerian CPI is also projected to rise by 6.11%, 6.73% and 6.85%, respectively. Sierra Leonean CPI is projected to rise by 6.83%, 6.94% and 7.06%, respectively.

The contraction in gross domestic product is expected to worsen under the pessimistic scenario due to another economic lockdown and closure of international borders. The fan chart pessimistic scenario indicated a decreasing trend in gross domestic product for the countries in the WAMZs. The GDP forecast of the six WAMZ countries are shown in Figure 4b. The fan chart forecast projects a decline in economies of the WAMZ, given the assumption that the effect of second round of COVID-19 would lead to a further 5 percent decrease in their output. Gambian GDP is projected to fall by 8.51%, 8.47% and 8.38%, in the last quarters of 2020, 2021 and 2022, respectively. Also, Ghana's GDP is projected to contract by 10.63%, 8.94% and 8.80%, in the last quarters of 2020, 2021 and 2022, respectively. Guinea's GDP is also projected to decrease by 8.94%, 8.70%, and 8.52% in the last quarters of 2020, 2021 and 2022, respectively. Liberia's GDP is also projected to contract in the last quarters of 2020, 2021 and 2022 by 8.85%, 8.70% and 8.62%, respectively. Similarly, Nigeria's GDP is projected to fall by 20.92%, 20.83% and 20.74% in in the last quarters of 2020, 2021, 2022, respectively. Output

sustained the same trend in Sierra Leone, the fan chart result forecast reveals the GDP will decrease by 8.25%, 7.74% and 7.91% in the last quarters of 2020, 2021 and 2022, respectively.

The gross external reserves is also expected to deteriorate due to decline in foreign grants. The gross external reserves position exhibits a deteriorating performance in the last two quarters of 2020 and all the quarters from 2021 – 2022, occasioned by anticipated closure of international borders that suppressed import arising from the second wave of COVID-19 impact as presented in Figure 4c. From 2020Q3, 2021 and 2022, Gambia's external reserves is projected to fall marginally by 8.53%, 8.36% and 8.09%, respectively. In Ghana, however, external reserve is projected to deteriorate in the forecast period by 10.21%, 8.57% and 7.20% in the last quarters of 2020, 2021 and 2022, respectively. Guinea's external reserve is projected to decrease marginally by 8.34%, 8.17% and 8.05% in the last quarters of 2020, 2021 and 2022, respectively. Liberia's external reserve is projected to also decline within the forecast period by 7.18%, 6.96% and 6.74% in the last quarters of 2020, 2021 and 2022, respectively. Nigeria's external reserve is also projected to contract as shown in the fan chart forecast, the gross external reserve would fall by 11.35%, 10.45% and 10.21% in the last quarters of 2020, 2021 and 2022, respectively. The fan chart also forecast marginal improvement Sierra Leone's gross external reserves by 8.01%, 7.58% and 7.69% in the last quarters of 2020, 2021 and 2022, respectively.

5.0 CONCLUSION AND RECOMMENDATIONS

COVID-19 pandemic has resulted in the restriction of movement of people, shutdown of international borders, slowdown in merchandise trade across all sectors of the economy and enormous shocks to supply and demand. In this paper, we examined the macroeconomic effect of COVID-19 on the WAMZ economies, using quarterly data from 2000Q1 to 2020Q2. To achieve, the objective of the study, we employed the VECM-based fan chart and built three scenarios – baseline, optimistic and realistic scenario – to effectively forecast macroeconomic conditions in the WAMZ before the outbreak of COVID-19, during COVID-19 and in the event of second wave that might snowball into another lockdown of economies.

The baseline scenario underscores the fragility of the WAMZ economies because of the presence of elevated inflation, slow recovery in output and weakened reserves positions. The optimistic scenario reveals the adverse effect of COVID-19 on the WAMZ economies. For instance, there is presence of heightened inflationary pressure, slowdown in output and muted improvement in gross external reserves. The third scenario, which assumes another lockdown of economies due to the second wave of the virus projects worsening economic conditions, as countries are currently mulling the idea of another economic lockdown due to the rising cases of infection. Generally, our projection shows upward trajectory in price level, spiral fall in gross domestic product and external reserves until 2024 due to the outbreak of COVID-19. Designing and implementing policies that will assist Member countries mitigate the adverse effect of the pandemic is extremely crucial. Currently, there is no silver bullet until a vaccine is developed. However, the following recommendations could reverse the adverse macroeconomic effect of the pandemic in the WAMZ:

1. **Promote Credible and transparent Macroeconomic Policies:** Promoting favourable macroeconomic environment and fiscal discipline are the most efficient strategies for mitigating the adverse effect of COVID-19 in the WAMZ economies. Such fiscal discipline

would involve blocking wastages, reducing cost of governance, and prioritizing investment in labour intensive sectors of the economy.

2. **Design Mutually Inclusive Economic Structure:** The adverse effects COVID-19 could be traced to the restriction of movement and partial lockdown of the economies due to urban characteristics such as poor sanitation, water supply and density of people. Addressing these challenges entail the design of inclusive economic structure that is mutually beneficial to all. This involves implementing housing and transport design that prevents the ease of disease spread from human to human, incentivize citizens to implement improved sanitary conditions and rodent controls, and vaccinate animals for common zoonotic infections.
3. **Promote Regional Supply Chain:** The breakdown in centralized supply chain may have accounted for the elevated inflationary pressure in the WAMZ, largely because of the import dependent nature of the economies. Promoting regional supply chain to eliminate breakdown in supply chain during natural disaster is extremely crucial, as well as massive investment in information technology, to promote the virtualization of all sectors of the economy
4. **Push for Grants, Debt-Relief and Concessional Financing:** WAMZ Member States are classified as low-income-countries (LIC) and these economies have limited fiscal space to combat the crisis. These countries were inundated with precarious food and security challenges, high debt-over-hang and shrinking revenue due to commodity price volatility. The countries could cease this opportunity to aggressively push for external support in the areas of concessional financing, grants and even debt relief, to free-up funds to address critical medical, food and security challenges facing the zone.
5. **Sustained Safety-Nets for the Low-Skilled Workers:** The adverse effect of Covid-19 on the WAMZs economies could be less severe than the forecast, if the rate of transmission continue to flatten and the gradual opening of the economies accelerate economic normalization. The normalization of economic activities will largely depend on measures put in place to cater for the acute labour force adversely affected by the pandemic. In the WAMZ, low-skilled workers that do not have the option of working remotely are the most affected. Majority of the labour force are informally employed and the impact of the pandemic appeared uneven across gender. There should be deliberate policy to ensure that the productive activities of the low-skilled and informally employed workers are not disrupted because of their size and contribution to GDP in the Zone.
6. **Establish Automatic Support Mechanism for Down-turns:** The outbreak of the Ebola virus in Guinea, Liberia and Sierra Leone in 2014 and the novel Corona Virus Disease (Covid-19) ravaging the globe, indicates that this might not be the last. Member States should, therefore, establish a rule based fiscal stimulus mechanism that support temporary downturns, as against the current adhoc approach currently adopted by countries. The rule-based fiscal stimulus mechanism will define the threshold for targeted cash transfers and liquidity injections that are effective in dampening down-turns.
7. **Reduce Over Dependence on external financial flows:** WAMZ Members States are mostly categorized as low-income-countries (LIC). While tackling the immediate challenges of COVID-19, Member States' recovery plans should include a strong structural element to reduce over reliance on external financial flows and global markets. Therefore, Member States should develop a robust value-adding, knowledge-based and industrialized economies module that is supported by a vibrant, competitive, and well-organized services sector.

8. **Galvanize International Cooperation to reverse De-Globalization:** The WAMZ economies might be the worst hit, especially, if a vaccine is discovered and there is no multilateral system to subsidize it and make it available in low-income-countries. Policy makers in the Zone should vigorously join the campaign against trade restrictions, and unilateral stockpiles of essential supplies. The global focus should be on developing effective modalities for diverting relief materials to the neediest and supporting the health system of the poorest countries.

