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Economic distance and cross-country spillovers among African economies: Implication for growth and Development

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This study examines the level of linkage between Nigeria and some selected African countries on one hand and the linkages between economic growth, inflation, and unemployment on the other hand, in these economies. The study covers the period between 2000 and 2019. The study aims to first measure the economic distance between Nigeria and these countries using the approach proposed by Mazurek. Second, the degree of spillovers was characterized between Nigeria and these countries, using a VAR-based spillover index method proposed by Diebold and Yilmaz. The main finding of the study is that the selected African economies are quite economically dispersed, and the level of cross-border spillover is negligible. This would suggest that growth in one economy has not been influenced by the growth in the other economies in the region. Given this, the study recommends that policies that will improve intra-African trade should be formulated. Such policies should incorporate a trade-by-barter-like framework, where Africa can demand what it produces and produce what it demands. Essentially, much more attention should be paid to the supply side of the market than the demand side following the Says law that increasing production will naturally result in proportionate increase in demand. To achieve this, enabling environment should be created to engender technological innovations while improving human and capital infrastructures.

Key words: African, development, economic distance, growth, spillovers.

INTRODUCTION

Empirical studies of economic interdependence among countries started emerging in the early 1990s. Today, most popular discussions on economic growth and development focus on the economic interdependence of nations and generally assume that the economy of one country is not independent of the economies of others

(Conley and Ligon, 2002). This argument is in line with an economic theory that also suggests that economic outcomes across countries will not be independent. For instance, Lucas (1990), De Long and Summers (1991), Krugman (1991), and Ciccone (1996) highlighted the importance of technology, human capital, and other forms

of spillovers. The existence of foreign trade lends empirical support to this claim. The role of international trade is becoming increasingly significant, especially with the unavoidable incidence of globalization. Modern economies are more linked due to merchandise and services trade, flows of money, and foreign investments, making economic relations a critical element of every country, especially in the developing world.

The sustainable development of an economy is essentially linked to international trade and free trade agreements, especially in the era of globalisation. This partly explains the reasons for numerous free trade agreements among countries and regions, in the bid to improve international trade. However, despite the existence of several free trade agreements, Africa is yet to assert itself as a key player in the world economy as shown by its decreasing contributions to global production and trade. The situation of Africa is even aggravated by the fact that intra-continent trade is very low; it is just 12% compared to averages of 61 and 67% of the European Union and Asia-Pacific Economic Co-operation, respectively (AfDB, 2014; Uzodigwe, 2017). The question that comes to mind is: why is intra-African trade still poor considering the huge natural resources at its disposal? Many reasons may be adduced for this, but we are of the view that the content of Africa's export and import baskets are among the major reasons.

First is the level of relative economic distance between African countries. Ghemawat (2001) has emphasized distance as an obstacle to foreign trade. A distance is often referred to the physical distance. In statistical meaning, distance determines the level of dissimilarity between patterns, objects, or units. Therefore the cultural, social, political, geographic, and economic distances can be distinguished. Our focus here is on economic distance defined as the similarity between the domestic and foreign countries in terms of economic systems and metrics (Thai-Ha, 2017). In general, the economic distance identifies a dissimilarity level between national economies. For example, countries are classified as undeveloped (pre-industrial, almost entirely agrarian), developing (underdeveloped industrial base, low living standard), and developed (postindustrial) economies. This could mean dissimilarities in macroeconomic fundamentals such as per capita gross domestic product (GDP), economic growth rates, inflation, unemployment rate, etc. It has been shown that economic distance affects the flows of trade (Linder, 1961; Thai-Ha, 2017). Greater economic distance between trading economies is likely to impede bilateral trade since it suggests heterogeneity in the demand structure. Economies with unrelated demand structures import and export less horizontally differentiated products. Hence, the size of mutual trade decreases with greater economic distance. On the contrary, mutual trade between nations tends to rise when they have more similar per-capita incomes, as a result of homogeneity in demand structure.

Further, efficient allocation of resources is made possible through trade. This can engender growth that might be transformed into higher factor accumulation, mainly for nations interrelated by technology diffusion and knowledge spillovers. Spillover is easily created when there is some level of closeness between/among nations shared. Put differently, any time there is an investment (this arrangement is made possible through trade) in one country by another, both the host nation and its surrounding nations gain from such investment. Accordingly, bilateral trade plays a vital part in the growth of that economy as well as its surrounding regions. This paper, therefore, intends to measure the level of economic distance as well as the degree of cross-border spillovers in Africa using Nigeria and fifteen other countries as reference countries. The study investigates these issues by looking at Nigeria vis-à-vis other countries. Specifically, the sample countries are categorised into; top income, middle income, and bottom income economies using the size of gross domestic product (GDP) as the basis.

The rest of the paper is structured as follows: following the introduction in section one is a brief review of a few related studies in section two, section three provides the analytical framework and model specification, and section four dwells on the data analysis and discussion of results and section five concludes with recommendations.

LITERATURE REVIEW

Theoretical literature

The theoretical underpinning for this study is the neoclassical theory of economic externality initially developed by Alfred Marshall in 1890. The theory posits that in a capitalist economy, economic agents do not internalize all the costs occasioned by their economic actions. The theory mirrors the spillover effect of economic activities. In the neoclassical context, the externality of the market economy occasions market failure. In other words, the forces of demand and supply cannot efficiently regulate the resources; hence resource allocation is not Pareto-optimum. When the economic agents participate in relevant economic activities, there is always a certain spillover of economic benefits, while the beneficiaries of indirect economic benefits do not need to pay fees, which makes the economic effects low. On the other hand, when the economic activities of the parties show negative externalities, that is, the economic activities cause economic losses to others, the parties are not required to compensate for the losses.

Eventually, this leads to inefficient economic efficiency (Malin et al., 2020). The neoclassical analysis of externality focuses on individual firms trying to maximize profits.

This context focus on open economies that constitute

themselves into Economic and Monetary Unions (EMUs), as it is currently obtained in most regions of the world. In this context, it is important to note that the existence of spillovers by itself is not evidence of a market failure. That is, it may not be possible, via fiscal coordination or some other policy intervention, to provide a Pareto improvement, that is, to make some people better off without making anyone worse off. Two reasons informed our choice of economic externality theory. First, spillovers reflect some level of externalities, whether positive or negative. This suggests that in the open economy, especially in regions where there is some level of economic interaction, what happens in one economy may affect other economies. Second, the existence of cross-country spillovers may imply that there is some level of closeness (economic distance) between and among economies.

Empirical literature

Modern economies are more connected due to several reasons which include, merchandise and services trade, flows of money, and foreign investments. This has made economic relationships a major component of every country, particularly the developing economies.

Some studies have discussed rising globalization, with greater links and similarities between individual states, based on political, economic, and technological phenomena. The use of technology has "flattened" the market, therefore, the directions of trade can be explained by all factors, but the geographic position of a specific economy is relative.

Nevertheless, some scholars contend with this position; Ghemawat (2001), for example, highlights distance as one hindrance to external trade.

In recent times, environmental aspects of international trade have been accorded a prominent place. For example, Boisso and Ferrantino (1997) examined the role of economic distance, cultural distance, and openness in international trade. The researchers estimated annual gravity equations covering the period of 1960-1985 on a large sample, allowing them to identify time trends in the coefficients. The study found among other things that the restrictive effect of economic and cultural distance on international trade increased until the early- to mid-1970s and then began to decline. Also, faster economic growth is associated with greater imports, with increasing intensity over time. Lower tariffs and export taxes are also associated with greater imports, while the effect of free trade groupings is more complex.

Wang et al. (2018) contend that globalization encourages industrial division and creates a large stream of products between nations, leading to severe environmental problems. Looking at the nexus between green logistics and external trade, the authors demonstrated that the logistics performance indexes(LPI) of exporting and importing nations are positively correlated with trade volumes and that the LPIs of exporting nations positively affect the probability of trade.

Ho et al. (2013) studied the nexus between geographic distance and trade, taking into account spatial influence. The paper measured these effects only through the convergence of dynamic panel data and not the effect of spillovers. They found that a significant element that affects using one region over the other is the extent of physical distance between these regions. Similarly, Amidi and Majidi (2020) examined economic growth in terms of 'bilateral trade flow' and 'geographical distance' using the spatial dynamic panel data model for the period 1992–2016. The findings revealed that the effect of spatial spillover or spatial dependence is one of the main economic growth determinants. Also, the authors found that spatial relationships across countries and the spatial effects of trade are quite relevant. A country's economic growth is affected by the performance of its neighbours and trade partners. This result suggests that the spillover effects of geographical position and trade partners are the key determinants of economic growth.

On methodology, Antonakakis and Badinger (2012) examined the linkages between output growth and output volatility in the G7 countries over the period 1958M2–2013M8 using the VAR-based spillover index approach by Diebold and Yilmaz (2012). The author found that output growth and volatility are highly intertwined. Generalized impulse response analyses suggest moderate growth spillovers and sizable volatility spillovers across countries. A similar method was employed by Udeaja (2019) in examining the intensity of connectedness among the Nigerian financial markets for the period January 2000 to December 2018. The study used all shares index, Treasury bill rate, and Naira/USD official exchange rate to measure the stock market, money market, and exchange rate market, respectively. The study found connectedness among the Nigerian financial markets to be highly time-varying and appear to be higher during the period of high depreciation of the naira which coincides with the period of falling oil prices and the domestic economic meltdown of 2014 and 2016, respectively.

MATERIALS AND METHODS

Data

The study made use of a dataset covering the periods between 2000 and 2019. The variables studied include output growth rates, inflation rate, and unemployment rate, and they were sourced from the World Bank Development Indicator (WBDI) and the respective country's Central Bank.

Theoretical framework

Most extant studies analyzed cross-country spillovers using the VAR approach, advanced by Koop et al. (1996) and Pesaran and Shin (1998) as a theoretical framework, and one such study is by

Salisu et al. (2018). However, in recent times, many studies have adopted the framework proposed by Diebold and Yilmaz (2009, 2012, 2014). Owing to its novelty and strength, the Diebold –Yilmaz (DY) methodology is commonly used to characterize spillovers. Contrary to the orthodox VAR, the DY methodology uses decomposition of forecast error variance from VAR and it is fit for the assessment of the level of interdependence among nations across different economies and within an economy. Many spillovers can be produced using the DY method, such as; Total-Spillovers, Directional-Spillovers, and Net-Pairwise-Spillovers (Udeaja, 2019, Antonakakis and Badinger, 2015).

