Measuring Geographic Distribution of Economic Activity in Nigeria Using Gross Domestic Product

Olanrewaju Lawal[a]*

Ijeoma Emele Kalu[b]

Abstract

Population of humans and their activities represent one of the major sources of change. It is evident that there is an ever growing need to understand, model and predict these changes and their consequences. Spatial representation of the pattern and dynamics of economic activity has a potential of supporting sustainable development. This paper examined the dynamics of economic activities in Nigerian at different scales, to provide an understanding of the centre of gravity and the geographical distribution of economic activities. GDP and population data were collated for 2010 and 2014. GDP per grid cell was computed based on population data and partitioned on a ratio of 90%:10% of GDP between Urban and Rural areas. Centrographic analysis was carried out within Geographical Information System (GIS). Result shows that there was an increase of about 40% in urban economic activity, and urban centre of gravity moved southwards ≈ 4.5km while median centre also moved southwards ≈ 6km. Distributional trend and orientation changed slightly and a compaction of about 0.8% was recorded. The pattern is similar at the Local Government Area (LGA) level. Analyses showed that the economic centre of gravity for the country fell within Kogi State. Total economic activity across the country is significantly dominated by a handful of major urban agglomerations. This dominance declined slightly over the period. Future government's economic policy needs to take into considerations spatial and environmental factors in planning. There is need for adequate understanding of spatial pattern and centrographic analysis of economic activity to support evidence based economic and regional development policies.

Keywords: spatial pattern, economic centre of gravity, GDP, geographical distribution, GIS

[a] Department of Geography and Environmental Management, Faculty of Social Sciences, University of Port Harcourt, P.M.B 5323, Choba Campus, Port Harcourt

[b] Department of Economics, Faculty of Social Sciences, University of Port Harcourt, P.M.B 5323, Choba Campus, Port Harcourt.

*Corresponding author's email address: olalaw@hotmail.com

Introduction

Population of humans and their activities represent one of the major sources of change on this planet. Therefore, it has become pertinent that, there is an ever growing need to understand, model and predict these changes and their consequences. To foster these, human activities across the landscape need to be represented at scales (temporal and spatial) which would stimulate new inquiries among both natural and social scientists. These endeavours could provide better understanding of the dynamics of human activity and enhance our planning capacity for the impacts of climate change, disasters and environmental change, as well as in the assessment of vulnerability, resilience and adaptive capacity. This paper examined the dynamics of Nigerian economic centre of gravity as well as the geographical distribution of economic activity. Economic centre of gravity in this context is the mean and/or median location of the nation's economic activity as measured by Gross Domestic Product (GDP) generated across the nation. These endeavours, provide an opportunity to better understand the pattern and dynamics of economic activity at different scales across the country.

The report by Brundtland in 1987 (WCED, 1987) identified three dimensions: social, economic and environmental (in other words social progress; economic growth; and protection of the environment) as important in planning and development of any nation. However, across many nations, planning and development are still focussed on the economic aspects which has further exacerbated degradation of the environment and not bringing about the much desired economic and equity goals (Adams, 2006; Sneddon, Howarth, & Norgaard, 2006). It is, therefore important that, integrated and holistic modelling approaches should be adopted in modelling these complexities of human activities and their interaction with the environment, thereby supporting data-driven (evidence) policy and development planning.

Development of spatial representation of pattern and dynamics of economic activity has a potential of supporting sustainable development; particularly, by providing an opportunity for incorporation of economic dimension into the analysis of climate change, vulnerability and resilience assessment, land use/land cover change as well as the impact of geophysical attributes on economic activity. Some works (Kandogan, 2014; Quah, 2011; Grether & Mathys, 2010) have showed the shifting global centre of economic activity towards the East. Moreover, the works of Nordhaus (2006) in the development of G-Econ database at Yale University as well as Lawal and Nuga (2015) provided a background in which geographically based economic activity was computed for this study. Thus, this work served to further enhance these

two works with context focused on Nigeria. This study seeks to provide further insight into the extent, pattern, direction and compactness of economic activities in the country.

Spatial distribution and pattern of economic activity could indicate income distribution and inherently the nature of inequality (Held & Kaya, 2006; Quah, 2002), human development and most likely social vulnerability and resilience. Furthermore, an understanding of the centre of economic activity across an area could help in the decision on siting growth or economic hubs (as the case may be) which could further support economic development in the country.

The development of a spatially explicit model of economic activity (a corollary of this current endeavour) could also help in supporting analysis aimed at answering a wide range of other questions in social science as well as the integration of social and economic data in natural sciences studies. For example, the outcome of this study could help further development of understanding the biological, geophysical and political factors driving economic activity across the country. Thus, providing evidence relevant for policy formulation in stimulating social and economic development across the country.

Pathways of human activities leading to changes on the planet may be driven by policy/planning, economic rewards and attributes of the place in question. Such changes, are often results of complex interaction of physical, biological, political and social, and economic factors.

Location decision impacts significantly on business and as such plays an important role in economic activity. This could be seen as influencing the efficiency of business, cost of production (raw materials, transport, labour, etc.), market access and consequently the competitiveness of businesses. Considering all of these has often resulted in the increasing agglomeration of businesses and industries in established urban centres.