REFERENCES

- Alberola, E., Erce, A., & Serena, J. M. (2016). International reserves and gross capital flows dynamics. *Journal of International Money and Finance*, 60, 151-171.
- Albulescu, C. T. (2020). COVID-19 and the United States financial markets' volatility. *Finance Research Letters*, 101699.
- Aleem, A. (2010). Transmission mechanism of monetary policy in India. *Journal of Asian Economics* 21, 186–197.
- Atkeson, A. (2020). What will be the economic impact of COVID-19 in the US? Rough estimates of disease scenarios (No. w26867). *National Bureau of Economic Research*.
- Baek, S., Mohanty, S. K., & Mina, G. (2020). COVID-19 and stock market volatility: An industry level analysis. *Finance Research Letters*, 101748.
- Bank of Ghana (2020a). Bank of Ghana Monetary Policy Committee Release, September 29, 2020. <https://www.bog.gov.gh/wp-content/uploads/2019/08/MPC-Press-Release-September-2020.pdf>
- Bank of Ghana (2020b). Bank of Ghana Monetary Policy Committee Release, July 19, 2020. <https://www.bog.gov.gh/wp-content/uploads/2020/09/MPC-Press-Release-September-2020-1.pdf>
- Barrafrem, K., Västfjäll, D., & Tinghög, G. (2020). Financial well-being, COVID-19, and the financial better-than-average-effect. *Journal of Behavioral and Experimental Finance*, 1-14.
- Blix, M., & Sellin, P. (1998). Uncertainty bands for inflation forecasts (No. 65). Sveriges Riksbank Working Paper Series.
- Buckee, C. (2020). Improving epidemic surveillance and response: big data is dead, long live big data. *The Lancet Digital Health*. [https://doi.org/10.1016/S2589-7500\(20\)30059-5](https://doi.org/10.1016/S2589-7500(20)30059-5)
- Caggiano, G., Castelnovo, E., & Kima, R. (2020). The global effects of Covid-19-induced uncertainty. *Economics Letters*, 194, 109392
- Carico Jr, R.R., Sheppard, J. and Thomas, B.C. (2020). Community pharmacists and communication in the time of COVID-19. *Research in Social and Administrative Pharmacy*. Available at <https://doi.org/10.1016/j.sapharm.2020.03.017>
- CBN (2020a). CBN Communique No. 132 of the MPC Meeting - Sep 21-22, 2020, <https://www.proshareng.com/news/MONETARY%20POLICY/CBN-Communique-No.-132-of-the-MPC-Meeting---Sep-21-22--2020/53383>
- CBN (2020b). Central Bank of Nigeria Economic Report for May 2020. <https://www.cbn.gov.ng/Out/2020/RSD/CBN%20Monthly%20Economic%20Report,%20May%202020.pdf>
- Central Bank of Liberia (2020a). Central Bank of Liberia Board Retains Monetary Policy Rate. https://www.marketwatch.com/press-release/central-bank-of-liberia-board-retains-monetary-policy-rate-press-release-2020-08-27?mod=mw_more_headlines&tesla=y
- Central Bank of Liberia (2020b). Central Bank of Liberia Economic Report for May, 2020. <https://www.cbl.org.lr/doc/MAY%202020%20MER%20FINAL%20FOR%20WEBSITE.pdf>

- Central Bank of the Gambia (2020). The Monetary Policy Committee (MPC) Press Release Thursday, August 27, 2020. <https://www.cbg.gm/monetary-policy-committee>
- CGTN Africa (2020). IMF approves aid for world's 28 poorest countries. Available at <https://sfrica.cgtn.com//2020/10/06/imf-approves-aid-for-world-poorest-countries/>
- CNNhealth (2020). Tracking coronavirus' global spread, <https://edition.cnn.com/interactive/2020/health/coronavirus-maps-and-cases/>
- Cogoljević, D., Gavrilović, M., Roganović, M., Matic, I., & Piljan, I. (2018). Analyzing of consumer price index influence on inflation by multiple linear regression. *Physica A: Statistical Mechanics and its Applications*, 505, 941-944.
- de la Miyar, J. R. B., Hoehn-Velasco, L., & Silverio-Murillo, A. (2020). Druglords Don't stay at home: COVID-19 pandemic and crime patterns in Mexico City. *Journal of Criminal Justice*, 101745.
- Ferneini, E.M. (2020). The financial impact of COVID-19 on our Practice, *Journal of Oral and Maxillofacial Surgery*. <https://doi.org/10.1016/j.joms.2020.03.045>
- Firano, Z., & Fatine, F. A. (2020). The COVID-19: macroeconomics scenarii and role of containment in Morocco. *One Health*, 10, 100152.
- Fouda, A., Mahmoudi, N., Moy, N., & Paolucci, F. (2020). The COVID-19 pandemic in Greece, Iceland, New Zealand, and Singapore: Health policies and lessons learned. *Health policy and technology* (forthcoming).
- Góes, C., Kamil, H., De Imus, P., Garcia-Escribano, M. M., Perrelli, M. R., Roache, M. S. K., & Zook, J. (2017). Spillovers from US Monetary Policy Normalization on Brazil and Mexico's Sovereign Bond Yields. International Monetary Fund.
- Goodell, J. W. (2020). COVID-19 and finance: Agendas for future research. *Finance Research Letters*, 101512.
- Hodgkinson, T., & Andresen, M. A. (2020). Show me a man or a woman alone and I'll show you a saint: Changes in the frequency of criminal incidents during the COVID-19 pandemic. *Journal of criminal justice*, 69, 101706.
- Huang, X., Wei, F., Hu, L., Wen, L., & Chen, K. (2020). Epidemiology and Clinical Characteristics of COVID-19. *Archives of Iranian Medicine*, 23(4), 268-271.
- Johansen, S., 1991, "Estimation and Hypothesis Testing of Cointegration Vectors in Gaussian Vector Autoregressive Models," *Econometrica*, Vol. 59 (6), pp. 1551–80.
- Johnson-Sirleaf, E., Cameron, D. and Kaberuke, D. (2020). Assessment of the Socio-Economic Impact of COVID-19 in Sierra Leone. https://www.google.com/search?q=ASSESSMENT+OF+THE+SOCIO-ECONOMIC+IMPACT+OF+COVID-19+IN+SIERRA+LEONE&spell=1&sa=X&ved=2ahUKEwiPxcIRkbLSAhWSZd8KHVDOB_CsQBSgAegQICxAn&biw=1252&bih=600
- Kannan, P., & Elekdag, S. (2009). Incorporating market information into the construction of the fan chart (No. 9-178). International Monetary Fund.

- Kennelly, B., O'Callaghan, M., Coughlan, D., Cullinan, J., Doherty, E., Glynn, L., ... & Queally, M. (2020). The COVID-19 pandemic in Ireland: An overview of the health service and economic policy response. *Health Policy and Technology* <https://doi.org/10.1016/j.hlpt.2020.08.021>
- Lemke, M. K., Apostolopoulos, Y., & Sönmez, S. (2020). Syndemic frameworks to understand the effects of COVID-19 on commercial driver stress, health, and safety. *Journal of Transport & Health*, 100877.
- Mensi, W., Sensoy, A., Vo, X. V., & Kang, S. H. (2020). Impact of COVID-19 outbreak on asymmetric multifractality of gold and oil prices. *Resources Policy*, 69, 101829.
- Narayan, P. K., Devpura, N., & Hua, W. (2020). Japanese currency and stock market—What happened during the COVID-19 pandemic? *Economic Analysis and Policy*, 68, 191-198
- Nicola, M., Alsafi, Z., Sohrabi, C., Kerwan, A., Al-Jabir, I., Iosifidis, C., ... Agha, R. (2020). The Socio-Economic Implications of the Coronavirus and COVID-19 Pandemic: A Review. *International Journal of Surgery*, <https://doi.org/10.1016/j.ijssu.2020.04.018>
- Park, J. K., Ryu, D., & Lee, K. (2019). What determines the economic size of a nation in the world: Determinants of a nation's share in world GDP vs. per capita GDP. *Structural Change and Economic Dynamics*, 51, 203-214.
- Prol, J.L. & Sungmin O. (2020). Impact of COVID-19 measures on short-term electricity consumption in the most affected EU countries and USA states. *ISCIENCE*, <https://doi.org/10.1016/j.isci.2020.101639>.
- Razi, A., & Loke, P. L. (2017). Fan Chart: The art and science of communicating uncertainty, 43, *Bank for International Settlements*.
- Rizwan, M.S., Ahmad, G. & Ashraf, D. (2020). Systemic risk: The impact of COVID-19. *Finance Research Letters*, 36 101682
- Salisu, A. A., & Vo, X. V. (2020). Predicting stock returns in the presence of COVID-19 pandemic: The role of health news. *International Review of Financial Analysis*, 71, 101546.
- Salisu, A. A., Ebuh, G. U., & Usman, N. (2020). Revisiting oil-stock nexus during COVID-19 pandemic: Some preliminary results. *International Review of Economics & Finance*, 69, 280-294.
- Shaw, R., Kim, Y. & Hua, J. (2020). Governance, technology and citizen behavior in pandemic: Lessons from COVID-19 in East Asia. *Progress in Disaster Science* 6 100090. <http://dx.doi.org/10.1016/j.pdisas.2020.100090>
- Shruthi, M. S., & Ramani, D. (2020). Statistical analysis of impact of COVID 19 on India commodity markets. *Materials Today: Proceedings* <https://doi.org/10.1016/j.matpr.2020.07.729>
- Sivakanthan, S., Pan, J., Kim, L., Ellenbogen, R., & Saigal, R. (2020). Economic Impact of COVID-19 on a High-Volume Academic Neurosurgical Practice. *World neurosurgery*, 1 – 6.
- Sohaili, K. (2010). Analysis of electricity subsidies removing in Iran on air pollution by using of VECM. *Procedia Environmental Sciences*, 2, 252-255.
- Sun, L., Ford, J. K. and Dickinson, D. G. (2010). Bank loans and the effects of monetary policy in China: VAR/VECM approach. *China Economic Review* 21, 65–97.