Model specification

Following Mazurek (2012), some measures of economic distance was outlined. Specifically, the relative economic distance was evaluated as well as the group relative distance between/among the countries of interest as follows:

Definition 1: Suppose we have two countries, *X* and *Y*, and the variable of interest *f*. The period is given by *γ* and *r* is the Pearson's correlation coefficient of time series f_x and f_y for the time *γ*. Therefore, our relative economic distance (RED) between *X* and *Y* (where X and Y are the two countries we are considering) in the indicator *f* for the time *γ* is defined by:

$$RED_{f,\gamma}(X,Y) = \{\frac{1 - r(fx, fy)}{2}\} * 100 \tag{1}$$

The RED presented in equation 1 has the following properties:
$RED_{f,r}(A,B) \in (0, 100)\%$.
  If the coefficient of correlation *r* of the two series, f_X and f_Y, is unity, then $RED_{f,t}(X,Y) = 0\%$.
  If the coefficient of correlation *r* of the two series, f_X and f_Y, is zero, then $RED_{f,t}(X,Y) = 50\%$.
  If a correlation coefficient of time series f_X and f_Y $r = -1$, then $RED_{f,t}(X,Y) = 100\%$.

The relative economic distance presented in equation 1 can also be extended in analyzing–group relative economic distance, which expresses the degree of 'economic globalization' among a group of economies (Mazurek, 2012).
Definition 2: Suppose further that *Z* is a list of economies such that $Z = \{Z_1, Z_2, Z_3 .... Z_n\}$ and $RED_{i,j}$ represents the relative economic distance between two nations *i* and *j* using a given in macroeconomic index *f* for a time *γ*. Accordingly, the group RED for this list of countries *Z* is defined by:

$$GRED_{f,r}(Z) = \frac{\sum_{i=1,i>j}^{n} RED_{ij}}{\binom{n}{2}} \tag{2}$$

Therefore, a Group RED is simply an estimation of the arithmetic mean of all the REDs among different economies in the group. Again, $GRED_{f,\gamma}(Z) \in [0, 100]\%$ and greater values of Group RED mean a greater mean level of economic closeness within a group (Mazurek, 2012).
  Two important questions arise from the definitions; namely (1) How suitable is RED for the evaluation of the relative economic distance? (2) Which macroeconomic indicator should be used for the evaluation? The answer to the first question can be provided by cointegration analysis. Hence, we test for cointegration among the variables in the groups to make sure that RED is suitable for the

evaluation of economic distance. To address the second question, Mazurek (2012) maintains that the growth rate of GDP is an appropriate indicator for evaluating how close economies are.
  However, other microeconomics fundamentals such as unemployment rates or inflation can also be used. In this paper, monthly and quarterly time series of GDP growth rates, inflation rates, and unemployment rates spanning from 2000:1 to 2019:4 are used.
  Next, the author look at the spillover index using the DY framework. Drawing from a 1980 seminal paper by Sims and building on the popular idea of variance decompositions. The DY framework helps to assess the contributions of shocks to variables to the forecast error variances of both the respective and the other variables of the model (Antonakakis and Badinger, 2015). In this paper, the version of the connectedness index in Diebold and Yilmaz (2012, 2014) was adopted.
  This version improves and takes a broader view of the approach proposed in Diebold and Yilmaz (2009). There are two major areas of improvement. Firstly, stronger procedures of directional spillovers and net spillovers were introduced, generating an 'input-output' disaggregation of the entire spillovers into the ones emanating from (or to) a specific source (variable) and giving the room to detect the major receivers and transmitters of spillovers (Antonakakis and Badinger, 2015). Secondly, following some other VAR-based studies, for example, Pesaran and Shin (1998), the DY framework employed a generalized VAR framework, where forecast-error variance decompositions do not change following the re-ordering of the variables, different from the Cholesky-factor identification adopted in Diebold and Yilmaz (2009).
  Aligning with the DY framework and following Antonakakis and Badinger (2015), we set up directional spillover indexes in a generalized VAR framework that is invariant to the variable (Antonakakis and Badinger, 2015). In setting up the spillover indexes, a covariance stationary N variable VAR (p) of the following form is considered.

$$Z_t = \sum_{j=1}^{q} \Phi_j Z_{t-1} + \varepsilon_t \tag{3}$$

Where $Z_t = (Z_{1t}, Z_{2t}, Z_{3t}, Z_{4t}, Z_{5t}, ..., Z_{Kt})$ is a vector of K endogenous variables, Φj, j= 1,..., q are K x K parameter matrices and $\varepsilon t \sim (0,\Sigma)$ is a vector of error terms, which are assumed to be well behaved; t =1, ..., T is the time index and k =1,..., K is the macroeconomic fundamental for each of the sixteen economies we are studying, namely; Nigeria (NIG), South Africa (RSA), Egypt (EGY), Algeria (ALG), Morocco (MOR), Kenya (KEN), Burkina Faso (BKF), Mauritius (MAU), Namibia (NAM), Madagascar (MAD), Guinea (GUI), The Gambia (GAM), Seychelles (SEY), Guinea Bissau (GUB), Comoros (COM) and Sao Tome and Principe (STP). The VAR equation in 3 has observations on GDP growth (grXt), inflation rate (infXt) and unemployment rate (unXt) (Xt, x =1, 2, 3, 4, 5, 6, …16), with X representing a country index. Therefore, given the sixteen selected economies and three macroeconomic indicators (GDP growth rate, inflation rate and unemployment rate), the model consists of K = 48 indicators, that is, Zt = (grXt, infXt, unXt) where grXt, infXt and unXt are 16 × 1 vectors with observation on GDP growth, inflation rate and unemployment rate for the 16 countries in that order.
  Key to the dynamics of the system is the moving average representation of model (3), therefore, re-specifying equation (3) as a moving average gives:

$$Y_t = \sum_{j=0}^{\infty} A_j \varepsilon_{t-j} \tag{4}$$

A_j is said to obey the recursion $A_j = \varphi_1 A_{j-1} + \varphi_2 A_{j-2} + \varphi_3 A_{j-3}$

$+ \varphi_3 A_{j-4} + ... + \varphi_p A_{j-p}$, A_0 is the K x K identity matrix and $A_j = 0$ for j < 0. Equation (4) is the basis for the derivation of variance decompositions. Hence, the procedure for providing the representations for the various indexes started with the H-step ahead forecast error variance decomposition.

$$Q_{ij}(H) = \frac{\sigma_{jj}^{-1} \sum_{h=0}^{H-1} (e_i' A_h \sum e_j)^2}{\sum_{h=0}^{H-1} (e_i' A_h \sum A_h' e_j)} \qquad (5)$$

The sigma (Σ) represents expected variance matrix of the error vector ε, while σ_{jj} denotes the expected standard deviation of the disturbance term for the *j-th* element. The term e_i is the choice error. From equation (5), we obtain a K x K matrix $_Q(H) = [_Q ij(H)]i,j = 1,...12$. Each of the entries in equation (5) provides the contribution of variable j to the forecast error variance of variable i. The elements in the major diagonal depict the (own) contributions of shocks to the variable i to its own forecast error variance, the off-diagonal elements show the (cross) contributions of the other variables j to the forecast error variance of variable i. Given that $\Sigma_j^k = _1Q ij(H) \neq 1$, (that is, the sum of the contribution shares is not equal to one) each entry of the variance decomposition matrix is normalized by its row sum. Thus, the normalized KPPS H-step-ahead forecast error variance decomposition is:

$$\overline{Q}_{ij}(H) = \frac{Q_{ij}(H)}{\sum_{j=1}^{k} Q_{ij}(H)} \qquad (6)$$

$\sum_{j=1}^{k} \bar{Q} ij (H) = 1$ while $\sum_{i,j=1}^{k} \bar{Q} ij (H) = K$. With equation (6), it can calculate the total spillover index. This is shown in Equation (7):

$$S(H) = \frac{\sum_{i,j=1,i}^{k} \overline{Q}_{ij}(H)}{\sum_{i,j=1}^{k} \overline{Q}_{ij}(H)} *100 = \frac{\sum_{i,j=1,i\neq j}^{k} \overline{Q}_{ij}(H)}{K} *100 \qquad (7)$$

Equation (7) defines the average contribution of spillovers from shocks to all (other) variables to the total forecast error variance. By looking at the directional spillovers, the directional spillovers received by variable *i* from all other variables j can be seen. This is expressed in the equation below.

$$S_{i\leftarrow j}(H) = \frac{\sum_{j=1,i\neq j}^{k} \overline{Q}_{ij}(H)}{\sum_{i,j=1}^{k} \overline{Q}_{ij}(H)} *100 = \frac{\sum_{j=1,i\neq j}^{k} \overline{Q}_{ij}(H)}{K} *100 \qquad (8)$$

Similarly, the directional spillovers from variable *i* to all other variables j is given by:

$$S_{i\rightarrow j}(H) = \frac{\sum_{j=1,i\neq j}^{k} \overline{Q}_{ji}(H)}{\sum_{i,j=1}^{k} \overline{Q}_{ji}(H)} *100 = \frac{\sum_{j=1,i\neq j}^{k} \overline{Q}_{ji}(H)}{K} *100 \qquad (9)$$

The directional spillovers provide a decomposition of total spillovers into those coming from (or to) a particular source. Accordingly, the spillover matrix is made up of four blocks, namely; the two main diagonal blocks (i, j from 1 up to 6 on one hand and i, j from 7 up to 12 on the other hand) indicating variable X to variable X spillover and variable Y to variable Y spillovers; and the off-diagonal blocks (i

is from 1 up to 6 and j is from 7 up to 12 and i is from 7 up to 12, j is from 1 up to 6), indicating variable X to variable Y spillover and variable Y to variable X spillovers, where X and Y are the variables under consideration, in this present case we have; GDP growth and Inflation, GDP growth and unemployment and inflation and unemployment.

Estimation procedure

The author begins the empirical investigation by first, providing the summary statistics of variables of interest. After testing for stationarity using ADF test statistics, he employed the Pearson Correlation to test for the degree of association between the indicators. He also tested for group cointegration using the Pedroni Panel Cointegration approach. Further, the results of the unconditional correlation are then used to evaluate both the relative and group economic distance. And finally, the level of connectedness was examined among countries of interest using Diebold and Yilmaz's (2009, 2012, 2014) spillover indices.

RESULTS AND DISCUSSION

Preliminary analysis

Before the estimation, summary statistics (Table 1) of the variables for each of the selected countries was provided. The results are shown in Table 1 in three panels. Panel A show the summary statistics for Nigeria and the next top five economies in Africa.

Panel B shows the summary statistics for the middle and bottom five economies in Africa respectively. Note that we have included Nigeria in all the categories because Nigeria is the basis for comparison. The mean value indicated that the three indicators in each of the sixteen countries have a positive mean value over the period. The quarterly average growth rate was highest in Nigeria (6.20), followed by Burkina Faso (5.69) and then Sao Tome and Principe (4.85). On the other hand, countries with the least mean growth in output during these periods were Comoros (2.64), followed by South Africa (3.2), and then Seychelles (3.2). The country with the highest average inflation rate during these periods was Guinea (14.3), followed by Nigeria (11.33) and then Egypt (10.65). Conversely, inflation rates were lowest in Morocco (0.78), followed by Burkina Faso (2.08) and Comoros (3.08). The quarterly average unemployment was highest in South Africa (25.02) followed by Namibia (21.36) and Algeria (14.63). On the other hand, countries with the least mean unemployment during these periods were; Madagascar (2.8), followed by Seychelles (3.31), and then Burkina Faso (4.55). The sizes of the standard deviation indicate that economic growth and inflation exhibit large variability, especially in countries like Nigeria, Madagascar, Seychelles, Guinea, Algeria, Guinea Bissau, etc., on the other, variability in unemployment is generally small. Finally, the unit root results of the Augmented Dickey-Fuller (ADF) show that all the indicators for each of the countries are stationary

Table 1. Descriptive statistics of output growth, inflation, and unemployment.