There are extensive analyses highlighting the importance of location in social and economic development. For example, Hall and Jones (1999) showed that, differences among countries in capital accumulation (national per capita productivity) could be attributed to their social infrastructure. Mellinger, Sachs, and Gallup (2000) showed that, there is a higher level of economic performance in coastal and temperate zone compared to other zones. Their work reported that, 8% of the world inhabited landmass are in the temperate zone proximate to the seas. This zone accounts for 23% of the world population and 53% of the world's GDP. Furthermore, a study by Allen, Bourke, and Gibson (2005) concluded that instead of market

forces, severe environmental constraints are primarily responsible for the spatial inequalities in income across Papua New Guinea. Sachs (2003) argued that geography has primacy over other factors in economic development. The study showed that, there is a strong correlation among levels of economic growth, per capita income and other economic and demographic indicators.

From earlier submission, it is pertinent to understand the spatial pattern and dynamics of economic activity in the country, to provide data for evidence-driven policy making in social and economic planning for the country. The generation of data, thus, spatial explicit economic data will enhance analysis across natural and social sciences. This would help in generating new understanding which is of relevance for policy making across many aspects of human-environment interaction.

Materials and Method

Data

Data for this study was collated for 2010 and 2014. GDP data were obtained from the International Monetary Fund's World Economic and Financial Survey database (International Monetary Fund, 2014). This source was utilised because of the reliability of the dataset. The selection of the years was informed by the availability of gridded population data. The dataset is available as a national aggregate, thereby necessitating the redistribution to cover the entire country.

Gridded population data for this study was obtained from Geodata Institute maintained web site — *www.worldpop.org.uk* (GeoData Insitute, nd). The method used in the production of this dataset is described by Linard, Gilbert, Snow, Noor, and Tatem (2012). This dataset is available at about 100 meters grid for the entire globe. The population data were based on the Alpha version of 2010 and 2014 estimates by the United Population Division estimates from the World Population Prospect Database (United Nations Department of Economic and Social Affairs Population Division, 2002).

Method

The collated dataset was processed within ArcGIS (ESRI, 2015). The gridded population data were used to discern urban and rural areas across the country. Data on population per grid was classified based on the density per grid. Areas with very low density were classified as rural, while high density areas were classified as urban.

Total number of cells falling into each category (urban and rural) were collated as well as the sum of the population within these cells. Based on these, GDP per grid cell was computed, with the assumption of a ratio of 90%:10% of GDP contribution by urban and rural areas. The GDP by class was then divided by the total number of people to derive the GDP per capita for each of the areas i.e. rural or urban. A conditional operation was then carried out to multiply the population per grid based on their location (i.e. If they fall within urban, such population will be multiplied by the appropriate value and similarly if from rural).

The geographic distribution of the economic activity (GDP based) was computed within ArcGIS. The attribute of the distribution was calculated using the toolsets and formulae in ArcGIS (Environmental Systems Research Institute, 2013) and are represented as follows:

1. Weighted mean centre: This represents the centre of gravity of economic activity in the country.

$$\bar{X}_w = \frac{\sum_{i=1}^{n} w_i x_i}{\sum_{i=1}^{n} w_i} \quad , \quad \bar{Y}_w = \frac{\sum_{i=1}^{n} w_i y_i}{\sum_{i=1}^{n} w_i}$$

Equation 1

Where x_i and y_i represent coordinates of the feature i, n is the total number of feature and w_i is weight at feature i (the total economic activity for feature i).

2. Weighted Standard Deviational Ellipse (WSDE): This represents the directional distribution of economic activity as a measure of central tendency, dispersion or directional trend.

$$SDE_x = \sqrt{\frac{\sum_{i=1}^{n} (x_i - \bar{X})^2}{n}}$$

$$SDE_y = \sqrt{\frac{\sum_{i=1}^{n} (y_i - \bar{Y})^2}{n}}$$

Equation 2

Where $\bar{X}, \bar{Y}$ represent weighted mean centres for the feature i.

3. Standard distance (SDIST): This was used to measure the compactness, i.e. degree of concentration or dispersion of economic activity around the geometric mean centre.

$$SD_w = \sqrt{\frac{\sum_{i=1}^{n} w_i(x_i - \bar{X}_w)^2}{\sum_{i=1}^{n} w_i} + \frac{\sum_{i=1}^{n} w_i(y_i - \bar{Y}_w)^2}{\sum_{i=1}^{n} w_i}}$$

Equation 3

Where $\bar{X}_w, \bar{Y}_w$ represent weighted mean centre

4. Median Centre: This was used to represent the robustness of the mean centre (centre of gravity identified). It identifies the location which minimises the distances to all the major economic activity zones as weighted by the share of contribution to National GDP. This was computed using the method outlined by Kulin and Kuenne (1962).

$$d_i^t = \sqrt{(X_i - X^t)^2 + (Y_i - Y^t)^2}$$

Equation 4

where *t* represents each step (iterative calculation) in the algorithm candidate. Median Center for each step is identified as X^t, Y^t, refined iteratively until it is a location that minimizes the Euclidean Distance *d* to all weighted features *i* in the dataset at each location X_i and Y_i is identified.

These geographic distribution statistics were computed for each year across two different spatial scales. And for this study, urban agglomeration and LGA were the two scales considered. Values for these scales were then compared temporally over the period understudied.

Results and Discussion

Economic activity distribution by urban agglomerations

In designating urban areas, any grid cells with 142 individuals and above forming consistent patch were considered. This was based on visual examination of gridded population data and the known extent of urban areas. This classification resulted in the identification of 29,742 and 34,486 urban areas for 2010 and 2014 respectively. These includes small towns and cities that meet the population and spatial criteria. The decision is based on the fact that, population aggregation in a particular place brings about intense economic activity (very likely to be greater than surrounding areas with sparse population).