- Thakur, V., & Jain, A. (2020). COVID 2019-Suicides: A global psychological pandemic. *Brain, Behavior and Immunity*. <https://doi.org/10.1016/j.bbi.2020.04.062>
- Webster, P. (2020). Virtual health care in the era of COVID-19. *The Lancet*, 395(10231), 1180-1181.
- WHO (2020). *Emergencies*. <https://www.who.int/emergencies/zika-virus/timeline/en/>
- World Economic Forum (2020). Coronavirus has exposed the digital divide like never before. Available at <https://www.weforum.org/agenda/2020/04/coronavirus-covid-19-pandemic-digital-divide-internet-data-broadband-mobile/>
- WTO (2020). Trade outlook 2020. https://www.wto.org/english/tratop_e/covid19_e/covid19_e.htm
- Zheng, C., & Zhang, J. (2020). The impact of COVID-19 on the efficiency of microfinance institutions. *International Review of Economics & Finance*, 71, 407 – 423

LIST OF TABLE

Table 1: IMF Projections of Real GDP, Consumer Prices and Current Account Balance (Annual Percentage Change) in the WAMZ

| Variables | Year | The Gambia | Ghana | Guinea | Liberia | Nigeria | Sierra Leone |
|--|------|---------------|-------|--------|---------|---------|-----------------|
| Growth | 2020 | 1.6 | 1.5 | 1.6 | 1.6 | -3.4 | 1.6 |
| | 2021 | 4.9 | 5.9 | 4.9 | 4.9 | 2.4 | 4.9 |
| Consumer Prices | 2020 | 11.2 | 9.7 | 11.2 | 11.2 | 13.4 | 11.2 |
| | 2021 | 5.8 | 8.5 | 5.8 | 5.8 | 12.4 | 5.8 |
| Current Account Balance | 2020 | -8.0 | -4.5 | -8.0 | -8.0 | -4.1 | -8.0 |
| | 2021 | -7.5 | -3 | -7.5 | -7.5 | -2.9 | -7.5 |

Source: World Economic Outlook (April 2020)

Table 2: COVID-19 Cases in the WAMZ (Date of first case – June 6, 2020)

| Country | Confirmed Cases | Recovery | Death | Recovery Rate(%) | Death Rate(%) | Date of First Case |
|--------------|--------------------|----------|-------|---------------------|------------------|--------------------|
| The Gambia | 26 | 21 | 1 | 80.77 | 7.69 | March 17, 2020 |
| Ghana | 9,462 | 3,547 | 44 | 37.49 | 0.93 | March 12, 2020 |
| Guinea | 4,117 | 2,857 | 23 | 69.40 | 1.12 | March 13, 2020 |
| Liberia | 345 | 185 | 30 | 53.62 | 17.39 | March 16, 2020 |
| Nigeria | 12,233 | 3,826 | 342 | 31.28 | 2.80 | February 28, 2020 |
| Sierra Leone | 969 | 608 | 48 | 62.75 | 4.95 | March 31, 2020 |

Source: CNNhealth, 2020.

Table 3: Summary Statistics

| | CAB | CPI | DR | EMVI | EXCH R | GDP (Million) | M2 (Million) | RES (Million) |
|------------------------|----------|---------|-----------|----------|-----------|------------------|--------------|------------------|
| Pane A: Gambia | | | | | | | | |
| Mean | -14.60 | 172.44 | 12.41 | 1626.12 | 35.06 | 337.00 | 3790.00 | 147.18 |
| Median | -14.06 | 155.25 | 12.55 | 998.27 | 30.34 | 353.00 | 3640.00 | 136.69 |
| Maximum | 40.90 | 338.41 | 16.85 | 14766.34 | 59.55 | 598.00 | 7960.00 | 236.24 |
| Minimum | -49.80 | 77.70 | 9.00 | 182.13 | 12.14 | 108.00 | 484.00 | 59.31 |
| Std. Dev. | 13.53 | 69.54 | 2.17 | 2033.10 | 12.76 | 115.00 | 2330.00 | 50.99 |
| Skewness | 0.40 | 0.67 | -0.13 | 4.10 | 0.20 | 0.03 | 0.18 | 0.24 |
| Kurtosis | 5.83 | 2.50 | 2.60 | 23.45 | 1.99 | 2.71 | 1.70 | 1.58 |
| Pane B: Ghana | | | | | | | | |
| Mean | -792.58 | 341.81 | 15.76 | 1633.30 | 2.62 | 10200.00 | 9090.00 | 2918.35 |
| Median | -663.35 | 263.56 | 16.27 | 998.27 | 1.53 | 9650.00 | 4570.00 | 2362.58 |
| Maximum | 226.80 | 821.34 | 33.50 | 14766.34 | 7.07 | 24900.00 | 32900.00 | 7134.45 |
| Minimum | -2845.70 | 52.06 | 10.38 | 222.65 | 0.43 | 1240.00 | 153.00 | 25.14 |
| Std. Dev. | 686.21 | 242.65 | 5.02 | 2031.47 | 2.02 | 6970.00 | 9880.00 | 2039.63 |
| Skewness | -0.99 | 0.58 | 2.26 | 4.10 | 0.77 | 0.32 | 0.94 | 0.15 |
| Kurtosis | 3.49 | 1.91 | 8.53 | 23.46 | 2.13 | 1.98 | 2.54 | 1.64 |
| | CAB | CPI | DR | EMVI | EXCHR | GDP | M2 | RES |
| Pane C: Guinea | | | | | | | | |
| Mean | -111.06 | 524.90 | 6.23 | 1633.30 | 6084.19 | 1800.00 | 31800000.00 | 427.89 |
| Median | -50.15 | 458.41 | 7.40 | 998.27 | 6789.55 | 1750.00 | 3080000.00 | 217.94 |
| Maximum | 884.80 | 1466.19 | 15.7 5 | 14766.34 | 10200.92 | 2890.00 | 8550000.00 | 1293.99 |
| Minimum | -2311.40 | 88.20 | 1.95 | 222.65 | 1626.00 | 705.00 | 149000.00 | 17.55 |
| Std. Dev. | 297.74 | 382.89 | 2.52 | 2031.47 | 2825.01 | 758.00 | 2690000.00 | 379.15 |
| Skewness | -4.23 | 0.63 | 0.17 | 4.10 | -0.19 | -0.09 | 0.47 | 0.58 |
| Kurtosis | 34.94 | 2.37 | 3.97 | 23.46 | 1.69 | 1.69 | 1.87 | 1.87 |
| Pane D: Liberia | | | | | | | | |
| Mean | -135.31 | 150.04 | 5.56 | 1633.30 | 121.42 | 547.00 | 104.00 | 293.87 |
| Median | -122.15 | 109.26 | 6.12 | 998.27 | 72.50 | 600.00 | 132.00 | 293.81 |
| Maximum | 69.20 | 521.44 | 7.00 | 14766.34 | 661.01 | 824.00 | 176.00 | 633.77 |
| Minimum | -495.30 | 22.03 | 2.67 | 222.65 | 41.25 | 1840.00 | 11.89 | -0.36 |
| Std. Dev. | 136.38 | 121.83 | 0.85 | 2031.47 | 123.59 | 252.00 | 66.05 | 242.59 |
| Skewness | -0.45 | 1.46 | -0.99 | 4.10 | 2.65 | -0.22 | -0.25 | 0.01 |
| Kurtosis | 2.67 | 4.25 | 3.18 | 23.46 | 9.75 | 1.31 | 1.32 | 1.22 |

| CAB | CPI | DR | EMVI | EXCHR | GDP | M2 | RES |
|-----|-----|----|------|-------|-----|----|-----|
|-----|-----|----|------|-------|-----|----|-----|

Pane F: Nigeria

| | | | | | | | | | |
|-----------|----------|--------|-------|---------|---------|----------|------------|------------|----------|
| Mean | 1367.79 | 336.24 | 13.9 | 2 | 1633.30 | 213.91 | 79700.00 | 4630000.00 | 29763.40 |
| Median | 1937.16 | 261.88 | 16.6 | 7 | 998.27 | 154.73 | 87300.00 | 3540000.00 | 34464.33 |
| Maximum | 9600.30 | 939.71 | 20.0 | 7 | 14766.3 | 4 | 143000.0 | 17200000.0 | 62082.72 |
| Minimum | 10469.83 | 72.90 | 6.90 | 4 | 222.65 | 100.12 | 17100.00 | 232000.00 | 1469.22 |
| Std. Dev. | 5055.99 | 238.93 | 4.24 | 2031.47 | 132.69 | 36800.00 | 4320000.00 | 16016.90 | |
| Skewness | -0.59 | 0.93 | -0.23 | 4.10 | 1.68 | -0.32 | 1.11 | -0.22 | |
| Kurtosis | 2.73 | 2.76 | 1.33 | 23.46 | 5.11 | 2.00 | 3.54 | 1.86 | |

Pane F: Sierra Leone

| | | | | | | | | |
|-----------|---------|--------|---------|---------|----------|---------|------------|--------|
| Mean | -217.88 | 391.80 | 7.46 | 1633.30 | 5303.93 | 787.00 | 998000.00 | 332.79 |
| Median | -190.25 | 275.74 | 9.22 | 998.27 | 4327.63 | 732.00 | 692000.00 | 422.43 |
| Maximum | -14.20 | 1601.3 | 14766.3 | 4 | 15224.84 | 1550.00 | 3330000.00 | 624.59 |
| Minimum | -540.80 | 93.92 | 4.03 | 222.65 | 1666.67 | 100.00 | 48900.00 | 23.20 |
| Std. Dev. | 166.13 | 356.66 | 2.33 | 2031.47 | 3438.70 | 389.00 | 942000.00 | 193.33 |
| Skewness | -0.09 | 1.66 | -0.48 | 4.10 | 1.27 | 0.13 | 0.87 | -0.35 |
| Kurtosis | 1.39 | 5.15 | 1.36 | 23.46 | 3.65 | 1.80 | 2.60 | 1.54 |

