The Sources of Economic Growth in Nigeria: A Growth Accounting Approach

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Abstract

The study investigated the sources of growth in Nigeria for the period 1960 to 2017 using the growth accounting framework of the standard neoclassical production function.Specifically, the study focused on evaluating the contribution of capital, labour and total factor productivity to economic growth in Nigeria. Additionally, in order to establish the relationship between capital, labour and total factor productivity, and economic growth, correlation coefficients between the variables were estimated. The results correlation analysis showed that the growths of capital, labour and total factor productivity were positively correlated with economic growth. Furthermore, the results from the growth accounting framework revealed that capital was found to be the major driver of economic growth in Nigeria during the entire period, 1961-2017. In the case of the sub-periods, capital was the major driver of economic growth in Nigeria during the first sub-period, 1961-1980. However, during the period, 1981-2000, labour was the major driver of economic growth, followed by capital while TFP growth contribution deteriorated as it was negative. Also, TFP was the major driver of economic growth during the period 2001-2017. Based on the foregoing, the study therefore recommends that, policies that encourage physical capital, human capital and technological development through domestic and foreign investments should be adopted, nurtured, sustained and intensified, noting that capital, human capital and technological development are key to economic growth and development.

Keywords: Total Factor Productivity, Relative Factor Shares, Economic Growth, Growth Accounting Framework, Nigeria.

Introduction

Economic growth rate, no doubt, is the measure of economic performance among countries. Countries with high economic growth rate are seen to be high performers while those with low growth rate are judged to be poor performers. This is why there is a lot of concern about rates of growth by countries and why there is a lot of pre-occupation with the question: why are some countries growing slowly and some growing fast? In order to answer this question, there has been a growing debate on sources of economic growth across countries since the introduction of the growth accounting method which is also known as the Solow model. The debate revolves around how much of total growth in output is attributed to factor inputs (capital and labour) or the accumulation of physical and human capital and to total productive(technical progress) (Solow, 1957). Hence, growth accounting method or sources of economic growth approach attempts to break down total output growth into its components parts- capital, labour and technical progress.

The Solow model attributes sustained long-term growth to technical progress due to the principle of diminishing marginal productivity. The technical progress or technical change, often called Solow's residual or total factor productivity (TFP) encompasses all sources of economic growth apart from those attributable to capital and labor. According to Aghion and Howitt (1992) and Romer (1990), technological progress is determined by internal forces in the economic system. They explained that technological progress depends on innovation and the incentive, while innovation depends on policies favoring competition, intellectual property rights and trade openness. Often, the final step in the growth accounting study is to relate factor growth rates, relative factor shares and TFP to such elements as government policies (such as economic reforms), openness, natural resources, and initial levels of physical and human capital. Empirically, it is observed that the growth accounting analysis allows a determination of whether growth is extensive or intensive. That is, whether economic growth is propelled by factor input growth or driven largely by productivity increases. This enables the policy makers to know whether the observed growth is sustainable or not. If growth is influenced by rapid increases in capital stock, such

growth is not sustainable in the long run but if it is influenced by increases in TFP, growth could be sustained (Iyoha, 2002). In furtherance, Solow (1957) and Denison (1962,1967) claimed from their growth accounting exercises that capital accumulation per labour accounted for between one-eighth and a quarter of the growth rates in the United States and other industrial countries, while TFP growth accounted for more than half of the growth rates in many countries. According to Young (1995), given large cross country variations in growth, TFP accounts for about 50 percent of growth in OECD countries and 30 percent in Latin American countries. This claim is consistent with O'Connell and Ndulu (2000) and Iyoha and Oriakhi (2000) growth accounting exercises, however, it is not consistent with Kim and Lau (1993), Pilat (1994), Krugman (1996) and Collins and Bosworth (1996) which argue that the spectacular growth in the East Asian countries was driven by capital accumulation while their economic slowdown could be taken as evidence of reduced rates of accumulation due to diminishing returns. In the same vein, Dike (1995) observed that the growth rate is greatly attributed to changes in factor inputs (capital and labour), with total factor productivity (TFP) playing a marginal role. Also, Matovu and Yuguda (1999) results show that growth was driven by both sizable factor accumulation and TFP growth. But TFP growth accounted less than factor input growth.

The results of growth accounting framework or sources of economic growth have been one of mixed. Therefore, it is crucial to re-examine the sources of economic growth in Nigeria using growth accounting exercise, hence, the following question is raised: What is Nigeria's source of economic growth? Is it productivity (TFP)(technology-productivity) or factor inputs(labour and capital)? This calls for an empirical investigation.

Given the average annual population growth rate of 2.4 percent between 2006 and 2017, the average growth rate of real output per capita was 2.9 percent. This revealed that Nigeria's economy experienced boost within this period. The Nigeria's average annual growth rate in real output during the period 2006-2017 stood at 5.3 percent. This falls short of China's real output growth rate of 9.3 percent within the same period, however, Nigeria's average annual growth rate in real output is higher than the growth rates of the Asian tigers- Singapore with 4.6 percent, South Korea with 3.4 percent, Hong Kong with 3.2 percent and Taiwan with 3.1 percent. Also, Nigeria's average annual growth rate in real output is higher than South Africa and Botswana except Ghana (see Table A-1 of the Appendix).