Table 1: Summary statistics for the total of urban economic activity

Statistics	Economy Activity		Change (%)
	2010	2014	
Mean (Million Naira)	1,678.52	2,407.18	30.27
Standard Deviation (Million Naira)	44,795.58	65,818.14	31.94
Maximum (Million Naira)	7,067,964.00	11,187,894.00	36.82
Sum (Million Naira)	49,922,415.29	83,013,859.82	39.86
Total GDP (Million Naira)	55,469,350.00	92,237,619.00	39.86
Total Population	148126037	175313107	15.51
Urban Population (Counts)	58,347,446	75,764,983	22.99
% Contribution to total GDP (Urban)	12.74%	12.13%	-5.05
Per Capital GDP (Urban)	0.86	1.10	21.91

Source: Authors' computation

The distribution of economic activity (GDP based) among urban areas between 2010 and 2014 (Table 1) shows an increase of about 39.86%. The urban population also grew by 22.99% over this period, compared to a total population growth of 15.51% in the country. Urban population percentage of the total population changed from 39.39% in 2010 to 43.22% in 2014. From the context of economic activity (with the assumption that 90% of GDP contribution comes from urban areas), there was an increase in the mean economic activity across the identified urban areas (30.27%). In 2010, the urban areas accounted for the 12.74% of the total GDP of the country and witnessed a slight decline in 2014 (12.13%). From these statistics, it is apparent that the urban population witnessed a growth in per capita GDP of about 22% over this period.

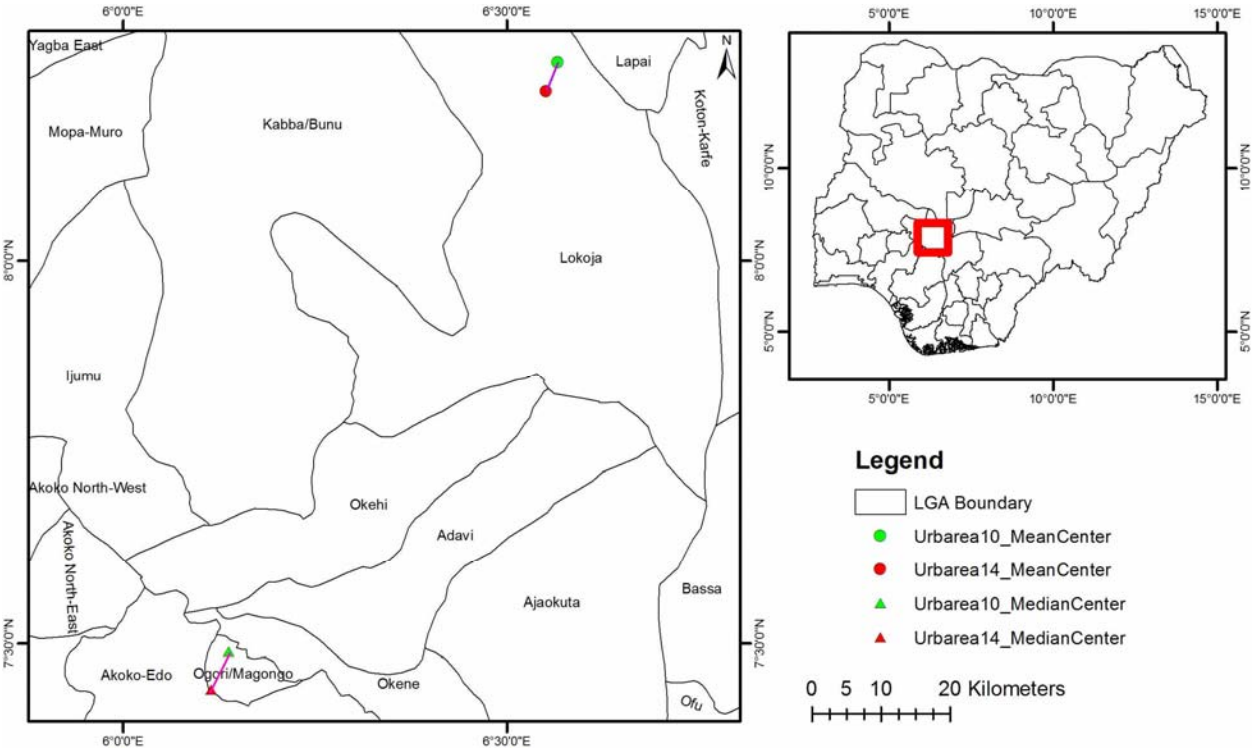

Figure 1: Economic centre of gravity based on urban area GDP (2010-2014)

NB. Urbarea10 – 2010; Urbarea14 - 2014

Source: Authors' representation

In relation to the changes and intensity of economic activities across the urban agglomeration across the country, the Centre of Gravity of Economic Activity (COGEA) moved between 2010 and 2014 (Figure 1). The centre of gravity as expressed by the mean centre moved slightly (4.5km) westwards and fell within the Lokoja LGA of Kogi State.

Using the more robust measure of Median centre, these centres were found to have moved to westwards from 2010 to 2014 (Figure 1). In 2010, the median centre was located at the North-eastern corner of Ogori/Magongo LGA of Kogi State and moved by about 6 kilometres southwest within the same LGA. This implies that the COGEA by this measure moved in a similar pattern to that of mean centre over the years and remains within Kogi State, moving along the south-western corridor. Therefore, there is an indication that, centre of economic activity is moving more and more towards the southwest. This could be as a result of either an increase in size and intensity or increase in the number of urban agglomeration in the south west and/or declining economic activities in the northern region of the country due to insurgency by Boko Haram.