Table 4: Unit Root Test

| | Gambia, The | | | | Ghana | | | |
|-------|-------------|------------|----------|------------|----------|------------|----------|------------|
| | PP | | ADF | | PP | | ADF | |
| | Levels | First Diff | Levels | First Diff | Levels | First Diff | Levels | First Diff |
| LRES | -2.10 | -10.15*** | -2.13 | -10.15*** | -1.84 | -8.23*** | -0.49 | -2.45 |
| LEMVI | -3.23** | -13.06*** | -3.41** | -12.05*** | -3.36 | -13.40** | -3.54*** | -12.12*** |
| LEXC | | | | | | | | |
| HR | -2.09 | -10.37*** | -2.09 | -10.41*** | -0.95 | -7.89** | -0.10 | -7.85*** |
| LGDP | -0.75 | -5.14*** | -1.64 | -3.08** | -1.51 | -5.12*** | -2.15 | -3.37** |
| LM2 | -5.15*** | -3.63*** | -5.07*** | -1.87 | -4.99 | -3.91*** | -1.97 | -3.80*** |
| DR | -1.80 | -10.50*** | -1.86 | -10.39*** | -1.99 | -8.02** | -3.72*** | -6.25*** |
| LCPI | -0.17 | -6.19*** | -0.18 | -4.07*** | -3.46 | -8.72** | -2.51 | -4.50*** |
| CAB | -5.96*** | -51.5*** | -5.95*** | -10.75*** | -0.70*** | -14.98*** | -0.42 | -13.47*** |

| | Guinea | | Liberia | |
|--|--------|-----|---------|-----|
| | PP | ADF | PP | ADF |

| | Levels | First Diff | Levels | First Diff | Levels | First Diff | Levels | First Diff |
|-------|----------|------------|----------|------------|---------|------------|----------|------------|
| LRES | -1.10 | -8.66*** | -0.71 | -8.57*** | -2.30 | -7.92*** | -1.70 | -7.45*** |
| LEMVI | -3.36** | -13.40*** | -3.54*** | -12.12*** | -3.36** | -13.40*** | -3.54*** | -12.12*** |
| LEXC | | | | | | | | |
| HR | -1.66 | -7.28*** | -1.83 | -7.26*** | -4.82 | -9.04*** | -3.37 | -5.32*** |
| LGDP | -0.96 | -4.59*** | -1.33 | -4.52*** | -1.20 | -4.61*** | -1.67 | -4.59*** |
| LM2 | -1.97 | -5.41*** | -2.41 | -4.90*** | -1.44 | -3.76*** | -2.09 | -6.13*** |
| DR | -1.97 | -13.75*** | -1.48 | -5.18*** | -2.40 | -12.71*** | -2.40 | -12.29*** |
| LCPI | -0.74 | -10.42*** | -1.25 | -3.62*** | -0.81 | -7.10*** | 2.13 | -4.76*** |
| CAB | -9.30*** | -35.65*** | -9.14*** | -8.38*** | -2.74* | -16.18*** | -1.87 | -16.07*** |

| | Nigeria | | | | Sierra Leone | | | |
|--------|---------|------------|---------|------------|--------------|------------|----------|------------|
| | PP | | ADF | | PP | | ADF | |
| | Levels | First Diff | Levels | First Diff | Levels | First Diff | Levels | First Diff |
| LRES | -0.10 | -2.93*** | -0.76 | -3.11*** | -3.34** | -10.98*** | -2.75* | -10.94*** |
| LEMVI | -3.36** | -13.40*** | -3.54** | -12.12*** | -3.36** | -13.40*** | -3.54*** | -12.12*** |
| LEXCHR | -2.00 | -7.27*** | -2.27 | -7.27*** | -2.08 | -10.46*** | 1.97 | -10.48*** |
| LGDP | -2.50 | -3.61*** | -2.79* | -4.67*** | -3.75** | -7.68*** | -0.61 | -8.84*** |
| LM2 | -1.46 | -3.92*** | -1.10 | -3.89*** | -4.65** | -4.04*** | -2.48 | -2.35 |
| DR | -1.21 | -8.14*** | -1.35 | -6.99*** | -0.67 | -6.87*** | -0.84 | -4.75*** |
| LCPI | -0.82 | -16.97*** | -0.39 | -4.81*** | 5.38 | -9.50*** | -1.91 | -2.09 |
| CAB | -0.65 | -12.47*** | -0.03 | -13.00*** | -1.42 | -10.30*** | -1.52 | -10.24*** |

Table 5: Model Lag Structure using Schwarz information criterion (SC)

| | Gambia, The | Ghana | Guinea | Liberia | Nigeria | Sierra Leone |
|------|-------------|-------|--------|---------|---------|--------------|
| LCPI | 1 | 1 | 1 | 1 | 2 | 1 |
| LGDP | 1 | 1 | 1 | 1 | 2 | 2 |
| LRES | 1 | 1 | 1 | 1 | 1 | 2 |

Source: Author's compilation

Table 6: Johansen cointegration tests for the model –Trace test

| | Gambia, The | Ghana | Guinea | Liberia | Nigeria | Sierra Leone |
|------|-------------|-------|--------|---------|---------|--------------|
| LCPI | 1 | 2 | 1 | 1 | 1 | 1 |
| LGDP | 1 | 2 | 2 | 2 | 1 | 2 |
| LRES | 1 | 3 | 2 | 2 | 6 | 2 |

Source: Author's compilation

Post Diagnostic Tests

Table 7: Portmanteau test for autocorrelation

| CPI Model | | | | | | | GDP Model | | | | |
|-------------|------|----------|--------|------------|--------|-----|-----------|--------|------------|--------|-----|
| | Lags | Q-Stat | Prob. | Adj Q-Stat | Prob. | df | Q-Stat | Prob. | Adj Q-Stat | Prob. | df |
| Gambia, The | | | | | | | | | | | |
| | 1 | 8.9040 | NA* | 9.0167 | NA* | NA* | 13.4647 | NA* | 13.6351 | NA* | NA* |
| | 2 | 24.6216 | 0.9942 | 25.1373 | 0.9928 | 45 | 35.9536 | 0.9991 | 36.7006 | 0.9987 | 66 |
| | 3 | 40.9762 | 0.9978 | 42.1291 | 0.9966 | 70 | 65.1252 | 0.9983 | 67.0089 | 0.9971 | 102 |
| | 4 | 98.1689 | 0.3914 | 102.3320 | 0.2854 | 95 | 156.2240 | 0.1375 | 162.9023 | 0.1726 | 138 |
| | 5 | 123.3299 | 0.3990 | 129.1704 | 0.2675 | 120 | 186.9560 | 0.2378 | 195.6831 | 0.1245 | 174 |
| Ghana | | | | | | | | | | | |
| | 1 | 8.2580 | NA* | 8.3625 | NA* | NA* | 4.1687 | NA* | 4.2221 | NA* | NA* |
| | 2 | 58.8848 | 0.0274 | 60.2874 | 0.0206 | 40 | 25.4129 | NA* | 26.0182 | NA* | NA* |
| | 3 | 80.9706 | 0.0873 | 83.2337 | 0.0633 | 65 | 50.0986 | 0.9271 | 51.6783 | 0.9016 | 66 |
| | 4 | 140.3984 | 0.0005 | 145.7893 | 0.0002 | 90 | 122.1290 | 0.0850 | 127.5503 | 0.0442 | 102 |
| | 5 | 168.4688 | 0.0009 | 175.7310 | 0.0002 | 115 | 144.5320 | 0.3346 | 151.4670 | 0.2045 | 138 |
| Guinea | | | | | | | | | | | |
| | 1 | 2.8134 | NA* | 2.8490 | NA* | NA* | 14.0724 | NA* | 14.2506 | NA* | NA* |
| | 2 | 37.1486 | 0.7910 | 38.0646 | 0.7584 | 45 | 68.9851 | 0.1997 | 70.5712 | 0.1651 | 60 |
| | 3 | 60.6644 | 0.7794 | 62.4966 | 0.7262 | 70 | 101.8515 | 0.3221 | 104.7182 | 0.2550 | 96 |
| | 4 | 152.1990 | 0.0002 | 158.8488 | 0.0000 | 95 | 213.6842 | 0.0000 | 222.4368 | 0.0000 | 132 |