Panel A: Nigeria and the next five top income economies in Africa

	grNIG*	grRSA	grEGY	grALG	grMOR	GrKEN	infNIG*	infRSA	infEGY	infALG	infMOR	infKEN	unNIG*	unRSA	unEGY	unALG	unMOR	unKEN
MEAN	6.20	2.67	4.34	3.32	4.11	4.72	11.33	6.70	10.65	6.51	0.78	7.58	4.86	25.02	11.0	14.67	10.08	10.96
Std	6.91	1.81	1.59	1.57	1.66	2.17	10.69	1.84	5.46	8.48	2.11	5.10	1.43	1.74	1.50	6.41	1.32	0.86
N	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80
ADF	-6.7**	-8.7**	-8.7**	-7.1**	-10.0**	-8.7**	-7.2**	-8.7**	-8.7**	-6.9**	-5.9**	-8.0**	-5.3**	-8.8**	-8.7**	-9.2**	-3.2**	-8.7**

Panel B: Nigeria and five middle income economies in Africa

	grNIG*	grBKF	grMAU	grNAM	grMAD	GrGUI	infNIG*	infBKF	infMAU	infNAM	infMAD	infGUI	unNIG*	unBKF	unMAU	unNAM	unMAD	unGUI
MEAN		5.69	4.24	3.86	3.16	4.61		2.08	3.75	6.95	8.73	14.30		4.55	7.61	21.36	2.80	4.52
Std		1.62	1.86	3.47	4.56	3.05		3.20	2.85	3.61	3.62	21.0		1.52	0.95	1.79	1.47	0.08
N		80	80	80	80	80		80	80	80	80	80		80	80	80	80	80
ADF		-10.**	-8.3**	-6.8**	-8.1**	-8.7**		-8.7**	-8.7**	-8.7**	-8.7**	-6.8**		-9.0**	-8.7**	-8.7**	-8.9**	-8.8**

Panel C: Nigeria and five bottom income economies in Africa

	grNIG*	grGAM	grSEY	grGUB	grCOM	GrSTP	infNIG*	infGAM	infSEY	infGUB	infCOM	infSTP	unNIG*	unGAM	unSEY	unGUB	unCOM	unSTP
MEAN		3.71	3.20	3.28	2.64	4.85		6.06	7.25	7.04	3.08	10.49		9.37	3.31	5.96	4.88	14.80
Std		3.44	4.38	2.48	0.82	1.97		3.74	9.92	17.83	2.59	6.73		0.11	0.85	1.18	1.21	1.40
N		80	80	80	80	80		80	80	80	80	80		80	80	80	80	80
ADF		-7.3**	-8.7**	-6.8**	-8.8**	-5.5**		-8.7**	-8.7**	-5.2**	-8.7**	-7.5**		-8.8**	-8.7**	-8.8**	-8.8**	-3.9**

Means and standard deviations are expressed in % point. ADF denotes augmented Dickey Fuller tests with 5% critical values of −2.9029.* We included Nigeria in each of the categories in order to evaluate the correlation between Nigeria's indicators and those of other countries ** Significant at 5% level.
Source: The authors' computation.

at first difference.

Unconditional correlation matrix

The unconditional correlations result carried out on the percentage rate (%) of GDP growth, inflation, and unemployment for Nigeria and the rest of the fifteen countries is presented in Table 2.

Specifically, the correlation between Nigerian indicators and those of other countries was examined. In Summary, the result shows that economic growth in Nigeria exhibits positive correlation with economic growth in nine of the countries, except for Kenya, Burkina Faso, Guinea, Seychelles, Guinea Bissau, and Comoros where evidence of a negative correlation between Nigeria's economic growth and each of the country's growth was found. The result also reveals that there is a positive correlation between economic growth in Nigeria and inflation in the vast majority of the countries (South Africa, Algeria, Morocco Kenya, Mauritius, Madagascar, Guinea, The Gambia, Seychelles, Comoros, and Sao Tome and Principe). Economic growth in Nigeria exhibits a negative correlation with Inflation in the rest of the countries (including Nigeria). On the relationship between economic growth in Nigeria and unemployment in other economies, as expected, the result indicates a negative correlation between Nigeria's economic growth and unemployment in Nigeria, South Africa, Egypt, Kenya, Burkina Faso, and Comoros. On the other hand, we find a positive correlation exists between Nigeria's economic growth and unemployment in the rest of the economies (Algeria, Morocco, Mauritius, Namibia, Madagascar, Guinea, The Gambia, Seychelles, Guinea Bissau, and Sao Tome and Principe. Table 3 presents information on the correlation between Nigeria's inflation and others' indicators

Table 2. Unconditional correlation.

Country	grNIG	infNIG	unNIG		grNIG	infNIG	unNIG		grNIG	infNIG	unNIG
	Nigeria and top income economies				**Nigeria and middle income economies**				**Nigeria and bottom income economies**		
grNIG	1			grNIG	1	-0.268	-0.332	grNIG	1	-0.268	-0.332
grRSA	0.372	0.394	-0.466	grBKF	-0.176	-0.126	0.174	grGAM	0.278	-0.425	0.158
grEGY	0.011	0.017	0.207	grMAU	0.301	0.172	-0.126	grSEY	-0.365	0.146	0.048
grALG	0.247	0.345	-0.44	grNAM	0.546	0.053	-0.616	grGUB	-0.178	-0.079	0.158
grMOR	0.295	-0.301	-0.431	grMAD	0.139	-0.376	0.157	grCOM	-0.085	0.535	0.007
grKEN	-0.004	-0.408	0.174	grGUI	-0.436	0.059	0.582	grSTP	0.069	0.116	-0.277
infNIG	-0.268	1	0.019	infNIG	-0.268	1	0.019	infNIG	-0.268	1	0.019
infRSA	0.048	0.45	-0.391	infBKF	-0.129	0.054	-0.191	infGAM	0.586	-0.088	0.198
infEGY	-0.06	-0.307	0.437	infMAU	0.313	0.112	-0.268	infSEY	0.475	-0.382	-0.278
infALG	0.229	0.438	-0.185	infNAM	-0.35	0.301	-0.169	infGUB	-0.124	0.508	-0.089
infMOR	0.147	-0.06	-0.273	infMAD	0.286	0.362	-0.153	infCOM	0.029	-0.466	0.007
infKEN	0.106	-0.166	-0.259	infGUI	0.149	0.133	-0.011	infSTP	0.167	0.207	-0.417
unNIG	-0.332	0.019	1	unNIG	-0.332	0.019	1	unNIG	-0.332	0.019	1
unRSA	-0.238	0.1	0.692	unBKF	-0.394	-0.313	0.493	unGAM	0.166	-0.082	-0.708
unEGY	-0.227	-0.126	0.166	unMAU	0.301	-0.222	-0.469	unSEY	0.096	-0.073	-0.283
unALG	0.172	0.481	-0.176	unNAM	0.008	-0.036	0.524	unGUB	0.24	0.03	-0.808
unMOR	0.192	0.463	-0.226	unMAD	0.24	0.358	-0.291	unCOM	-0.17	0.035	0.759
unKEN	-0.069	-0.352	-0.505	unGUI	0.308	0.009	-0.859	unSTP	0.394	0.293	-0.450

Source: The authors' computation.

Table 3. Summary of pedroni panel cointegration test.

Alternative hypothesis: common AR coefs. (within-dimension)				
			Weighted	
	Statistic	Prob.	Statistic	Prob.
Panel v-Statistic	3.586899	0.0002	-0.545788	0.7074
Panel rho-Statistic	-4.296234	0.0000	-3.755383	0.0001
Panel PP-Statistic	-8.083400	0.0000	-8.944788	0.0000
Panel ADF-Statistic	-2.928594	0.0017	-4.562470	0.0000

Alternative hypothesis: individual AR coefs. (between-dimension)		
	Statistic	Prob.
Group rho-Statistic	-2.863701	0.0021
Group PP-Statistic	-12.47019	0.0000
Group ADF-Statistic	-3.390374	0.0003

Source: The authors' computation.

(output growth, inflation, and unemployment) as well as the correlation between Nigeria's unemployment and other's indicators. Generally, the evidence is mixed; there is a positive as well as a negative correlation between these variables across countries. It is, however, important to note that these results are not statistically significant at a 5% level of significance.

Further, the existence of a long-run relationship among the variables using Pedroni Panel Cointegration was tested. The results are presented in Table 3. The result

indicates that the variables are cointegrated. This justifies our choice of relative economic distance in evaluating the level of proximate between/among the selected countries.

Economic distance

We begin the discussion by looking at relative economic distance (RED in %) for the fifteen (15) countries in Africa vis-à-vis Nigeria. It made use of the quarterly growth rate

Table 4. Relative economic distance between Nigeria and selected African countries.

	Country	GDP Growth		Inflation rate		Unemployment rate		Average RED (%)
		Pearson's R	RED (%)	Pearson's R	RED (%)	Pearson's R	RED (%)	
Top five economies	South Africa	0.372	31.4	0.450	27.5	0.692	15.4	24.8
	Egypt	0.011	49.45	-0.307	65.4	0.166	41.7	52.2
	Algeria	0.247	37.65	0.438	28.1	-0.176	58.8	41.5
	Morocco	0.295	35.25	-0.060	53	-0.226	61.3	49.9
	Kenya	-0.004	50.2	-0.166	58.3	-0.505	75.25	61.3
Middle five economies	Burkina-Faso	-0.176	58.8	0.054	47.3	0.493	25.35	43.8
	Mauritius	0.301	34.95	0.112	44.4	-0.469	73.45	50.9
	Namibia	0.546	22.7	0.301	35	0.524	23.8	27.2
	Madagascar	0.139	43.05	0.362	31.9	-0.291	64.55	46.5
	Guinea	-0.436	71.8	0.133	43.4	-0.859	92.95	69.4
Bottom five economies	The Gambia	0.278	36.1	-0.088	54.4	-0.708	85.4	58.6
	Seychelles	-0.365	68.25	-0.382	69.1	-0.283	64.15	67.2
	Guinea-Bissau	-0.178	58.9	0.508	24.6	-0.808	90.4	58
	Comoros	-0.085	54.25	-0.466	73.3	0.759	12.05	46.6
	Sao Tome and Principe	0.069	46.55	0.207	39.7	-0.450	72.5	52.9

Source: The authors' computation.

of GDP (expressed in %) was used, inflation rate (expressed in %), and unemployment rate (expressed in %) from 2000 to 2019 to measure the RED in Africa. The results are shown in Table 4.