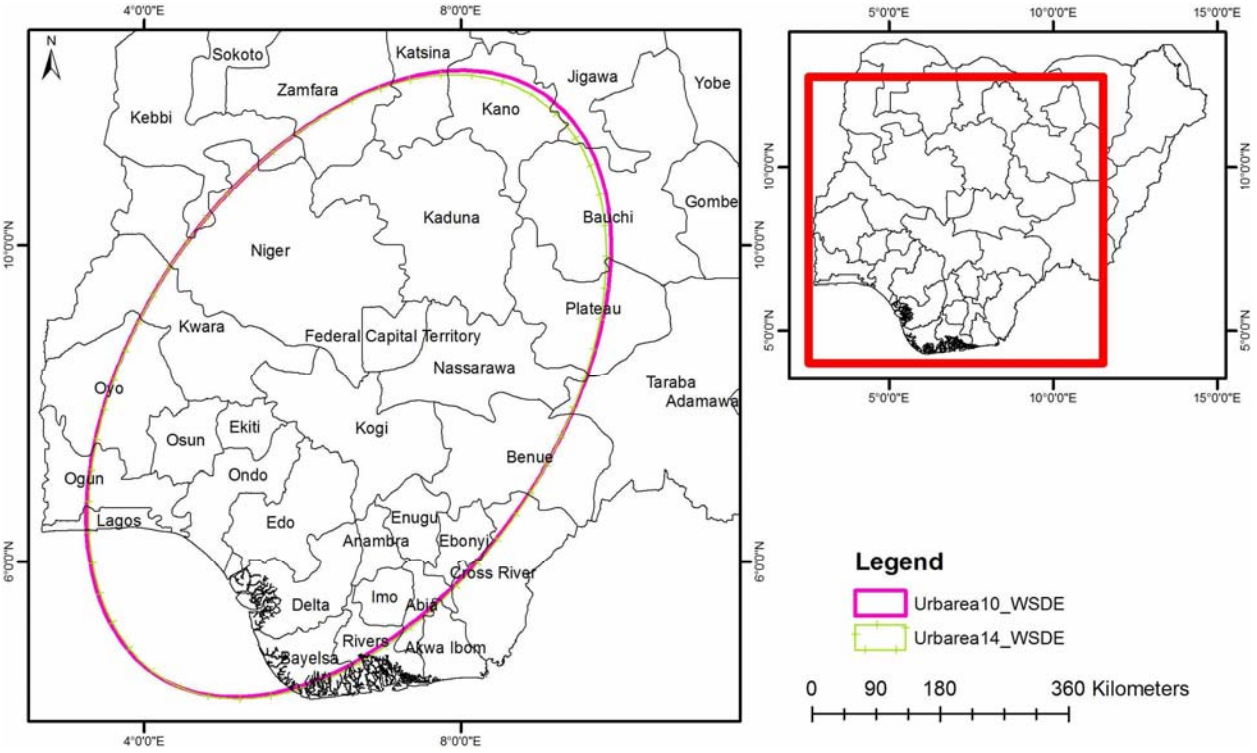

Figure 2: Standard deviation ellipses showing trend of urban economic activity between 2010 and 2014

NB. Urbarea10 – 2010; Urbarea14 – 2014

Source: Authors' representation

Using the one standard deviation, the WSDE and SDIST were computed for the economic activity across the urban agglomeration identified. Between 2010 and 2014, there was a very slight difference in the directional distribution of the economic activity. The orientation of the dispersion or directional trend remain the same tending toward the Southwest to North-central at an angle of 33.90° in 2010 to 32.98° in 2014 (Figure 2). The length and area of the trend coverage also changed slightly over this period, both length and area decreased by about 0.72% and 0.97% respectively.

Using the geometric mean, the SDIST shows the compactness of the economic activity among urban areas across the country. The area surrounding the geometric mean of urban area economic activity declined from 511,203.97 km^2 in 2010 to 503,134.98 km^2 in 2014 (Figure 3).