| | | | | | | | | | | | |
|--------------|---|----------|--------|----------|--------|-----|----------|--------|----------|--------|-----|
| Liberia | 5 | 170.3243 | 0.0017 | 178.1824 | 0.0005 | 120 | 234.8355 | 0.0005 | 244.9982 | 0.0001 | 168 |
| | 1 | 4.4037 | NA* | 4.4595 | NA* | NA* | 5.6994 | NA* | 5.7715 | NA* | NA* |
| | 2 | 35.8750 | 0.8325 | 36.7377 | 0.8049 | 45 | 46.6035 | 0.8972 | 47.7244 | 0.8740 | 60 |
| | 3 | 54.0273 | 0.9209 | 55.5972 | 0.8953 | 70 | 74.1224 | 0.9524 | 76.3155 | 0.9309 | 96 |
| | 4 | 106.3942 | 0.1994 | 110.7203 | 0.1291 | 95 | 161.4608 | 0.0415 | 168.2507 | 0.0181 | 132 |
| | 5 | 138.1836 | 0.1227 | 144.6290 | 0.0624 | 120 | 204.2301 | 0.0297 | 213.8713 | 0.0096 | 168 |
| Nigeria | 1 | 6.5744 | NA* | 6.6587 | NA* | NA* | 10.3950 | NA* | 10.5283 | NA* | NA* |
| | 2 | 13.3841 | NA* | 13.6452 | NA* | NA* | 26.1246 | NA* | 26.6665 | NA* | NA* |
| | 3 | 41.4891 | 0.6215 | 42.8597 | 0.5630 | 45 | 61.0379 | 0.6498 | 62.9579 | 0.5834 | 66 |
| | 4 | 59.8490 | 0.8013 | 62.1988 | 0.7352 | 70 | 105.3168 | 0.3911 | 109.5984 | 0.2858 | 102 |
| | 5 | 79.5448 | 0.8727 | 83.2254 | 0.8005 | 95 | 133.4583 | 0.5934 | 139.6412 | 0.4449 | 138 |
| | | | | | | | | | | | |
| Sierra Leone | 1 | 4.6474 | NA* | 4.7063 | NA* | NA* | 8.0037 | NA* | 8.1050 | NA* | NA* |
| | 2 | 37.3011 | 0.7857 | 38.1972 | 0.7535 | 45 | 51.3638 | 0.7788 | 52.5769 | 0.7409 | 60 |
| | 3 | 50.2481 | 0.9641 | 51.6486 | 0.9510 | 70 | 75.6394 | 0.9381 | 77.7983 | 0.9128 | 96 |
| | 4 | 124.7343 | 0.0220 | 130.0551 | 0.0099 | 95 | 160.4246 | 0.0467 | 167.0459 | 0.0211 | 132 |
| | 5 | 146.2568 | 0.0518 | 153.0125 | 0.0225 | 120 | 183.6509 | 0.1936 | 191.8207 | 0.1005 | 168 |
| | | | | | | | | | | | |

Table 8: *Reserves Model*

| Lags | | Q-Stat | Prob. | Adj Q-Stat | Prob. | df |
|-------------|---|----------|--------|------------|--------|-----|
| Gambia, The | | | | | | |
| | 1 | 12.8997 | NA* | 13.0630 | NA* | NA* |
| | 2 | 37.8986 | 0.9979 | 38.7029 | 0.9971 | 66 |
| | 3 | 77.2122 | 0.9680 | 79.5482 | 0.9513 | 102 |
| | 4 | 128.1359 | 0.7150 | 133.1521 | 0.6007 | 138 |
| | 5 | 167.3814 | 0.6269 | 175.0139 | 0.4642 | 174 |
| Ghana | | | | | | |
| | 1 | 18.2658 | NA* | 18.4971 | NA* | NA* |
| | 2 | 82.1584 | 0.0303 | 84.0279 | 0.0220 | 60 |
| | 3 | 112.0348 | 0.1259 | 115.0683 | 0.0898 | 96 |
| | 4 | 188.5234 | 0.0009 | 195.5826 | 0.0003 | 132 |
| | 5 | 231.5867 | 0.0008 | 241.5168 | 0.0002 | 168 |
| Guinea | | | | | | |
| | 1 | 21.7969 | NA* | 22.0729 | NA* | NA* |
| | 2 | 87.2451 | 0.9599 | 89.1992 | 0.9447 | 112 |
| | 3 | 150.4359 | 0.9191 | 154.8520 | 0.8728 | 176 |
| | 4 | 281.0429 | 0.0355 | 292.3330 | 0.0118 | 240 |
| | 5 | 337.5558 | 0.0900 | 352.6134 | 0.0286 | 304 |
| Liberia | | | | | | |
| | 1 | 19.2614 | NA* | 19.5052 | NA* | NA* |
| | 2 | 97.4758 | 0.8342 | 99.7251 | 0.7902 | 112 |
| | 3 | 157.6051 | 0.8367 | 162.1971 | 0.7643 | 176 |
| | 4 | 268.9951 | 0.0962 | 279.4498 | 0.0409 | 240 |
| | 5 | 336.5851 | 0.0961 | 351.5457 | 0.0313 | 304 |
| Nigeria | | | | | | |
| | 1 | 23.7288 | NA* | 24.0292 | NA* | NA* |
| | 2 | 59.6899 | 0.9566 | 60.9123 | 0.9447 | 80 |

| | | | | | | |
|--------------|---|----------|--------|----------|--------|-----|
| | 3 | 121.1222 | 0.9173 | 124.7381 | 0.8750 | 144 |
| | 4 | 197.1432 | 0.6946 | 204.7603 | 0.5505 | 208 |
| | 5 | 252.5796 | 0.7952 | 263.8924 | 0.6264 | 272 |
| Sierra Leone | | | | | | |
| | 1 | 18.9733 | NA* | 19.2135 | NA* | NA* |
| | 2 | 81.5181 | 0.9865 | 83.3620 | 0.9803 | 112 |
| | 3 | 130.3473 | 0.9959 | 134.0936 | 0.9919 | 176 |
| | 4 | 234.8947 | 0.5809 | 244.1435 | 0.4135 | 240 |
| | 5 | 289.8889 | 0.7103 | 302.8040 | 0.5086 | 304 |

Table 9: Residual Serial autocorrelation LM test

| | Lags | CPI Model | | | GDP Model | | | Reserves Model | |
|-------------|------|-----------|--------|--|-----------|---------|--|----------------|--------|
| | | LM-Stat | Prob | | | LM-Stat | | Prob | |
| Gambia, The | | | | | | | | | |
| | 1 | 23.4959 | 0.5486 | | 30.0204 | 0.7480 | | 45.1084 | 0.142 |
| | 2 | 18.3356 | 0.8278 | | 27.2201 | 0.8538 | | 34.90697 | 0.5204 |
| | 3 | 17.2693 | 0.8718 | | 30.3888 | 0.7322 | | 39.9613 | 0.2985 |
| | 4 | 69.5508 | 0.2158 | | 20.8937 | 0.6106 | | 62.94928 | 0.0036 |
| | 5 | 26.7980 | 0.3661 | | 32.8107 | 0.6211 | | 40.57599 | 0.2756 |
| Ghana | | | | | | | | | |
| | 1 | 31.2789 | 0.2543 | | 29.7842 | 0.7579 | | 35.2701 | 0.5805 |
| | 2 | 30.8675 | 0.2743 | | 30.0146 | 0.4072 | | 44.9947 | 0.2185 |
| | 3 | 27.0684 | 0.3525 | | 28.1716 | 0.8210 | | 36.0105 | 0.4682 |
| | 4 | 27.7043 | 0.3307 | | 23.9035 | 0.9348 | | 48.9597 | 0.7179 |
| | 5 | 30.6166 | 0.2020 | | 24.5285 | 0.9263 | | 46.4113 | 0.1146 |
| Guinea | | | | | | | | | |
| | 1 | 20.2323 | 0.1276 | | 27.9000 | 0.1227 | | 75.0562 | 0.1186 |
| | 2 | 28.2649 | 0.1436 | | 36.2547 | 0.7202 | | 78.6502 | 0.1224 |
| | 3 | 24.8452 | 0.4711 | | 36.0981 | 0.4641 | | 70.3776 | 0.2728 |

| | | | | | | | |
|--------------|---|---------|--------|---------|--------|----------|--------|
| | 4 | 31.2799 | 0.5291 | 31.5972 | 0.6911 | 68.0517 | 0.5772 |
| | 5 | 23.2808 | 0.5612 | 31.0840 | 0.7014 | 62.5424 | 0.5282 |
| Liberia | | | | | | | |
| | 1 | 23.544 | 0.5458 | 33.9591 | 0.5660 | 73.3601 | 0.6167 |
| | 2 | 31.6132 | 0.6777 | 28.7907 | 0.3756 | 74.9565 | 0.7410 |
| | 3 | 18.9058 | 0.8016 | 29.2142 | 0.7812 | 63.3842 | 0.4982 |
| | 4 | 32.1625 | 0.9061 | 22.6716 | 0.1171 | 73.4157 | 0.6668 |
| | 5 | 31.4038 | 0.8996 | 27.6188 | 0.7932 | 75.7679 | 0.1490 |
| Nigeria | | | | | | | |
| | 1 | 41.0099 | 0.3229 | 45.2143 | 0.1396 | 76.73391 | 0.1321 |
| | 2 | 26.1370 | 0.4003 | 41.1254 | 0.2561 | 70.70354 | 0.2639 |
| | 3 | 38.1125 | 0.2451 | 42.5813 | 0.2089 | 61.71962 | 0.5576 |
| | 4 | 19.4902 | 0.7730 | 42.1938 | 0.1396 | 70.38233 | 0.1811 |
| | 5 | 20.6529 | 0.7118 | 31.7595 | 0.6705 | 55.69743 | 0.7607 |
| Sierra Leone | | | | | | | |
| | 1 | 29.6855 | 0.2363 | 39.4510 | 0.3183 | 72.4550 | 0.2191 |
| | 2 | 25.7991 | 0.6747 | 28.7255 | 0.2765 | 66.0638 | 0.4054 |
| | 3 | 13.2363 | 0.9735 | 24.0598 | 0.9359 | 47.6720 | 0.9367 |
| | 4 | 27.6300 | 0.8641 | 25.0391 | 0.1278 | 53.0083 | 0.5925 |
| | 5 | 24.0651 | 0.5156 | 26.1469 | 0.8864 | 59.7323 | 0.6280 |