Relative Economic Distance (RED)

Table 4 shows the relative economic distance between Nigeria and each of the fifteen countries, using three indicators (Economic growth, inflation rate, and unemployment rate). When evaluated using quarterly GDP growth, the South African economy is the closest economy to Nigeria, followed by the Moroccan economy and the Algerian economy.

Among the top five economies, the Kenyan economy is the farthest from the Nigerian economy. Of the middle five economies, the Namibian economy is the closest to the Nigerian economy, while Mauritius ranks second within that category. Similarly, The Gambia from the bottom five category is the closest to the Nigerian economy, while the Seychelles economy is the farthest from the Nigeria economy. Using the average relative economic distance and generally speaking, the South African economy is the closest to the Nigerian economy. This outcome appears to be expected, given that the relationship that exists between Nigeria and South Africa appears to be robust.

The rest of the results are summarised in Figure 1.

Group Relative Economic Distance (GRED)

A group relative economic distance was evaluated among each of the three categories, to examine the level of globalisation among the groups. The result indicates that the level of globalisation, though generally low is higher among the top-income economies in Africa (Figure 2). This may be because cooperation appears to be higher among the top-income economies in Africa.

Spillover indices

Having examined the degree of economic distance between Nigeria and selected economies in Africa, the level of connectedness and spillovers
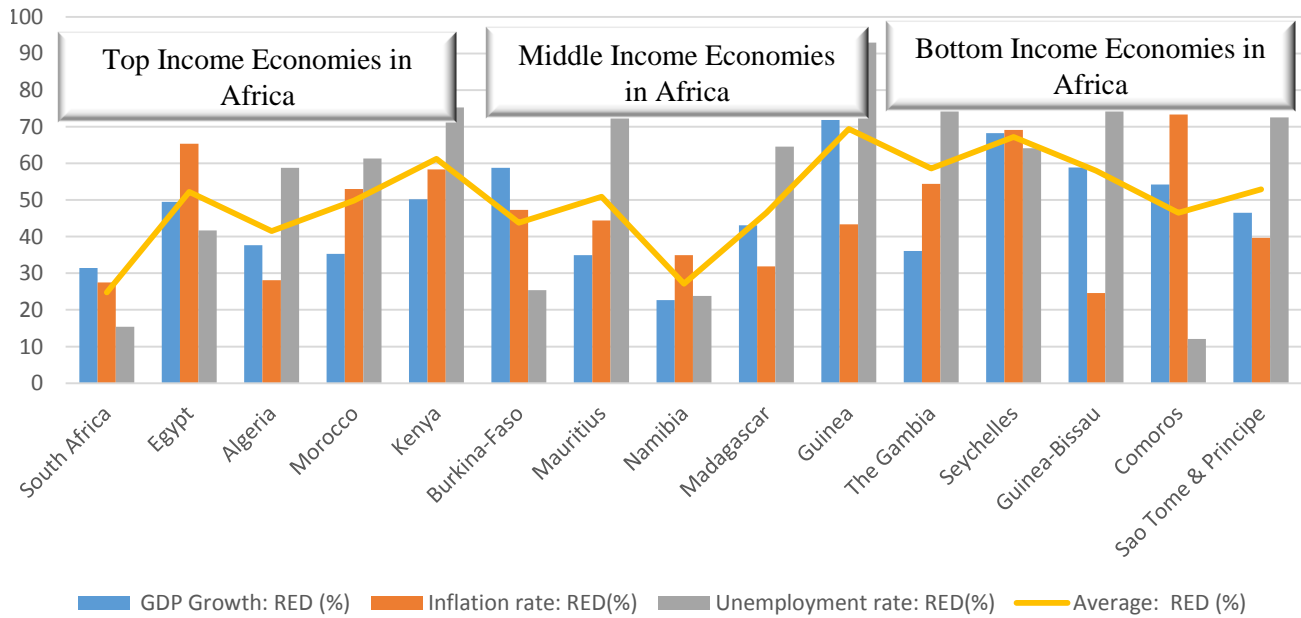
Figure 1. Relative economic distance between Nigeria and selected African countries
Source: The authors' computation.
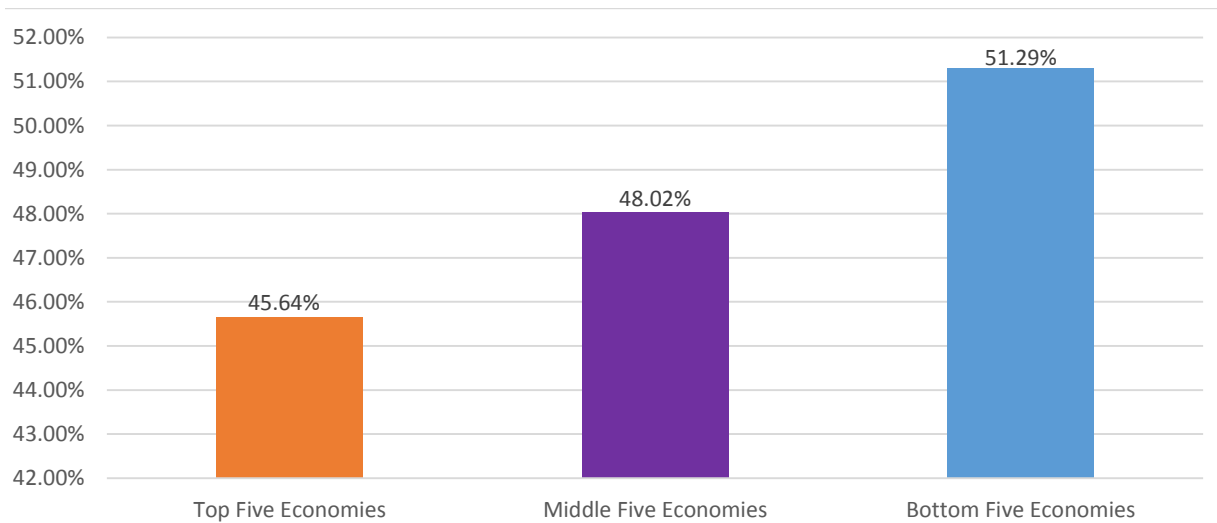
Figure 2. Group Relative Economic Distance (GRED) of the selected African countries.
Source: The authors' computation.

between/among these economies was further investigated. Specifically, the connectedness between a pair of variables was examined (that is economic growth versus inflation, economic growth versus unemployment, and inflation versus unemployment) for each of the three categories (Top, Middle, and Bottom income economies). Before our discussion, the elements in the Tables are first described in Tables (Tables 5a to 7c).

In Panel A of the Tables, the ijth item represents the calculated share of the forecast error variance of an indicator *i* emanating from innovations to indicator j (Equ. 3.5). In the passing, it is important to bear in mind that each variable is linked with one of the economies' indicators (GDP growth, inflation or unemployment). The elements on the diagonal (i = j) account for own-variable spillovers (that is, growth-to-growth, inflation-to-inflation,

Table 5a. Spillover table for the full connectedness of economic growth and inflation In Nigeria and some top income economies in Africa.

To i	From jgrNIG	grRSA	grEGY	grALG	grMOR	grKEN	infNIG	infRSA	infEGY	infALG	infMOR	infKEN	From others
Panel A													
grNIG	64.1	0.4	1.5	8.9	2.6	0.7	10.2	0.7	9.2	0.2	0.1	1.4	35.9
grRSA	1.6	51.6	4.3	1.2	0.1	6.1	7.8	1	0.1	24.8	0.2	1.2	48.4
grEGY	1.3	5.7	72.5	1.3	0	0.9	0.9	2.6	2.6	4.1	3.9	4	27.5
grALG	6.9	1.2	5.3	46.6	11.6	0	6.5	1.5	1.6	2.1	1.5	15.3	53.4
grMOR	0.8	0.7	0.2	11.7	53.8	0.4	9.7	10.8	0.1	0.7	1.4	9.9	46.2
grKEN	2.3	1.9	1	0.1	1.1	63.4	9.3	14.4	1.4	1.2	0.4	3.6	36.6
infNIG	6.5	9.6	0.4	5.6	8.8	4.7	41.5	12.1	0.7	9	0.1	0.9	58.5
infRSA	0.4	3	1	0.5	8	6.7	11.9	60.5	4.9	0.1	1.6	1.4	39.5
infEGY	5.9	0.1	0.2	0.5	0	1.4	0.5	1.9	71.2	1.2	16.9	0.2	28.8
infALG	0.7	28.9	5.2	4	1.2	0.8	10.8	0	0.7	47.3	0	0.5	52.7
infMOR	0.1	1.9	9.7	1.7	1.1	0.9	0.1	1.1	11.2	0	71.7	0.6	28.3
infKEN	0.7	1.1	5.2	12.2	10.9	4.4	0.2	2.4	0.2	0.9	1.2	60.5	39.5
Contribution to others	27.2	54.5	33.9	47.7	45.5	27	67.9	48.6	32.7	44.3	27.2	38.9	495.3
Contribution including own	91.3	106.1	106.4	94.3	99.3	90.4	109.4	109.1	103.9	91.5	98.8	99.5	TSPI (%) = 41.30%
Panel B													
Contr. to others' gr	12.9	9.9	12.3	23.2	15.4	8.1							81.8 (17.96%)
Contr. to others' inf	7.8	41.6	21.5	20.5	28.9	14.5							134.8 (29.60%)
Contr. to others' gr							34.2	30	12.4	31	6.1	31.8	145.5 (31.95%)
Contr. to others' inf							23.5	17.5	17.7	11.2	19.8	3.6	93.3 (20.49%)

Source: The authors' computation.

And unemployment-to-unemployment) within economies, on the other hand, the off-diagonal elements (i ≠ j) account for the cross-variable spillovers within and between economies. Also, the row sums without the major diagonal elements classified as 'Contributions from others' (Equation 8) and the column sums classified as 'Contributions to others', (Equation 9) show the aggregate contagions 'to' (received by) and 'from' (transmitted by) each indicator. The aggregate spillover index expressed in Equation (7), shown

in the lower right corner of panel A in Tables 5a – 7c, is nearly equal to the grand off-diagonal column sum (or row sum) relative to the grand column sum plus the diagonals (or row sum plus diagonals), stated in percentage points.

Nigeria and the next top five income economies in Africa

Economic growth rate and Inflation rate: Table

5a shows the level of connectedness/spillover between the economic growth rate and inflation rate in Nigeria and the next Five Top Income economies in Africa. The diagonal elements account for the growth-to-growth and inflation-to-inflation spillovers within economies, on one hand. On the other hand, the off-diagonal elements measure cross-variable spillovers within and between economies. The result indicates that GDP growth-to- GDP growth spillovers within countries are large in most of the countries,

Table 5b. Spillover table for the full connectedness of economic growth and unemployment in Nigeria and some top income economies in Africa.