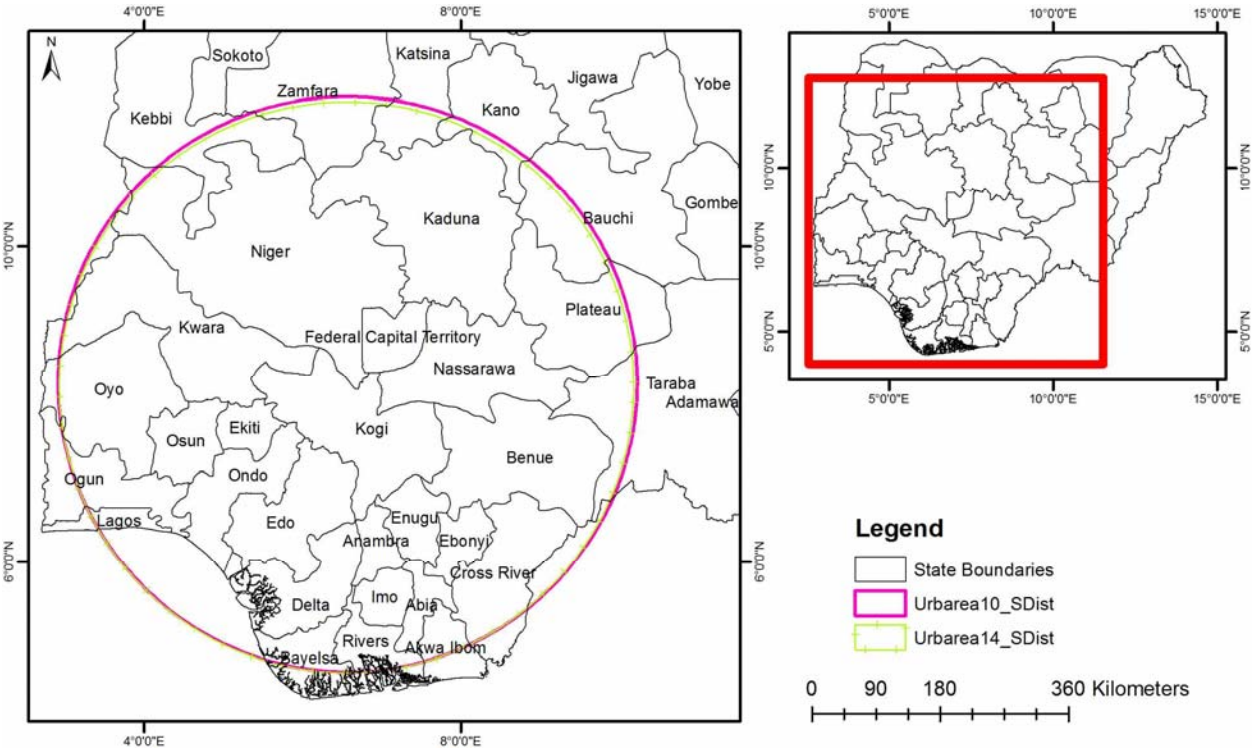

Figure 3: Standard distance of economic activity among urban areas in Nigeria (2010-2014)

NB. Urbarea10 – 2010; Urbarea14 - 2014

Source: Authors' computation

Additionally, there was a decrease of about 0.79% in diameter, with the shrinkage more prominent in the north-central and north-eastern parts of the country. The standard distance measure shows that, from 2010 to 2014 there was a slight increase in compaction of economic activity across the urban areas in the country. Thus, economic activity increased in intensity or size around the southern urban areas and/or decreased around the northern urban agglomerations.

There was an increase in the number of urban agglomerations by 13.76% a consequent growth of about 23% over the period studied. With urban areas accounting for most of the economic activities in the country, it would be expected that as the number of urban areas grows, so shall the sphere of their economic activity across the country. However, this is contrary to what was observed, the results highlighted above shows that despite the increase in the number of urban areas across the country, the established urban areas still pull so much weight in determining the centre of gravity of economic activity. This could be attributed to the increasing population (increase fertility and rural – urban migration) of these established centres, thus allowing them to have more contribution. Furthermore, in 2010, three of the top five highest contributing

urban agglomeration were found in the southern part (Lagos, Ibadan, Port Harcourt) of the country and two (Kano and Maiduguri) in the northern part (Table 2). Compared to 2014, four of the top five were found in the southern part (Lagos, Ibadan, Aba and Benin) and Kano in the northern part of the country. These top five urban conglomerations accounted for about 78% to 80% of the total economic activity in the country. All these provided an indication to why there was a shift in the COGEA toward the South-western part.

Table 2: Total economic activity by top urban agglomeration

Urban Agglomeration	Total GDP (Million Naira) 2010	Urban Agglomeration	Total GDP (Million Naira) 2014
Lagos	7,067,964.00	Lagos	11,187,894.00
Kano	1,974,950.25	Kano	2,993,281.00
Ibadan	1,499,459.38	Ibadan	2,272,615.75
Maiduguri	585,238.19	Aba	1,035,658.81
Port Harcourt	576,944.44	Benin	996,003.31

Economic activity distribution by Local Government Area

Comparing the economic activity at the LGA level was done by adding the economic contribution of the rural areas to that of the urban. Using the same metrics as above the centre of gravity and geographic distribution of economic activity was examined.

Table 3: Summary statistics for sum of LGA economic activity

Statistics	Economy Activity (Million Naira)	
	2010	2014
Mean	71558.83	118993.90
Standard Deviation	103585.71	158438.72
Maximum (Alimosho LGA)	922628.50	1445390.13
Minimum (Gombe LGA)	90.11	159.93

Source: Authors' computation

Between 2010 and 2014 the average economic activity increased across the LGA in the country by about 40% (Table 3).

Table 4: Total economic activity for the top 10 local government areas

State	LGA	Economy Activity (Million Naira)		Change
		2010	2014	
Lagos	Alimosho	922,628.50	1,445,390.13	36.17%
Lagos	Surulere	753,506.25	1,142,062.88	34.02%
Lagos	Apapa	648,864.88	983,599.94	34.03%
Lagos	Lagos Mainland	601,191.19	911,192.88	34.02%
Kano	Fagge	576,204.38	873,313.50	34.02%
Lagos	Kosofe	569,656.31	863,461.81	34.03%
Lagos	Ikeja	567,963.88	860,840.56	34.02%
Lagos	Amuwo Odofin	563,240.50	854,062.69	34.05%
Rivers	Port Harcourt	492,394.91	746,586.44	34.05%
Kano	Ungogo	492,291.47	746,238.31	34.03%

Source: Authors' computation

The top rated LGA (Alimosho LGA) witnessed a 36.17% increase in its economic activity (Table 4) while the least active LGA (Gombe LGA) witnessed a 43.66% increase in economic activity over the same period (Table 5). When compared, the difference between the two (i.e. LGA with the least economic activity and that with the highest) is staggering (see Table 3). However, there is an indication that there was an improvement, with about 12% increase in the ratio over the years. This is also reflected in the increase in economic activity for Gombe LGA as mentioned earlier.