Table 10: *Heteroskedasticity test - No cross terms*

| | CPI Model | | | | GDP Model | | | | Reserves Model | | |
|--------------|-----------|-----|--------|--|-----------|-----|--------|--|----------------|------|--------|
| | Chi-sq | df | Prob. | | Chi-sq | df | Prob. | | Chi-sq | df | Prob. |
| Gambia, The | 179.829 | 180 | 0.4896 | | 146.517 | 294 | 0.1190 | | 128.248 | 294 | 0.2825 |
| Ghana | 231.416 | 210 | 0.1483 | | 539.702 | 546 | 0.5679 | | 372.93 | 336 | 0.0806 |
| Guinea | 149.544 | 180 | 0.1105 | | 170.68 | 336 | 0.7968 | | 184.294 | 720 | 0.8341 |
| Liberia | 139.497 | 180 | 0.2102 | | 127.952 | 336 | 0.8315 | | 188.708 | 720 | 0.3119 |
| Nigeria | 186.168 | 330 | 0.1179 | | 192.236 | 546 | 0.1836 | | 189.925 | 1008 | 0.1366 |
| Sierra Leone | 163.170 | 180 | 0.8108 | | 104.634 | 336 | 0.2008 | | 196.504 | 720 | 0.1246 |

Heteroskedasticity test - With cross terms

| | CPI Model | | | | GDP Model | | | | Reserves Model | | |
|--------------|-----------|------|--------|--|-----------|------|--------|--|----------------|------|--------|
| | Chi-sq | df | Prob. | | Chi-sq | df | Prob. | | Chi-sq | df | Prob. |
| Gambia, The | 468.089 | 405 | 0.1164 | | 109.494 | 735 | 0.8371 | | 801.461 | 735 | 0.2445 |
| Ghana | 597.438 | 525 | 0.3154 | | 1379.04 | 1875 | 0.1198 | | 927.897 | 924 | 0.4578 |
| Guinea | 561.53 | 405 | 0.7051 | | 1134.66 | 924 | 0.8114 | | 2510.68 | 2340 | 0.1072 |
| Liberia | 508.958 | 405 | 0.3403 | | 1087.26 | 924 | 0.1102 | | 2551.73 | 2340 | 0.8213 |
| Nigeria | 1176.97 | 1155 | 0.3199 | | 1696.19 | 1329 | 1.5165 | | 3645.34 | 3264 | 0.9186 |
| Sierra Leone | 394.148 | 405 | 0.6411 | | 1011.65 | 924 | 0.2231 | | 2422.94 | 2340 | 0.1135 |

Table 10: *Jarque-Bera (JB) Normality test*

| | CPI Model | | | | GDP Model | | | | Reserves Model | | |
|--------------|-----------|----|--------|--|-----------|----|--------|--|----------------|----|--------|
| | JB | df | Prob. | | JB | df | Prob. | | JB | df | Prob. |
| Gambia, The | 0.0047 | 10 | 0.1103 | | 0.8732 | 12 | 0.3169 | | 0.9539 | 16 | 0.3287 |
| Ghana | 0.6757 | 10 | 0.4148 | | 0.8079 | 12 | 0.4531 | | 1.4827 | 16 | 0.1192 |
| Guinea | 0.2126 | 10 | 0.7281 | | 0.8211 | 12 | 0.4732 | | 0.904 | 16 | 0.9942 |
| Liberia | 0.7725 | 10 | 0.2113 | | 1.7762 | 12 | 0.4245 | | 0.1689 | 16 | 0.3914 |
| Nigeria | 0.2390 | 10 | 0.5118 | | 1.3885 | 12 | 0.3865 | | 0.3299 | 16 | 0.399 |
| Sierra Leone | 0.9489 | 10 | 0.6249 | | 0.5243 | 12 | 0.6895 | | 0.9811 | 16 | 0.4855 |

LIST OF FIGURES

1.0 Pre-Diagnostics

Figure 1a: Inverse Roots of AR Characteristic Polynomial – The Gambia

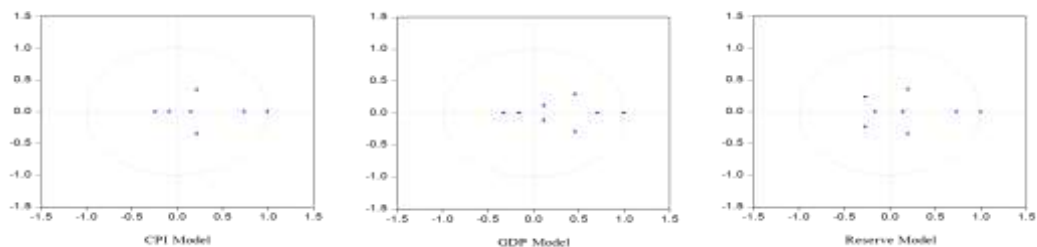


Figure 1b: Inverse Roots of AR Characteristic Polynomial – Ghana

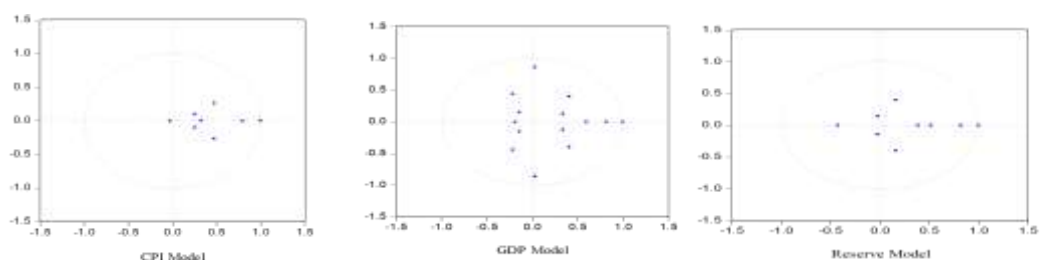


Figure 1c: Inverse Roots of AR Characteristic Polynomial – Guinea

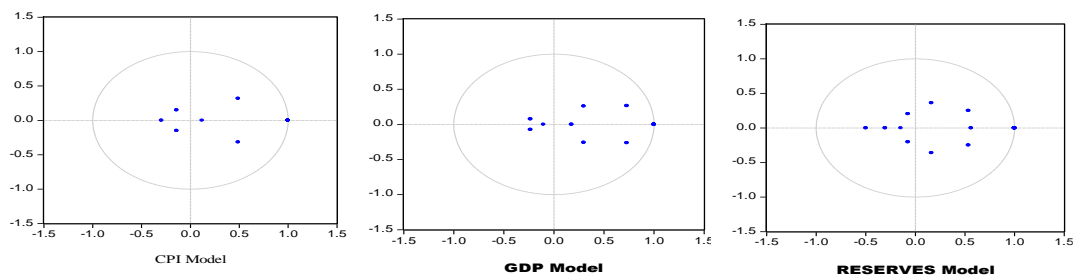


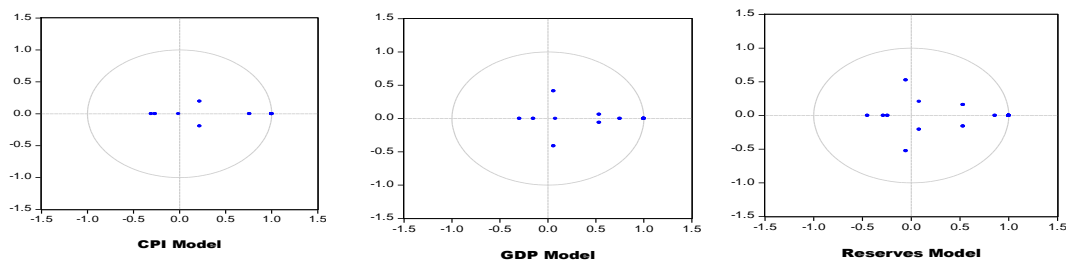
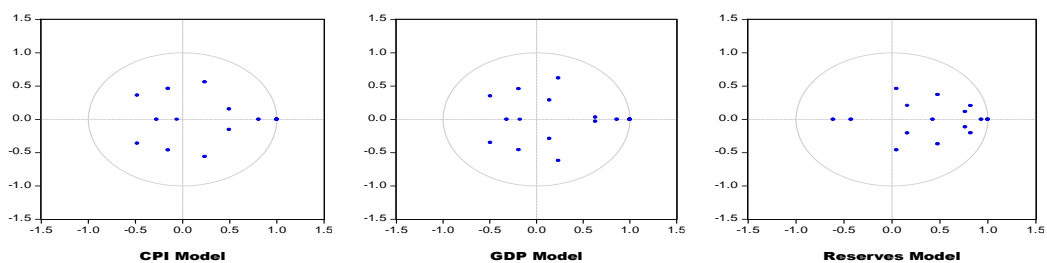
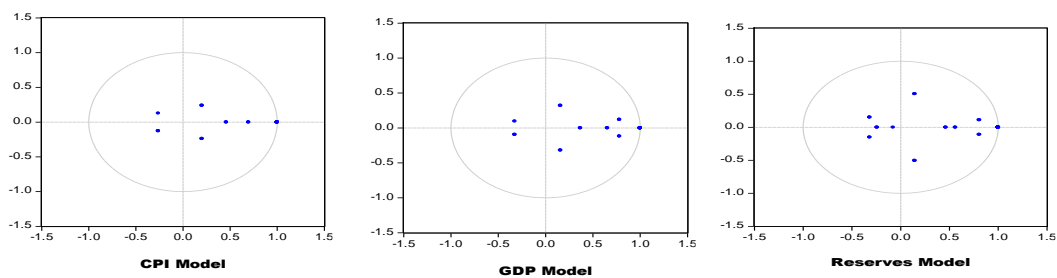
Figure 1d: Inverse Roots of AR Characteristic Polynomial – Liberia**Figure 1e:** Inverse Roots of AR Characteristic Polynomial – Nigeria**Figure 1f:** Inverse Roots of AR Characteristic Polynomial – Sierra Leone