To i	From j grNIG	grRSA	grEGY	grALG	grMOR	grKEN	unNIG	unRSA	unEGY	unALG	unMOR	unKEN	From others
Panel A													
grNIG	68.3	0.3	1.1	10.2	2.5	1.2	0.8	2.8	2.7	3.6	6.4	0.1	31.7
grRSA	1.7	62.1	5.3	2.4	0.1	14.1	1.4	2.3	6.8	0	0.1	3.8	37.9
grEGY	0.5	7.4	59.1	0.3	0	0.9	2.2	14.2	1.2	0.1	1.3	12.6	40.9
grALG	6.1	1.1	1.9	42.6	9.4	0.1	0.9	7.4	9.6	10.3	10.6	0.2	57.4
grMOR	1	0.4	0.1	14.8	67.2	0.7	9.4	0	0.4	4.3	1.5	0.1	32.8
grKEN	3.4	3.5	1.1	0	1.1	75.7	0.1	0.1	10.3	2.5	2	0.2	24.3
unNIG	1.2	1.5	2.9	0	5.3	0	73.6	5.1	0.9	0	0.1	9.4	26.4
unRSA	4.5	7.6	13.7	4.1	0.1	0.6	4.3	55.7	3.4	2.8	0.2	3.2	44.3
unEGY	1.7	2.6	10.1	10.4	0.2	5	2.9	8.6	51.6	0.6	0.8	5.6	48.4
unALG	3.2	0	0.2	6.6	2.4	1	0	1.7	0.8	58.5	21.8	3.9	41.5
unMOR	3.1	0.2	0.3	13.1	2.8	2.4	0.2	0.1	0.8	25.8	50.8	0.5	49.2
unKEN	0.1	7.2	9	0.1	0	0.6	13.2	2	0.7	4.7	0.3	62.1	37.9
Contribution to others	26.5	31.8	45.5	62	23.8	26.4	35.4	44.4	37.6	54.7	45	39.6	472.7
Contribution including own	94.8	93.9	104.6	104.7	91	102.2	109	100.1	89.2	113.2	95.8	101.6	*TSPI (%) = 39.40%*
Panel B													
Contr. to others' gr	12.7	12.7	9.5	27.7	13.1	17							92.7 (21.66%)
Contr. to others' un	12.6	11.5	26.1	27.7	8	9							94.9 (22.17%)
Contr. to others' gr							14	24.5	29.8	10.5	20.4	16.8	116 (27.10%)
Contr. to others'un							20.6	17.5	6.6	33.9	23.2	22.6	124.4 (29.07%)

Source: The authors' computation.

except in Algeria, but generally low between countries. For instance, innovations in Nigeria's economic growth account for about 64.1% variations of Nigeria's GDP growth rates, but only for 1.6% of South Africa, 1.3% of Egypt, 6.9% of Algeria, 0.8% of Morocco, and 2.3% of Kenya. Similarly, innovations in other countries' output growth (South Africa, Egypt, Algeria, Morocco, and Kenya) are responsible for about 0.4, 1.5, 8.9, 2.6, and 0.7% of the 12-months ahead forecast error variance of GDP growth in Nigeria. Growth-to-inflation spillovers, both within and between

countries are also low. The result further reveals that inflation-to-inflation spillovers within countries are high in most of the countries, except in Nigeria and Algeria. In addition, inflation-to-inflation spillovers between countries are low. Inflation-to-growth spillovers are equally low within and between countries. The total spillover index of 41.30% suggests a low connectedness between economic growth and inflation among top-income economies in Africa.

In Panel B of the Table, a more differentiated picture of the results was provided, the directional

spillovers into growth-to-growth spillovers and inflation-to-growth spillovers was decomposed (termed 'Contribution to others 'gr'), as well as growth-to-inflation spillovers and inflation-to-inflation spillovers (termed 'Contribution to others' inf'). The results reveal that 31.95% of all four gross directional spillovers are from inflation-to-growth, with Nigeria, Kenya, and Algeria being the biggest contributors of growth-to-inflation spillovers to other countries. The proportion of GDP growth-to-GDP growth spillovers appears somehow small, having a mean value of 17.96%.

Table 5c. Spillover table for the full connectedness of inflation and unemployment in Nigeria and some top income economies in Africa.

To i	From j grNIG	grRSA	grEGY	grALG	grMOR	grKEN	unNIG	unRSA	unEGY	unALG	unMOR	unKEN	From others
Panel A													
infNIG	59.2	16.9	1.1	12.5	0.1	1	0	0.6	4.4	2	1.1	1.2	40.8
infRSA	11.1	60.3	1.7	1.2	2.2	0.6	1	0.6	13.7	0.5	7	0	39.7
infEGY	0.5	0.6	71.9	3.7	14.8	0.4	1.4	0.3	2.4	1	2.3	0.7	28.1
infALG	14	0.2	0.8	68	0	0.4	0.9	1.2	4.2	0	6.8	3.5	32
infMOR	0.1	0.9	6.8	0.1	52.6	0.7	2.1	7.8	0.6	0.9	0.8	26.6	47.4
infKEN	1.1	1	0.4	2.1	1.1	67.3	0.8	12.5	1.2	7.4	2.6	2.5	32.7
unNIG	0	1	0.5	0.4	2.5	0.1	79.9	5.4	2.4	0.1	0.1	7.6	20.1
unRSA	0.1	0.8	1.2	6.4	3.1	8.8	7.3	60.5	4	4	0.5	3.5	39.5
unEGY	2.3	8.1	0.9	1.5	1.8	4.5	4.1	10.7	58.6	0.2	1.1	6.2	41.4
unALG	2.1	1.8	0.1	0.3	0.5	4.3	0.2	2.9	0.6	62.7	20.9	3.5	37.3
unMOR	1.5	3	0.4	4.6	0.4	3.6	0.3	0.1	1.2	28.3	56.1	0.5	43.9
unKEN	1.3	0.1	1.1	4.5	15.3	0.3	9.9	2.2	1.6	5.7	0.6	57.3	42.7
Contribution to others	34	34.2	15	37.3	41.9	24.6	28	44.3	36.4	50.1	44	55.9	445.8
Contribution including own	93.2	94.6	86.8	105.3	94.5	91.9	107.9	104.7	95	112.9	100.1	113.1	*TSPI (%) = 37.10%*
Panel B													
Contr. to others' inf	26.8	19.6	10.8	19.6	18.2	3.1							98.1 (22.47%
Contr. to others' un	7.3	14	3.3	17.4	23.2	21.3							86.5 (19.81%)
Contr. to others' inf							6.2	22.4	24.1	11.8	19.8	32	116.3(26.64%)
Contr. to others' un							21.8	21.3	9.8	38.3	23.2	21.3	135.7(31.08%)

Source: The authors' computation.

Finally, with shares of 29.60 and 20.49%, growth-to-inflation and inflation-to-inflation spillovers make up some fractions of total spillovers.

Economic growth rate and the unemployment rate: The result in Table 5b shows that GDP growth-to- GDP growth spillovers within countries are large in nearly all the countries, except in Algeria but generally low between countries. This result is similar to what is presented in the preceding table. Similarly, unemployment-to-

unemployment spillovers within countries are also high in all the countries.

In addition, unemployment-to-unemployment spillovers between economies, including unemployment-to-GDP growth spillovers within and between economies are very negligible small. The result indicates that innovation in Nigeria's unemployment accounts for about 74% of variations in Nigeria's unemployment, on the other hand, the innovations in Nigeria's unemployment account for just 4.3% of South Africa's

unemployment, 2.9% of Egypt's unemployment, none for Algeria, 0.2% of Morocco and 13.2% of Kenya. At 39.40%, the total spillover index is low. In Panel B of the Table, the results reveal that 29.07% of all four gross directional spillovers are from unemployment-to-unemployment, with Algeria and Morocco being the biggest contributors of unemployment-to-unemployment spillovers to the other countries. The shares of growth-to-growth, growth-to-unemployment, and unemployment-to-growth spillovers in the gross

Table 6a. Spillover table for the full connectedness of economic growth and inflation in Nigeria and middle income economies in Africa.

To i	From j grNIG	grRSA	grEGY	grALG	grMOR	grKEN	unNIG	unRSA	unEGY	unALG	unMOR	unKEN	From others
Panel A													
grNIG	42.4	7.4	12.6	15.1	1.4	1.9	7.2	3.7	2.6	4.1	0.8	0.8	57.6
grBKF	8.6	40.4	8	6.1	12	5.9	0.4	12.8	3.3	0.1	2.5	0.1	59.6
grMAU	8	5.6	37.8	17	1.3	1.2	1.2	3.5	4.8	0.1	1.9	17.6	62.2
grNAM	9	4.3	15.5	40.5	0.2	1.9	1.5	7.4	9	3	0.2	7.4	59.5
grMAD	0.4	13.3	2.9	0.8	43	0.1	8.6	0.2	3.1	4.4	21.2	1.9	57
grGUI	1	3.7	0.7	2.2	0.2	63.5	2.3	14.4	1.6	5	2.7	2.8	36.5
infNIG	7.7	1	0.4	0.5	15.8	3.3	46.6	2.9	1.6	5	14.7	0.6	53.4
infBKF	2.6	8.9	3.3	8.9	0.1	13.3	1.4	48.6	1.8	6.6	3.6	0.9	51.4
infMAU	0.9	4.4	5.5	7.8	2.7	1	0.9	2	54.1	2.3	0.6	17.8	45.9
infNAM	3.7	0.6	0.2	6.1	2.2	6.7	4.3	11.9	2.8	57.6	1.9	1.9	42.4
infMAD	3.3	4.3	2.6	0.3	20.7	2.7	7.6	3.1	0.6	1.3	51.6	1.9	48.4
infGUI	0.2	1.4	15.2	4.6	1	3.6	2.4	0.4	13.2	2.2	1.5	54.4	45.6
Contribution to others	45.4	54.9	67	69.4	57.5	41.5	37.8	62.4	44.2	34.1	51.7	53.8	619.6
Contribution including own	87.8	95.2	104.8	110	100.4	105	84.4	111	98.2	91.7	103.3	108.2	TSPI (%)= 51.6%
Panel B													
Contr. to others' gr	27	34.3	39.7	41.2	15.1	11							168.3(32.65%)
Contr. to others' inf	10.7	11.7	21.7	22.1	21.8	27							115(22.31%)
Contr. to others' gr							14	29.2	19.6	13.7	8.1	27.8	112.4 21.81%)
Contr. to others' inf							16.6	20.3	20	17.4	22.3	23.1	119.7(23.22%)

Source: The authors' computation.

directional spillovers are 21.66, 22.17, and 27.10% respectively.

Inflation rate versus unemployment rate: Table 5c shows the spillover/connectedness between inflation and unemployment in top-income economies in Africa. In summary, the result indicates that inflation-to-inflation spillovers within countries are large in all the countries but low between countries. Similarly, unemployment-to-unemployment spillovers within countries are equally large in all the countries, but low between

countries. Innovations in Nigeria's unemployment rate are responsible for about 80% of Nigeria's unemployment in Nigeria, while just 7.3 and 9.9% of South Africa and Kenya respectively. The result further reveals that inflation-to-unemployment spillovers within and between countries are low. In addition, unemployment-to-inflation spillovers within and between countries are low. In Panel B of the Table, the greater share of gross directional spillovers is from unemployment-to-unemployment which is about 31.08% of the total, followed by unemployment-to-inflation spillovers.