Table 5: Total economic activity for the bottom 10 local government areas

State	LGA	Economy Activity (Million Naira)	
		2010	2014
Kogi	Mopa-Muro	3,212.39	5,701.71
Adamawa	Teungo	3,147.22	5,586.05
Borno	Kwaya Kusar	3,139.46	5,572.28
Borno	Kala/Balge	2,759.85	4,898.50
Osun	Aiyedire	2,687.35	4,769.82
Sokoto	Tureta	2,389.34	4,240.88
Niger	Edati	2,378.28	4,221.25
Cross River	Bakassi	793.08	1,407.65
Osun	Isokan	551.96	979.68
Gombe	Gombe	90.11	159.93

Source: Authors' computation

The top ten LGA with the highest economic activity contributed about 11.16% to the total in 2010 and 10.22% to that of 2014 (a decline of about 8%) in real terms. However, there was still an increase of about 66% over the same period in economic activity across these LGA with increase in economic activity ranging between 34.02% and 36.17% (with an average of 34.24%). Moreover, the identity and position of the LGA remained the same over the period examined. It is no surprise that out of these ten; seven, two and one are from Lagos, Kano and Rivers States respectively. These LGAs belongs to metropolitan areas which were previously identified as having very intense economic activity. Thus, the addition of rural economic activity further increases their prominence.

Examination of the bottom ten LGAs shows that, there were no changes in the identity and position of the LGAs. As indicated in Table 5, these ten LGAs belongs to Kogi (1), Adamawa (1), Borno (2), Osun (2), Sokoto (1), Niger (1), Cross River (1) and Gombe (1) States. Together, they accounted for around 0.038% and 0.041% in 2010 and 2014 respectively of the total national economic activity, and this represents a 6.31% increase over the years.

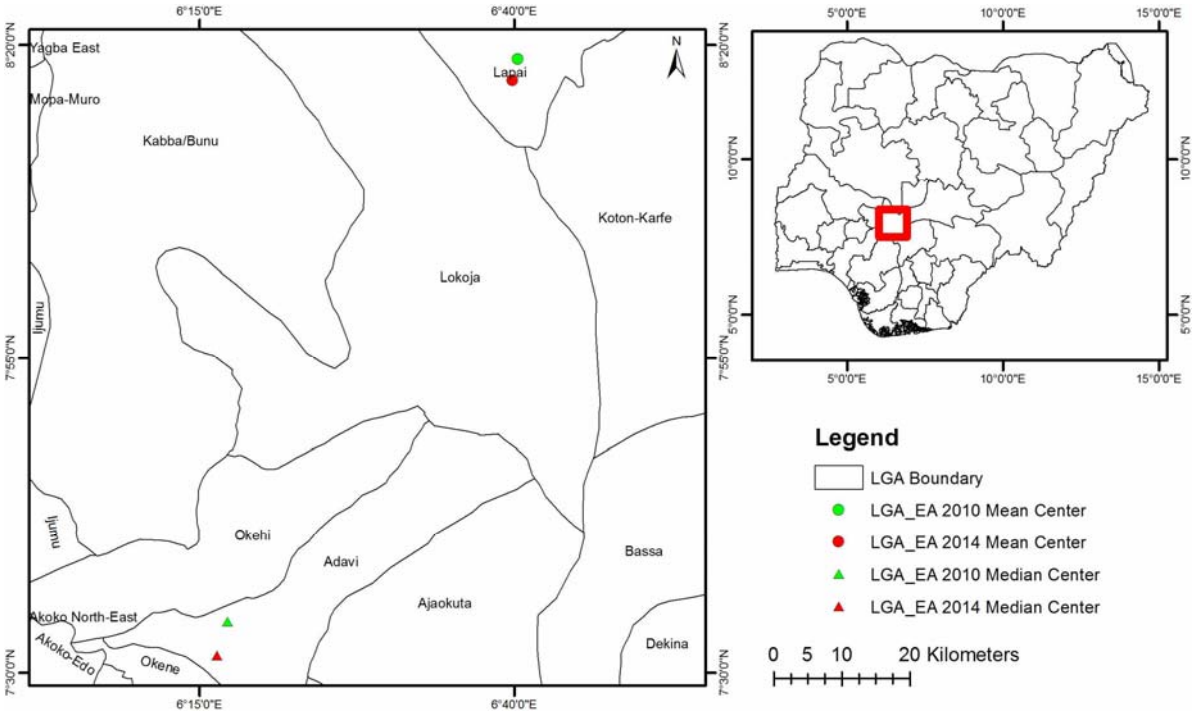

Figure 4: Economic centre of gravity based on LGA's GDP (2010-2014)