Figure 2a: The Gambia Forecast for CPI, GDP, and Gross External Reserves

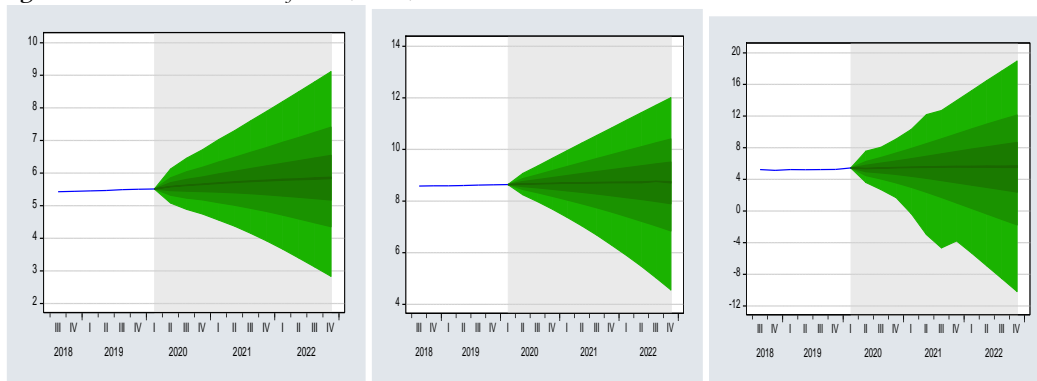


Figure 2b: Ghana Forecast for CPI, GDP, and Gross External Reserves

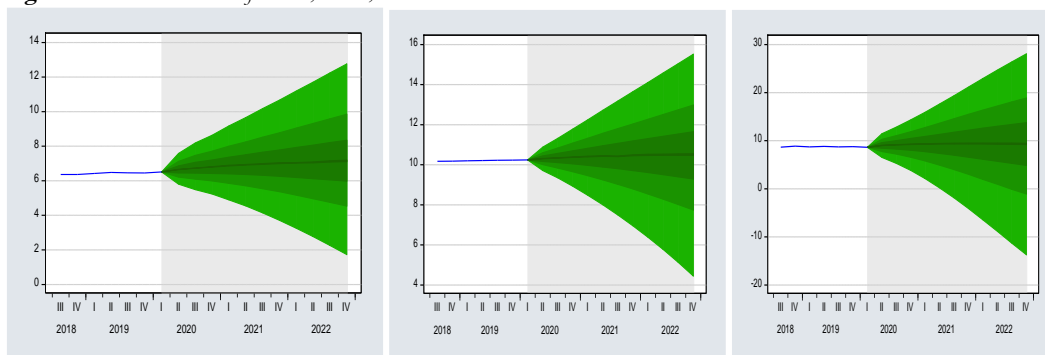


Figure 2c: Guinea Forecast for CPI, GDP, and Gross External Reserves

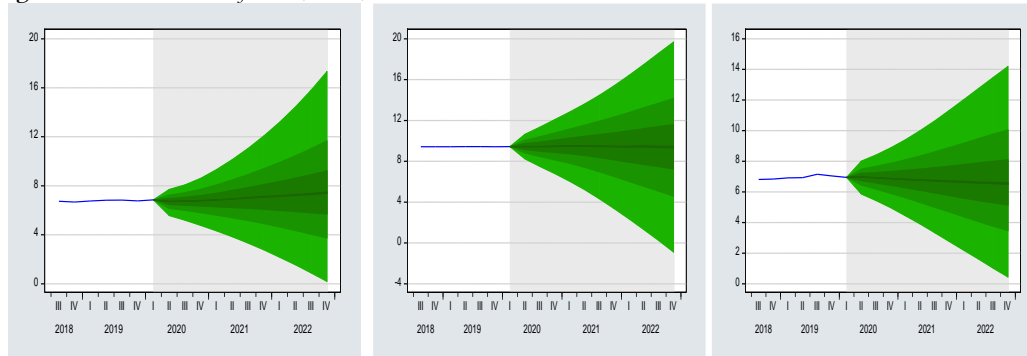


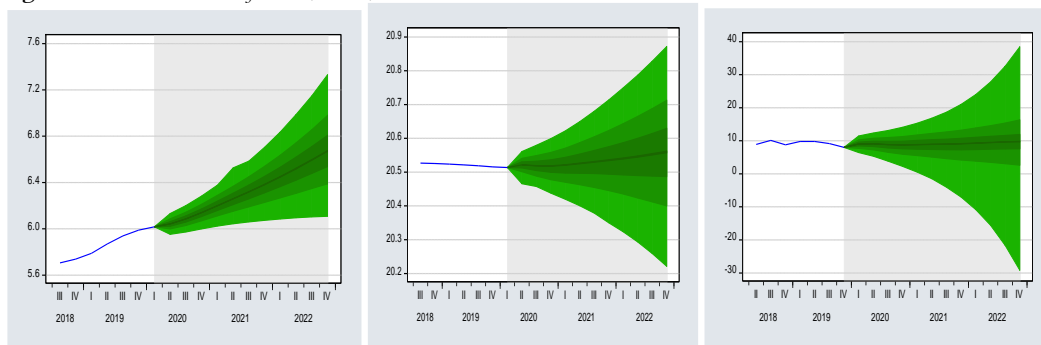
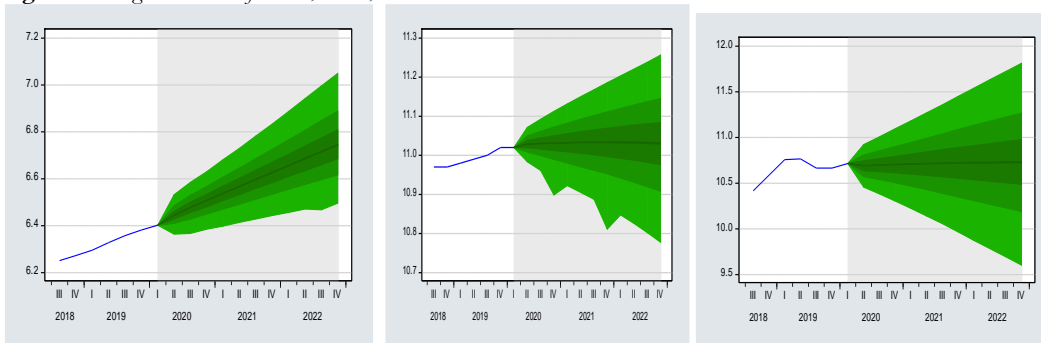
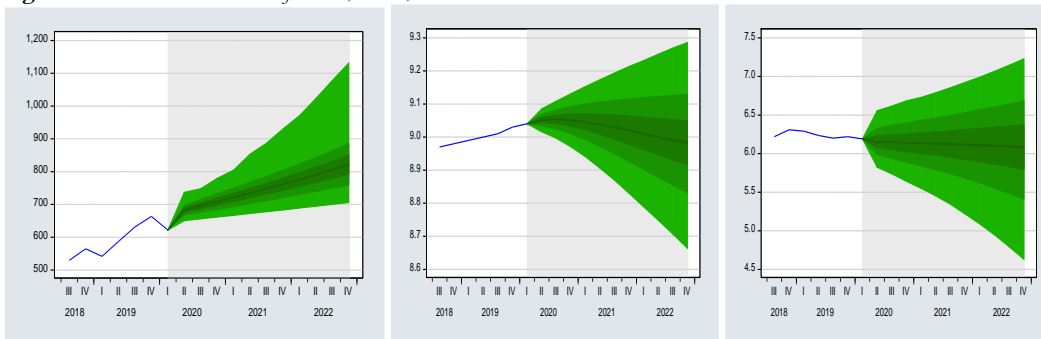
Figure 2d: Liberia Forecast for CPI, GDP, and Gross External Reserves**Figure 2e: Nigeria Forecast for CPI, GDP, and Gross External Reserves****Figure 2f: Sierra Leone Forecast for CPI, GDP, and Gross External Reserves**