Inflation-to-unemployment spillovers take the least share of 19.81%.

Spillover in Nigeria and five middle income economies in Africa

Economic growth rate and Inflation rate: Table 6a shows the level of connectedness/spillover between economic growth and inflation in Nigeria and the Five Middle-Income economies in Africa. The diagonal elements as usual represent the

Table 6b. Spillover table for the full connectedness of economic growth and unemployment in Nigeria and some middle-income economies in Africa.

To i	From j grNIG	grBKF	grMAU	grNAM	grMAD	grGUI	unNIG	unBKF	unMAU	unNAM	unMAD	unGUI	From others
Panel A													
grNIG	52.3	8.5	14	18	1.6	1.9	0.2	1.7	0.9	0.3	0.6	0	47.7
grBKF	9	44.2	9.2	7.6	13.5	6.4	0.7	1.1	5.4	0	2.7	0.1	55.8
grMAU	8.3	6.5	40.6	17.2	1.4	1.5	0	17.6	5	0.1	1.7	0	59.4
grNAM	10.2	5.4	16.4	45.1	0.4	1.5	9.8	7.3	0.7	2.3	0.8	0.1	54.9
grMAD	0.9	20.7	5	1	70	0.4	0.1	1.5	0.1	0.3	0	0	30
grGUI	1.4	3.7	1	2.4	0.6	70.5	3.3	5.4	1.9	1.8	0.2	7.7	29.5
unNIG	0.5	0.3	0	6.9	0	2.7	56	0.1	6.5	15.7	0.3	10.7	44
unBKF	1.1	0.5	14.4	4.5	0.4	4.4	0.3	66.4	1	0.3	6.7	0.1	33.6
unMAU	0.9	3.8	6.1	0.6	0.1	0.6	8.7	1.3	54.3	1.5	12.4	10	45.7
unNAM	0.1	0	0	1.7	0.1	0.6	19.4	0.4	0.6	66.5	10.5	0	33.5
Unmade	0.6	4.9	1.7	0.7	0.3	2	0.5	8.1	15	10.7	55.5	0.1	44.5
unGUI	0	0.1	0	0.1	0	2.4	21.1	0.1	12.8	0.8	0.1	62.5	37.5
Contribution to others	33.1	54.3	67.8	60.7	18.4	24.5	64.2	44.6	49.8	33.8	36.1	28.8	516.1
Contribution including own	85.4	98.5	108.4	105.8	88.4	95	120.2	111.1	104.1	100.3	91.6	91.3	TSPI (%) = 43%
Panel B													
Contr. to others' gr	29.8	44.8	45.6	46.2	17.5	11.7							195.6 (40.07%)
Contr. to others' un	2.7	9.1	16.1	12.8	0.6	10.3							51.6 (10.57%)
Contr. to others' gr							13.9	33.5	9	2.5	6	0.2	65.1 (13.34%)
Contr. to others' un							50	10	35.9	29	30	20.9	175.8 (36.02%)

Source: The authors' computation.

growth-to-growth and inflation-to-inflation spillovers within economies on one hand. On the other hand, the off-diagonal elements measure cross-variable spillovers within and between economies. Again, the result indicates that growth-to-growth spillovers within countries are generally small in all the countries, except Guinea. The results also reveal low growth-to-growth spillovers between countries. Innovations in Nigeria's economic growth account for about 42.4% of Nigeria's economy, while just 8.6% of Burkina Faso, 8% of Mauritius, 9% of Namibia, 0.4% of Madagascar, and 1% of Guinea. Similarly, innovations in other

countries' GDP growth rates, Burkina Faso for example, are responsible for 7.4% of the 12-months ahead forecast error variance of output growth in Nigeria. Growth-to-inflation spillovers, both within and between countries are low. The result further reveals that inflation-to-inflation spillovers within countries are high in most of the countries, except in Nigeria and Burkina Faso. In addition, inflation-to-inflation spillovers between countries are low. Inflation-to-growth spillovers are equally low within and between countries.

In Panel B, the results reveal that 32.65% of all 4 gross directional spillovers are from GDP growth

rate to GDP growth rate, and Namibia appears to be the largest contributor of GDP growth to GDP growth spillovers to other countries. With the share of 22.31, 21.81, and 23.22%, growth-to-inflation, inflation-to-growth, and inflation-to-inflation spillovers make up substantial fractions of total spillovers.

Economic growth rate and the Unemployment rate: The result in Table 6b shows that GDP growth -to- GDP growth spillovers within countries are large in three of the countries, namely: Nigeria, Madagascar, and Guinea, while low in the

Table 6c. Spillover table for the full connectedness of inflation and unemployment in Nigeria and some middle income economies in Africa.

To i	From j infNIG	infBKF	infMAU	infNAM	infMAD	infGUI	unNIG	unBKF	unMAU	unNAM	unMAD	unGUI	From others
Panel A													
infNIG	63.5	4.1	2.1	6.5	20.6	0.9	0.1	0.2	1	0.5	0	0.5	36.5
infBKF	1.9	66.5	0.6	8.9	2.2	2.2	7.9	3.6	1.1	3.2	1.1	0.6	33.5
infMAU	0.9	0.5	50.7	2.7	0.6	19	0.6	21	2	0.1	0.9	1	49.3
infNAM	4.1	10	3.1	61.6	2.3	2.9	4	2	1.2	1.2	7.2	0.3	38.4
infMAD	9.5	1.8	1	1.7	67.8	2.2	0	5.6	5.7	2.3	2	0.5	32.2
infGUI	2.7	0.7	11.6	2.8	1.5	52.7	0	23.4	3.2	0	0.8	0.6	47.3
unNIG	0	4.7	0.6	2.6	0	0	55.8	0.1	7.3	17.9	0.6	10.3	44.2
unBKF	1	1.6	14.5	3.4	1.9	22.1	0.3	48	1.1	0.8	5.2	0.1	52
unMAU	1.6	1.2	0.1	3.1	2.7	0.3	9.3	2.6	54.4	2.4	12.5	9.8	45.6
unNAM	0.9	0.4	0	1.2	0.9	0	15.7	0.8	0.4	67.8	11.5	0.3	32.2
Unmade	0	1.8	0.7	3.4	1.3	0	0.2	8.6	13.8	13.3	56.5	0.4	43.5
unGUI	0.3	0.6	1.9	0.2	0.3	0.1	20	0.2	14.4	0.6	0.1	61.1	38.9
Contribution to others	22.8	27.5	36.2	36.5	34.3	49.9	58.1	68.2	51.3	42.4	42	24.4	493.6
Contribution including own	86.3	94	86.9	98.1	102.1	102.6	114	116.2	105.7	110.2	98.5	85.5	TSPI (%)= 41.1%
Panel B													
Contr. to others' inf	19.1	17.1	18.4	22.6	27.2	27.2							131.6 (27.46%)
Contr. to others' un	3.8	8.7	17.7	12.7	5.8	22.4							71.1 (14.84%)
Contr. to others' inf							12.5	52.2	12.2	6.1	10	2.9	95.9 (20.01%)
Contr. to others' un							45.5	12.3	37	35	29.9	20.9	180.6 (37.89%)

Source: The authors' computation.

remaining countries. On the other hand, growth-to-growth spillovers between countries are generally low, and growth-to-unemployment spillovers within and between countries are also low. Similarly, unemployment-to-unemployment spillovers within countries are high in all the countries. In addition, unemployment-to-unemployment spillovers between nations and also unemployment-to- GDP growth spillovers within and between nations are small. The result indicates that innovations in Nigeria's unemployment account for about 56% of Nigeria's

unemployment. On the contrary, innovations in Nigeria's unemployment account for about 0.3% of Burkina Faso and 21.1% of Guinea. The total spillover index is also low. In Panel B of the Table, the results reveal that 40% of all four gross directional spillovers are from growth to growth, with Namibia and Mauritius being the biggest contributors of the spillovers to the other countries. The shares of growth-to-unemployment and unemployment-to-growth spillovers are very small. Unemployment-to-unemployment spillovers make up a substantial fraction of the gross

directional spillovers.

Inflation rate and the unemployment rate: Table 6c shows the spillover/connectedness between inflation rate and unemployment rate in five middle-income economies in Africa, namely; Burkina Faso, Mauritius, Namibia, Madagascar and Guinea. In summary, the result indicates that inflation-to-inflation spillovers within countries are large in all the countries but low between countries. Similarly, unemployment-to-unemployment spillovers within countries are

Table 7a. Spillover table for the full connectedness of economic growth and inflation in Nigeria and bottom income economies in Africa.

To i	From jgrNIG	grGAM	grSEY	grGUB	grCOM	grSTP	InfNIG	infGAM	infSEY	infGUB	infCOM	infSTP	From others
Panel A													
grNIG	30.1	7.8	7.5	0.8	1.4	0.8	13.5	23.5	8.9	3.4	1.2	1.4	69.9
grGAM	5.2	37.3	16.4	8.3	0.8	0.2	8.2	6.4	4.4	10.4	1.5	0.9	62.7
grSEY	3.1	9.7	35.5	7.1	4.5	0.2	5.1	5.4	17.7	1.5	6.4	3.9	64.5
grGUB	0.1	6.3	9	57.1	0.8	0.3	0.4	0.1	1.2	20.9	0.8	2.8	42.9
grCOM	2.9	1	2.9	1.1	65.5	0.1	1.7	3.4	4.7	6.8	9.1	0.7	34.5
grSTP	2.4	0	0.5	0	0.2	50	7	10	6.4	0.4	1.8	21.5	50
infNIG	10.6	7.7	9	0.2	1.1	2.8	32.5	14.9	9.6	5.8	1.6	4.1	67.5
infGAM	17.5	6.2	9.3	1.1	1.9	4	14.1	28.9	5.9	4.2	2.7	4.1	71.1
infSEY	9.3	2.9	18.5	0.8	7	2.6	9.5	7.2	38	0.4	1.8	2.2	62
infGUB	1.3	9.9	4.6	19.3	11.2	0.3	5.4	2.9	0.2	42.1	0.4	2.3	57.9
infCOM	0.6	2	7.9	2.6	11.5	2.9	0.6	1	0.5	0.7	65.9	3.8	34.1
infSTP	2.5	0.8	2.8	2.2	1.6	16.3	8.8	7.9	0.5	4.7	2.8	49	51
Contribution to others	55.7	54.4	88.3	43.4	42	30.6	74.3	82.8	60.1	59	30	47.5	668.1
Contribution including own	85.8	91.7	123.8	100.6	107.5	80.6	106.9	111.8	98	101.1	95.9	96.5	TSPI (%) = 55.70%
Panel B													
Contr. to others' gr	13.7	24.8	36.3	17.3	7.7	1.6							101.4 (20.41%)
Contr. to others' inf	31.2	23.3	33.6	6.9	22.8	12.6							130.4 (26.25%)
Contr. to others' gr							22.4	42.4	25.6	22.5	11.7	9.7	134.3 (27.04%)
Contr. to others' inf							38.4	33.9	16.7	15.8	9.3	16.5	130.6 (26.29%)

Source: The authors' computation.

equally large in all the countries except in Burkina Faso, but low between countries. Innovations in Nigeria's unemployment rate are responsible for about 55.8% changes in Nigeria's unemployment. On the other hand, innovations in Nigeria's unemployment rate account for just 0.3, 9.3, 15.7, 0.2, and 20% changes in unemployment rates in Burkina Faso, Mauritius, Namibia, Madagascar, and Guinea respectively. The result further reveals that inflation-to-unemployment, as well as unemployment-to-inflation spillovers both within and between countries, are low. In Panel B of the Table, the greater share of gross directional spillovers is from unemployment-to-unemployment which is about 37.89% of the total, followed by inflation-to-unemployment spillovers. Inflation-to-inflation spillovers take the least share of 14.84%.