Source: Authors' representation

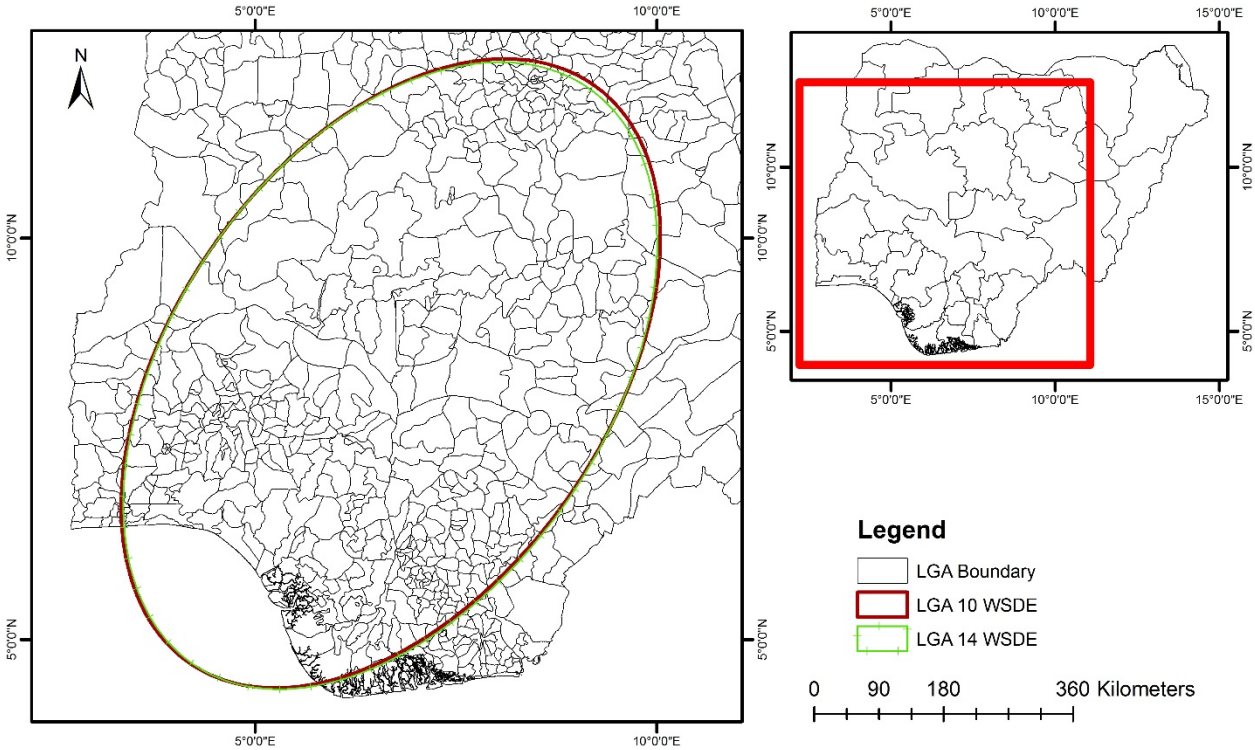

Figure 5: Standard deviation ellipses showing trend of LGA economic activity between 2010 and 2014

NB. LGA 10 – 2010; LGA 14 - 2014

Source: Authors' representation

Across the LGAs in the country, there was a change in the location of COGEA between 2010 and 2014 (*see* Figure 4). COGEA moved at a rate of about 0.80 km per year (about 3.20 km over the period) southwards and rotated to about 103.56° westward. These two points (i.e. for 2010 and 2014) fell within the Lapai LGA of Kogi State. Median centre also showed a similar trend, moving towards the southwest by about 5.17 km with westward orientation of 107.26 degrees and falls within the Adavi LGA of Kogi State.

Similar to the observation for the location of centres identified for urban areas' economic activity, COGEA remained within Kogi State and shifted southwards over the period of analysis. This further confirmed previous results showing that the balance of economic activity is shifting towards the southwest.

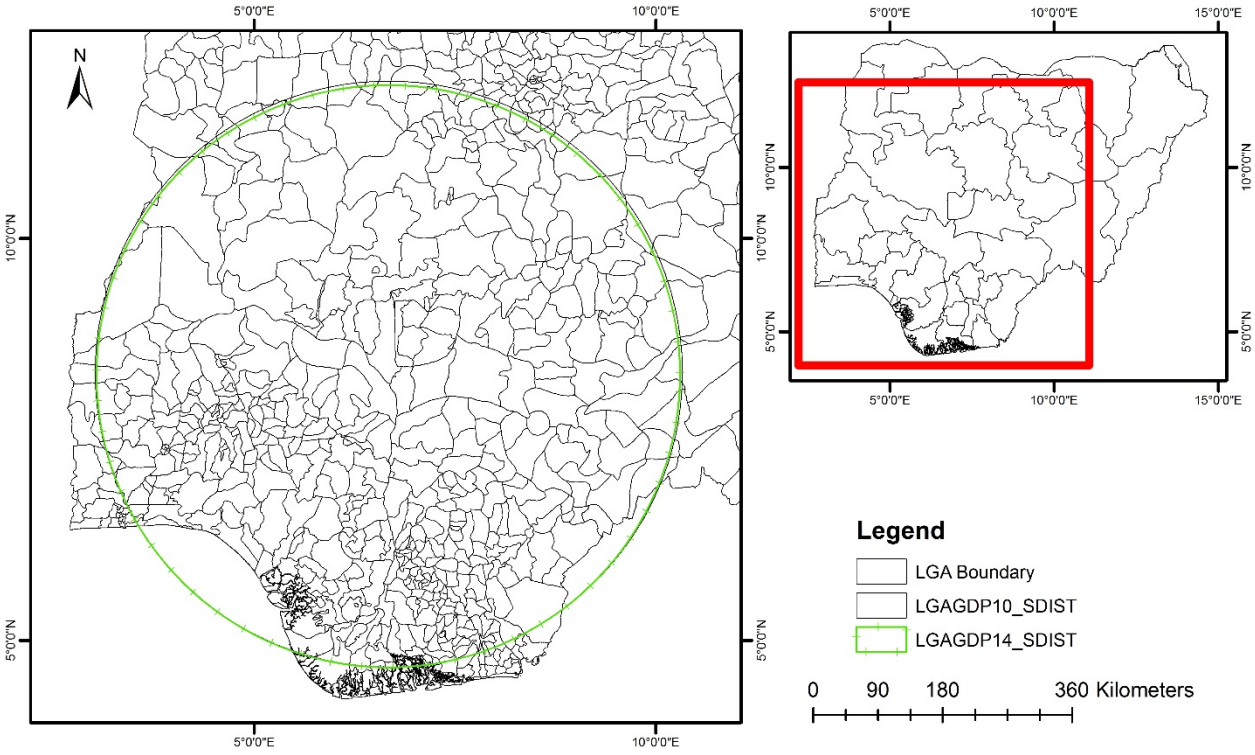

Figure 6: Standard distance of economic activity across LGAs in Nigeria (2010-2014)

NB. LGAGDP10 – 2010; LGAGDP14 - 2014

Source: Authors' representation

With the WSDE (as indicated in Figure 5) measuring the directional trend, there were slight differences (distributional trend SW-NC) between WSDE of economic activity for the urban agglomerations and that of LGAs. There was a change in the dimension of the one standard deviation ellipse generated, in which the rotation angle decreased from 35.09° to 34.43° while length and area decreased by about 0.54% and 0.69% respectively.