Figure 3a: CPI Forecast of WAMZ Member States

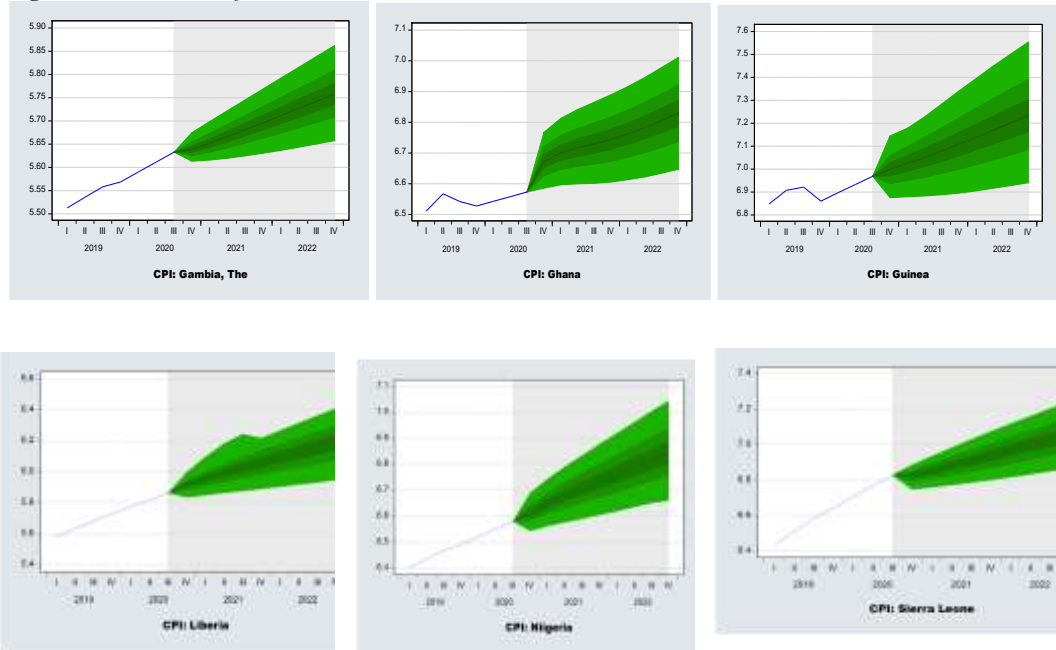


Figure 3b: GDP Forecast of WAMZ Member States

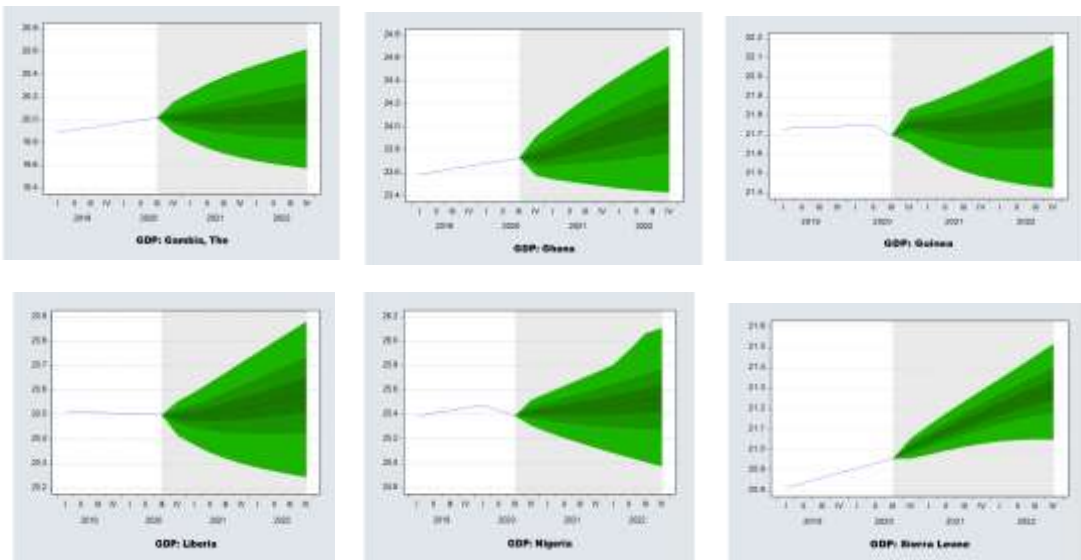
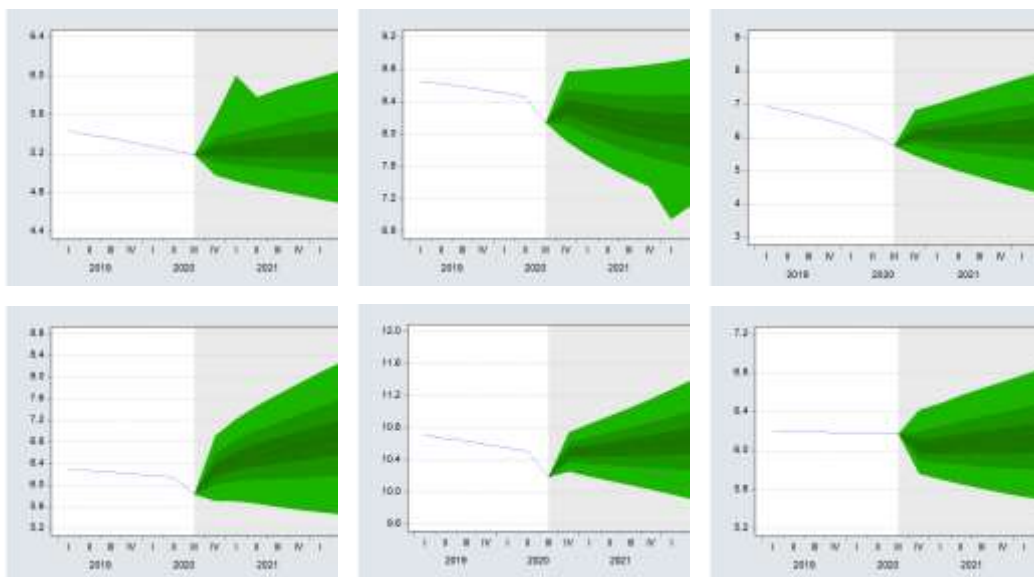


Figure 3c: Gross External Reserves Forecast of WAMZ Member States



4.0 Pessimistic Scenario

Figure 4a: CPI Forecast of WAMZ Member States

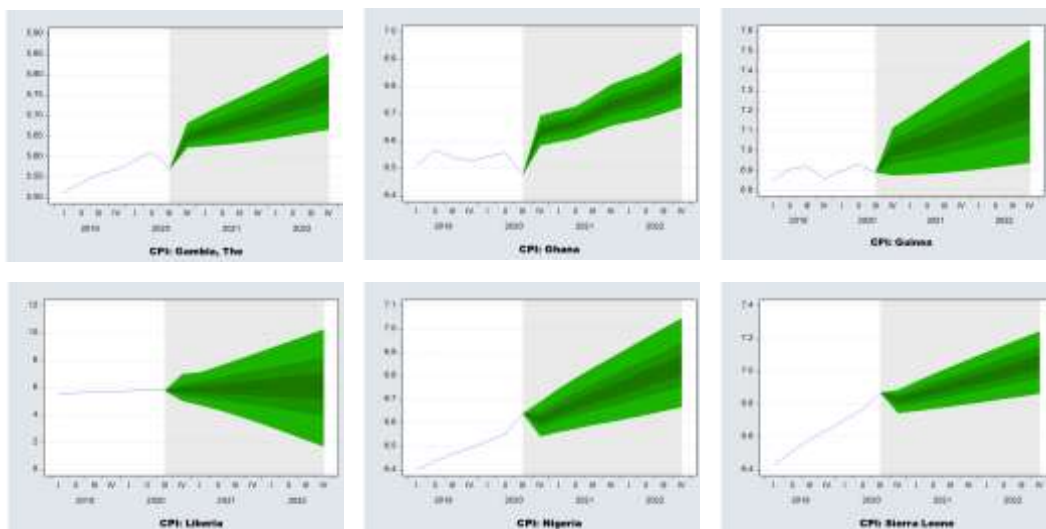


Figure 4b: GDP Forecast of WAMZ Member States

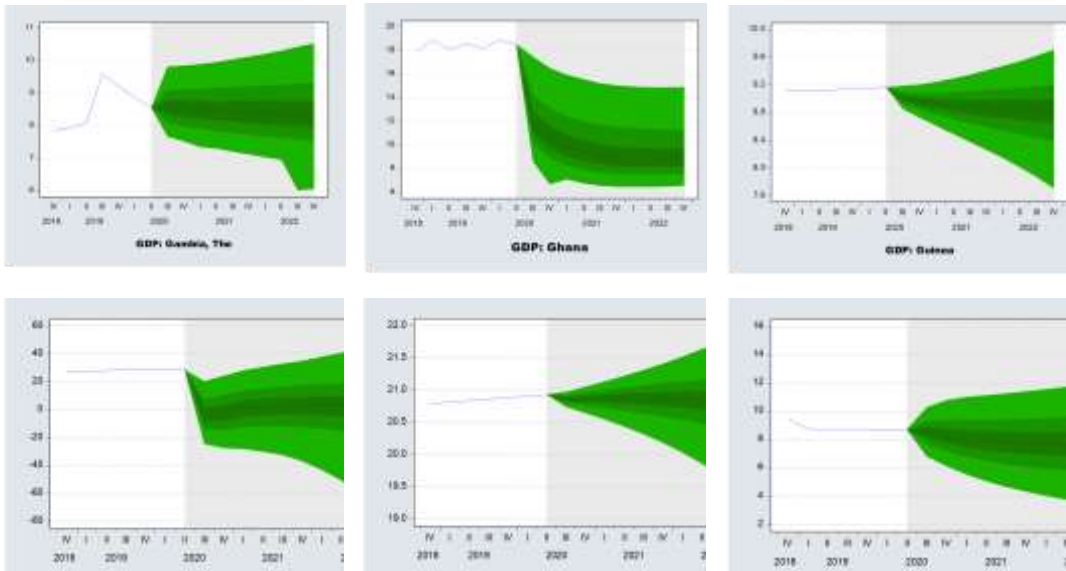


Figure 4c: Gross External Reserves Forecast of WAMZ Member States