Spillover in five bottom income economies in Africa

Economic growth rate and Inflation rate: Table 7a shows the level of connectedness/spillover between the economic growth rate and inflation rate in Nigeria and the Five Bottom Income economies in Africa. The diagonal elements as usual represent the growth-to-growth and inflation-to-inflation spillovers within economies on one hand. On the other hand, the off-diagonal elements measure cross-variable spillovers within and between economies.

The result reveals mixed evidence of GDP growth-to-GDP growth spillovers within countries. GDP growth-to-GDP growth spillovers within countries are generally small in Nigeria, Gambia,

Table 7b. Spillover table for the full connectedness of economic and unemployment in Nigeria and some bottom income economies in Africa.

To i	From j grNIG	grGAM	grSEY	grGUB	grCOM	grSTP	unNIG	unGAM	unSEY	unGUB	unCOM	unSTP	From others
Panel A													
grNIG	57.7	15.2	13.7	0.3	2.8	1.5	0.1	0.1	0.4	0.1	0.1	8.2	42.3
grGAM	6.8	50.3	19.6	9.3	1.5	0	0.5	0.3	1.1	1.6	1.5	7.5	49.7
grSEY	4.4	14	56.9	7.9	6.9	0.4	0	0.2	1.8	0	0	7.3	43.1
grGUB	0.6	8.1	10	67.6	1.4	0.2	0.6	2.5	0	4	4	1.1	32.4
grCOM	2.3	1.2	2.3	0.3	63.5	0.2	4.6	3.8	15.3	3.1	3	0.3	36.5
grSTP	3.2	0	0.7	0.1	0.3	76.4	0.1	0.6	17.5	0.4	0.4	0.2	23.6
unNIG	0.1	0.9	0.1	0.4	4.3	0.1	74.7	5	1.2	6.8	6.2	0.2	25.3
unGAM	0	0.2	0.2	0.1	4.1	0.2	4.1	30.2	0.4	30.2	30.2	0.1	69.8
unSEY	0.1	0.4	3.3	0	9.3	12.8	2.3	0.7	69.5	0.6	0.6	0.4	30.5
unGUB	0.1	0.9	0	0.5	3.5	0.2	5.2	28.9	0.3	30.3	30.1	0.1	69.7
unCOM	0.1	0.8	0	0.5	3.4	0.2	4.9	29.2	0.3	30.3	30.3	0	69.7
unSTP	3.4	9	9.7	0.4	0.5	0.3	1.7	0.1	0.3	0.1	0	74.4	25.6
Contribution to others	21	50.8	59.5	20	38	16.2	24.1	71.4	38.6	77.1	76.2	25.4	518.3
Contribution including own	78.7	101	116.4	87.6	101.5	92.6	98.8	101.7	108	107.4	106.5	99.7	TSPI (%) = 43.20%
Panel B													
Contr. to others' gr	17.3	38.5	46.3	17.9	12.9	2.3							135.2 (27%)
Contr. to others' un	3.7	12	9.9	1.4	21.7	13.5							62.2 (12.42%)
Contr. to others' gr							5.8	7.2	34.3	5.2	6	24.4	82.9 (16.55%)
Contr. to others' un							18.2	63.9	2.5	68	67.1	0.8	220.5 (44.03%)

Source: The authors' computation.

and Seychelles; it is high in Guinea Bissau, Comoros, and Sao Tome and Principe. The result also reveals low growth-to-growth spillovers between nations.

Innovations in Nigeria's economic growth are responsible for about 30.1% variations in Nigeria's GDP growth rate, however, these innovations account for just 5.2% variations in Gambia's GDP growth, 3.1% of Seychelles, 0.1% of Guinea Bissau, 2.9% of Comoros and 2.4% of Sao Tome

and Principe. Similarly, innovations in other countries' output growth, Sao Tome and Principe for example, are responsible for a 0.8% variation in Nigeria's GDP growth. Growth-to-inflation spillovers, both within and between countries are low. The result further reveals that inflation-to-inflation spillovers within countries are generally low except in Comoros. In addition, inflation-to-inflation spillovers between countries are low. Inflation-to-growth spillovers are equally

low within and between countries. In Panel B, the results reveal that all four gross directional spillovers; growth-to-growth (20.41%), growth-to-inflation (26.25%), inflation-to-growth (27.04%), and inflation-to-inflation (26.29%) have equal shares in f total spillovers.

Economic growth rate and the unemployment rate: The result in Table 7b shows that GDP growth-to- GDP growth spillovers within countries

Table 7c. Spillover table for the full connectedness of inflation and unemployment in Nigeria and bottom income economies in Africa.

To i	From jinfNIG	infGAM	infSEY	infGUB	infCOM	infSTP	unNIG	unGAM	unSEY	unGUB	unCOM	unSTP	From others
Panel A													
infNIG	39.9	19.1	11.4	7	2	5.7	0	0.2	0.5	0	0	14.1	60.1
infGAM	19.4	45.8	8.4	6.3	5.2	7.1	1	1	0.5	0.2	0.2	4.8	54.2
infSEY	14.6	10.3	59.3	1.1	3	2.7	0.1	0	6.2	0.1	0.1	2.5	40.7
infGUB	8.7	5.3	0.4	63.1	0.8	4	6	0.7	6.5	2.2	2.1	0.2	36.9
infCOM	0.7	1.4	0.7	0.7	72.5	3.2	8.5	1.4	6.8	1.6	1.8	0.8	27.5
infSTP	8.9	10.5	0.5	5.9	2.2	47.7	0.4	0.3	22.8	0.4	0.4	0	52.3
unNIG	0	1.8	0.2	2.8	8.5	0.4	65.6	5.5	0.5	7.4	6.8	0.4	34.4
unGAM	0.2	0.7	0.1	0.2	0.8	0.1	4.4	30.9	0.6	31	31	0	69.1
unSEY	1.4	2.8	2.9	4.8	3.8	18.7	0.2	0.8	63	0.7	0.7	0.3	37
unGUB	0	0.2	0.2	0.9	0.6	0.1	5.8	29.5	0.4	31.2	30.9	0.1	68.8
unCOM	0	0.2	0.2	0.9	0.6	0.1	5.5	29.8	0.4	31.2	31.1	0	68.9
unSTP	18.7	6.7	2.6	0.2	0.5	0	0.7	0	0.1	0.4	0.2	69.9	30.1
Contribution to others	72.6	59	27.4	30.8	28	42.3	32.6	69.2	45.3	75.2	74.2	23.2	579.9
Contribution including own	112.5	104.8	86.8	93.9	100.5	90	98.3	100.1	108.3	106.4	105.3	93.1	TSPI (%) = 48.3%
Panel B													
Contr. to others' inf	52.3	46.6	21.4	21	13.2	22.7							177.2 (31.45%)
Contr. to others' un	20.3	11.7	3.3	8.9	14.2	19.4							77.8 (13.81%)
Contr. to others' inf							16	2.6	37.1	2.3	2.8	22.4	83.2 (14.76%)
Contr. to others' un							16.6	65.6	2	70.7	69.6	0.8	225.3 (39.98%)

Source: The authors' computation.

are large in all the countries. On the other hand, growth-to-growth spillovers between countries are generally low, and growth-to-unemployment spillovers within and between countries are equally low. Similarly, unemployment-to-unemployment spillovers within countries are large in three of the countries while small in the remaining three countries. In addition, unemployment-to-unemployment spillovers between nations and also unemployment-to-growth spillovers within and between nations are negligible. At 43.20%, the total spillover index is considered somehow low. In Panel B of the Table,

the results reveal that 44.03% of all four gross directional spillovers are from unemployment-to-unemployment spillovers, with Guinea Bissau, Comoros, and the Gambia being the biggest contributors of the spillovers to the other countries. The shares of growth-to-unemployment and unemployment-to-growth spillovers are very small, while growth-to-growth spillovers make up a substantial fraction of the gross directional spillovers.

Inflation and unemployment: Table 7c shows the spillover/connectedness between inflation and

unemployment in five bottom-income economies in Africa. In summary, the result indicates that inflation-to-inflation spillovers within countries are large in three of the countries (Seychelles, Guinea Bissau, and Comoros) but generally low between countries. Similarly, unemployment-to-unemployment spillovers within countries are also large in three of the countries (Nigeria, Seychelles, and Sao Tome and Principe but low between countries. Innovations in Nigeria's unemployment rate are responsible for about 66% changes in Nigeria's unemployment, while it accounts for just 4.4% of Gambia's unemployment,

0.2% of Seychelles, 5.8% of Guinea Bissau, 5.5% of Comoros and 0.7% of Sao Tome and Principe. The result further reveals that inflation-to-unemployment, as well as unemployment-to-inflation spillovers both within and between countries, are low. In Panel B of the Table, the greater share of gross directional spillovers is from unemployment-to-unemployment which is about 39.98% of the total, followed by inflation-to-inflation spillovers. Inflation-to-unemployment and unemployment-to-inflation spillovers take the share of 13.45 and 14.76% respectively.

Summary of spillover results

Table 8 summarizes the outcome of the spillover analysis as presented in Tables 4a – 6c. The result indicates that variable to variable spillover within countries is largely high.

Robustness check

The robustness check was done using Cholesky ordering in the place of the generalized decomposition approach. Hence, we have re-ordered the variables and ordered the countries (descending order) by size in each category. Some of the results are reported in Tables A1, A2, and A3 in the Appendix. Overall, the results turn out quantitatively identical (Appendix Tables A1 to A3).

Conclusion

This study investigated the level of proximate between Nigeria and selected countries in Africa on one hand and the linkages between economic growth, inflation, and unemployment in these countries. We made use of part of the paper, the relative economic distance between Nigeria and fifteen other countries using quarterly GDP growth rates, inflation rates, and unemployment was first evaluated. Next, the characterization of the level of spillovers within and between economies using data on GDP growth rates, inflation rates, and unemployment. Then, countries of interest was separated into three categories, namely: Top Income, Middle Income, and Bottom Income Economies. From each category, five countries were selected and Nigeria is included in each category.