Examining the compactness of the total economic activity at the LGA level, the attributes of the SDIST (Figure 6) compaction of economic activities increased over the study period. This is evident from the decrease in the diameter of the standard distance circle (one standard deviation around the geometric mean centre). Moreover, the area also contracted about 1.20% between 2010 and 2014. This agrees with the trend observed for the urban agglomerations as shown in Figure 3.

Studies (World Health Organisation, 2011; WRI 2003) have confirmed the increase in number of urban agglomerations and population, just as this study identified. Consequently, there is bound to be an increase in the total contribution of urban areas to National GDP as observed. This increase in number of urban agglomerations provides opportunity for development as well as challenges for management. From the results, increasing number of urban agglomerations slightly reduced the contribution of the established urban centres like Lagos, Kano, Port Harcourt, etc. This implies that seeds for the development of potential urban centres are already being sown across the country. However, the question would be, how will these seeds thrive (sustainably or otherwise)? For example, according to the World Health Organisation (2011), about 63% of the urban dwellers live in slums in Nigeria; this could have dire consequences on how such urban areas develop and contribute to sustainable development in the country. Across the LGA, the trend is also not different with metropolitan LGA, attracting a higher proportion of economic activities across the States and regions of the country. Nonetheless, there is evidence showing an increasing spread of smaller economic centres across the length and breadth of the country. This augurs well for non-metropolitan LGA as they also witnessed a significant increase in economic activities over the period under this study.

Spatial analysis of the intensity of economic activities across the urban agglomerations and LGA gave an indication that the centre of gravity at these two levels lies within Kogi State. Thus, we could refer to this as an "opportunity centre" in the sense that, it is right at the middle of the nation's economic activity (average location to all major economic activities across the country). This could be an ideal location for innovation centres; economic development hub supported by adequate infrastructure. With the State right at the middle, where all economic activity and businesses congregate, the potential based on location (distance to other economic hubs) could be harnessed to boost economic development in the country. Also, even though there was a shrinkage of the area of influence for economic activity (as indicated by distributional trend area and standard distance area) over the period of observation, the centre

of economic gravity still fell within Kogi State. Thus, further supporting the importance of Kogi State as the economic centre of gravity for the nation.

Distributional trend ellipse and the standard distance computed show that there are economic "dead zones" across many parts of the country. Therefore, the challenge is how to stimulate economic development in such places in a sustainable fashion. Moreover, with the area of influence (as mentioned in preceding paragraph) shrinking, there is a problem that these "dead zones" are increasing and there is the need for concerted effort to stem this tide. This observation also shows that economic activity is getting more and more compacted within small regions across the country, following a planar direction. In this case, there are opportunities as the compactness can stimulate development in such areas which could eventually spread to other places. This, thus shows the interplay of the backwash effect and spread/spill over effects (Hirschman, 1958; Myrdal, 1957). However, the challenge is that of infrastructure and poverty in the urban area and widening gaps between urban and rural areas. All of which could stem growth of economic development and ultimately sustainable development of the nation. Furthermore, increasing compaction offers opportunity for targeted infrastructure development, and economic planning. It also offers opportunities to astute entrepreneurs and businesses on potential markets and zones across the country.

Conclusions

From this study, a spatially explicit model of economic activity was developed, from which the economic centre of gravity and the distribution of economic activity were examined. Combining population and GDP figures, the study concluded that the economic centre of gravity for the country falls within Kogi State and has shifted slightly further to the south between 2010 and 2014. Also, we could conclude that total economic activity across the country is significantly dominated by a handful of major urban agglomerations, however, their dominance waned slightly over the period. Moreover, there is evidence suggesting that the country witnessed a compaction of economic activities over the period in question while the orientation of the distributional trend remained same.

The examination of the standard distance and standard deviation ellipse led to the identification of areas which could be referred to as "economic dead zones". It should be noted that, these are not devoid of economic activities. However, such places wield very little influence on the overall economic activity of the country and as such could experience faster pace of

drain/backwash effect. This often leads to increasing pressure on already established urban areas, potential degradation of quality of life, and increasing rate of poverty in such urban agglomerations.

This study suggests that future government policies meant to increase economic growth should also take into consideration spatial and environmental factors especially in terms of locating infrastructures and industries. For economic growth to achieve a more balanced development in the country, there is a need to stop the dominant urban bias in government policy especially in terms of infrastructural development and siting of industries and other economic activities. Thus, adequate understanding of spatial pattern and centrographic analysis of economic activity will provide the required data to support evidence-based economic and regional development policies.

This study is another step in spatial representation of economic activity in Nigeria, thus building on by Lawal and Nuga (2015) and extending such work by examining the geographical distribution of economic activities across the country. There is a need for further refinement of the dataset as high-resolution data becomes available. For example, the dataset could be further enriched to reflect the differences in relation to natural resource extraction and exploitation as well as intra-urban difference in economic activities. This would provide a much clearer picture of the spatial pattern and trend of economic development across the country.

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