When evaluated using economic growth as an indicator, the closest economy to Nigeria's economy is South Africa, followed by Morocco in the top income category. In the Middle-income category, Namibia turned out to be the closest economy to Nigeria, followed by Mauritius. While in the bottom income category, The Gambia and Sao Tome and Principe are the closest economies to

Nigeria's economy. Though the results are not statistically significant, they appear to be in tandem with what is obtainable in Africa. For instance, Nigeria and South Africa are the emerging giants of Africa. Politically, both countries are the dominant state entities in their respective sub-regions. They also have a history of cooperation with, and involvement in, a range of continental projects like the New Partnership for Africa's Development (NEPAD). Similarly, diplomatic relations between Nigeria and Namibia date back to the 2nd March 1990 following the country's attainment of independence. Since then, relations have been warm and cordial owing to the role Nigeria played during Namibia's liberation struggle with the provision of financial, material, and logistical support for The South West Africa People's Organisation (SWAPO). In recognition of these contributions, Nigeria was recognised as a frontline State despite its geographical location.

Generally speaking, the economic distance between Nigeria and selected African countries is considered far, compared to what is obtainable in covering the period 2000 to 2019. In the empirical developed economies. Mazurek (2012) for example, used the same approach and indicator (GDP growth) and found that the relative economic distance (in %) between the Czech Republic and the USA is 12%. These are countries separated by a geographic distance of 8255km (air travel). The results have great implications for African growth and development, especially given the fact that relative economic distance is conceptually related to the σ-convergence. Our result, therefore, suggests that the process of convergence is still low in Africa, group relative economic distance indicates that the level of globalisation is generally low among African economies.

The study further considers the linkages among output growth rates, inflation rates, and the unemployment rate for the sample of sixteen nations using spillover index estimates that mimic those of Diebold and Yilmaz (2012, 2014). Particular attention was paid to spillovers within and between countries. From the results obtained, we arrive at the following conclusions. First, variable-to-own variable spillovers within the country are generally large, though the level of transmission differs across categories. For example, growth-to-growth spillovers within the country are larger in the top-income economies than those found in the middle and bottom-income economies. This implies that growth reinforces growth. Similarly, unemployment-to-unemployment spillovers within the country are equally large and appear to be the same in the top and middle-income economies. This result also suggests that unemployment reinforces unemployment.

This argument is in line with the unemployment hysteresis hypothesis and may account for the reason for persistent unemployment in Africa. Inflation also appears to reinforce inflation within the economy. Second, variable-to-own variable spillovers between countries are

Table 8. The summary of spillover results.

Nature of Spillover	Top income economies		Middle income economies		Bottom income economies	
	Within country	Between countries	Within country	Between countries	Within country	Between countries
GDP Growth-to- GDP growth	large	Small	Mixed	Small	Large	Small
GDP Growth-to-inflation rate	Small	Small	Small	Small	Small	Small
GDP Growth-to-unemployment rate	Small	Small	Small	Small	Small	Small
Inflation rate-to-inflation rate	Large	Small	Large	Small	Mixed	Small
Inflation rate-to- GDP growth rate	Small	Small	Small	Small	Small	Small
Inflation rate -to- unemployment rate	Small	Small	Small	Small	Small	Small
Unemployment rate -to-unemployment rate	Large	Small	Large	Small	Mixed	Small
Unemployment rate -to- GDP growth	Small	Small	Small	Small	Small	Small
Unemployment rate -to- inflation rate	Small	Small	Small	Small	Small	Small

Source: The authors' computation.

small, suggesting that the level of cross-border interactions, especially in the form of economic activities is still very poor in Africa. This is evident in the volume of intra-African trade which is put at 12% of African total trade (AfDB, 2014). Third, variable-to-other variable spillovers both within and between countries are low. For instance, growth-to-inflation spillovers within and between countries are low in all three categories. This result indicates that growth within the domestic economies in Africa has not been inflationary. Available data shows that the fastest growing economy in Africa in 2020, South Sudan has an inflation rate of 7.5% and it is growing at 8.2%, Rwanda, the second fastest is growing at 8.1% with an inflation rate of 10.9%.Again inflation-to-unemployment spillovers and vice versa, within and between countries are low.

The central finding is that African economies are quite economically dispersed and the level of cross-border spillover is negligible. Suggesting that growth in one economy has not been influenced by the growth in the other economies within the region Given this, it was recommended

that policies will improve intra-African trade which should be evolved.

Such policies should incorporate a trade-by-barter-like framework, where Africa can demand what it produces and produce what it demands. Thus, much more attention should be paid to the supply side of the market than the demand side following the Says law that increasing production will naturally result in proportionate increases in demand. To achieve this, enabling environment should be created to engender technological innovations while improving human and capital infrastructure.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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APPENDIX

Appendix A1. Cholesky ordering.

	unGUI	unMAD	unNAM	unMAU	unBKF	unNIG	grGUI	grMAD	grNAM	grMAU	grBKF	grNIG	From Others
unGUI	94.8	0.0	1.7	0.4	0.1	1.6	1.1	0.0	0.1	0.1	0.1	0.0	5.2
unMAD	0.1	87.8	0.0	0.3	0.7	0.3	2.3	0.5	3.0	0.2	2.2	2.5	12.2
unNAM	0.0	14.9	79.1	0.2	0.0	1.0	1.9	0.2	0.1	0.1	2.0	0.5	20.9
unMAU	16.9	23.2	0.3	51.9	0.4	0.1	1.9	0.1	0.8	0.0	0.3	4.1	48.1
unBKF	0.1	9.0	0.5	2.8	79.6	2.5	0.4	0.0	4.3	0.1	0.2	0.5	20.4
unNIG	18.3	1.0	29.3	4.4	0.5	43.9	0.0	0.0	0.4	0.0	0.3	1.9	56.1
grGUI	10.5	0.4	3.5	0.2	5.8	14.5	62.1	0.2	0.2	1.2	0.0	1.3	37.9
grMAD	0.0	0.1	0.3	0.2	2.4	0.7	0.7	93.1	2.0	0.2	0.0	0.4	6.9
grNAM	0.2	1.7	6.8	0.5	13.3	22.2	1.7	0.6	50.0	1.2	1.8	0.0	50.0
grMAU	0.1	3.9	0.2	11.1	36.9	0.8	0.4	2.0	18.4	24.0	0.4	1.8	76.0
grBKF	0.3	5.8	1.6	6.5	0.5	5.2	8.1	32.1	7.7	13.0	18.7	0.5	81.3
grNIG	0.0	1.0	0.1	1.0	2.2	3.0	1.3	2.8	33.2	3.5	9.6	42.3	57.7
Contribution to others	46.4	61.1	44.4	27.7	63.0	52.0	19.6	38.5	70.3	19.5	16.8	13.5	472.7
Contribution including own	141.2	148.9	123.5	79.6	142.6	95.9	81.7	131.6	120.3	43.5	35.5	55.8	39.4%

Appendix A2. Cholesky ordering.

	infKEN	infMOR	infALG	infEGY	infRSA	grKEN	grMOR	grALG	grEGY	grRSA	grNIG	From others
infKEN	92.7	0.8	1.4	0.0	0.5	0.9	0.2	2.1	0.3	0.3	0.7	7.3
infMOR	0.8	93.8	0.0	1.1	0.0	0.4	1.5	0.3	0.3	1.8	0.0	6.2
infALG	1.2	0.1	93.0	0.1	0.0	3.0	0.1	0.2	0.2	0.7	1.3	7.0
infEGY	0.2	22.3	1.7	71.9	0.0	0.7	0.5	0.4	0.0	1.4	1.0	28.1
infRSA	1.3	2.9	0.1	4.4	84.6	0.1	5.2	0.0	0.6	0.5	0.2	15.4
grKEN	5.4	0.8	1.8	1.7	29.1	57.8	2.2	0.1	0.0	0.7	0.4	42.2
grMOR	18.4	3.2	1.2	0.8	12.4	0.6	62.3	0.8	0.3	0.1	0.0	37.7
grALG	29.8	3.8	3.7	2.4	1.5	6.2	6.1	41.7	1.9	0.1	2.9	58.3
grEGY	5.1	4.4	5.1	7.0	2.3	3.6	1.8	2.3	66.5	1.8	0.0	33.5
grRSA	2.4	0.4	44.7	1.6	1.2	22.8	3.9	2.0	0.8	18.1	2.3	81.9
grNIG	2.0	0.2	0.3	15.6	0.4	6.8	2.3	5.9	0.5	0.3	65.6	34.4
Contribution to others	66.5	38.8	60.1	34.8	47.3	45.0	23.7	14.1	4.9	7.6	9.0	351.9
Contribution including own	159.3	132.6	153.1	106.7	132.0	102.8	86.0	55.8	71.5	25.7	74.6	32.0%

Appendix A3. Cholesky ordering.

	infSTP	infCOM	infGUB	infSEY	infGAM	infNIG	unSTP	unCOM	unGUB	unSEY	unGAM	unNIG	From others
infSTP	96.4	0.4	0.5	0.1	0.1	0.7	0.8	0.1	0.0	0.7	0.0	0.0	3.6
infCOM	4.0	87.9	0.8	0.2	0.3	0.9	0.2	0.7	0.0	0.9	0.1	3.9	12.1
infGUB	5.9	3.1	85.4	1.0	0.4	1.0	0.2	0.0	0.1	0.0	0.0	2.8	14.6
infSEY	4.2	3.0	1.3	87.5	0.0	0.9	0.3	0.0	0.0	2.3	0.5	0.0	12.5
infGAM	14.4	17.7	3.0	17.3	44.9	1.8	0.2	0.0	0.1	0.5	0.1	0.1	55.1
infNIG	13.6	9.3	6.9	29.2	4.4	35.3	0.0	0.0	0.1	0.8	0.3	0.0	64.7
unSTP	0.1	0.8	0.2	3.4	6.9	28.1	59.2	0.2	0.2	0.0	0.7	0.3	40.8
unCOM	0.4	1.8	4.0	1.0	1.8	0.6	1.9	83.2	1.5	0.1	1.8	1.8	16.8
unGUB	0.4	1.9	4.1	0.9	1.9	0.4	3.1	81.3	2.4	0.1	1.8	1.8	97.6
unSEY	26.0	1.1	1.9	4.5	1.7	5.6	6.4	0.3	8.1	43.7	0.6	0.1	56.3
unGAM	0.3	2.7	1.6	0.5	3.8	0.6	1.6	85.5	1.1	0.1	1.0	1.4	99.0
unNIG	0.6	11.8	2.4	0.6	2.3	2.4	0.3	8.1	39.4	3.5	1.5	27.1	72.9
Contribution to others	70.0	53.5	26.7	58.7	23.4	43.1	15.1	176.4	50.7	8.9	7.4	12.2	546.0
Contribution including own	166.4	141.4	112.1	146.2	68.3	78.4	74.3	259.5	53.1	52.6	8.4	39.3	45.5%