The Nigeria's growth rate was attributed to enhanced macroeconomic management, oil export boom and investment in both physical and human capital. These elements relate with factors growth rates, relative factor shares and TFP. Given the above, it is necessary to fully understand the sources of economic growth in Nigeria during the period 1960- 2017. Specifically, this study analyzes the total factor productivity, capital accumulation and labour contributions to growth using a growth accounting framework from 1960 to 2017.

The rest of the work is structured as follows; section two provides review of the related and relevant literature, section three explains the method of analysis, section four focuses on the empirical results and discussions. Lastly, section five presents the conclusion and recommendations.

Literature Review

Theoretical Review

The organizing principle of growth accounting is the neoclassical production function. A widely accepted framework in determining the sources of economic growth is the growth accounting. It is also known as the sources of economic growth approach and was pioneered by Solow (1957), Denison (1962, 1967) and Kendrick (1961). It has been recently revisited and expanded by Barro (1991), Elias (1992), Young (1995), Dowling (1998), Senhadji (1999) and Iwata *et al* (2003). Basically, growth accounting provides a breakdown of observed economic growth into its main components, viz., the changes attributable to the growth in capital and labour (factor inputs), and the residual or unexplained component. This residual or unexplained component is often called Solow's residual and it was originally taken as the contribution of technical change or technological progress. It has since become known as total factor productivity (TFP) because it captures all sources of economic growth apart from those attributable to capital and labor. However, Abramovitz (1956) sees TFP as not necessarily a measure of technology since the it could be a function of other things like military spending, or monetary shocks, or the political party in power and institutional factors. Hence, he referred TFP as measure of our ignorance which covers many components: innovation- based technological progress, imitation–based technological progress, institutional change, efficiency change, omitted variables and measurement errors. Therefore, it is now common to examine the fundamental determinants of economic performance in any economy using the growth accounting exercise. The growth accounting exercise helps to determine whether growth is extensive or intensive, that is, whether economic growth has been driven by factor input growth or by productivity increases. The reason for this distinction is to determine if observed

economic growth is sustainable or not. If economic growth is driven by rapid increase in capital stock, such growth may not be sustainable in the long run but if growth is driven by increases in total factor productivity, such growth may be sustainable in the long run (Iyoha, 2002).

Empirical Review

Many researchers have shown that there is no simple determinant of economic growth (Thomas and Serju, 2009). This is supported by Bosworth and Collins (2003) that examined the major contributors to growth using growth accounting framework for a period of 40 years covering 84 countries which account for 95 per cent and 85 per cent of World's GDP and population respectively. The study revealed that on average labour productivity grew by 2.3 per cent, with improvements in total factor productivity and an increase in physical capital per worker contributing to 1.0 per cent each, while human capital contributed to roughly 0.3 per cent. The study indicates that there is a significant relationship between growth and factors such as quality of institutions, geographical location, and trade openness. The study observed that while the quality of institutions worked through TFP growth, budget balance and trade openness functioned mainly through capital accumulation. Staritz et al. (2007) x-rayed the determinants of Guyana's growth from 1998 to 2004 using growth accounting exercise. The study showed that the country's growth slowdown was attributed to adverse terms of trade, weak infrastructure and exogenous shocks. But, on the other hand, it was pointed out that a perpetual decrease in factor accumulation, deterioration in political and institutional environment, massive labour migration and decrease in private and foreign direct investment were causes for persistent poor growth performance. Similarly, Klenow and Rodriguez-Clare (1997) estimated the sources of economic growth using growth accounting approach and the study revealed that differences in TFP growth account for about 90% of the variation in growth rates of output per worker across a sample of 98 countries over the period 1960-1995 after accounting for human capital accumulation. This result is consistent with Easterly and Levine (2001) which revealed that the TFP accounts for most of the cross-country and cross-time variation in growth. Wang and Yao (2001) examined the sources of growth in China using a simple growth accounting exercise during1952 to 1999. The study showed that the accumulation of human capital in China (measured by the average years of schooling for the population aged 15 to 64) was quiet rapid and contributed significantly to growth and welfare. The study also found out that the growth of total factor productivity played a positive and significant role in the reform period but it was negative in the pre-reform period.

Bunini (2017) examined the sources of economic growth in Tanzania, Uganda and Kenya using a growth accounting approach of a Cobb-Douglas production function. The study analyzed and compared the contribution to growth of TFP, capital accumulation, labour and human capital over the period of 52 years from 1960 to 201. The results showed that variation in sources of growth over time and across countries, and that economic growth in Tanzania and Kenya was dominated by TFP, whereas in Uganda it was driven by capital accumulation. The study concluded by observing that the improved growth was as a result of the government strategies to implement appropriate economic policies that fosters domestic investment to create employment, and reduction of poverty. Similarly, Matovu and Yuguda (1999) investigated the sources of growth in Botswana using a growth accounting framework during 1982-1997. The results showed that the impressive growth since independence was made possible by both sizable factor accumulation and TFP growth. Although not as important as the increases in factor inputs, TFP growth was nonetheless significant. Collins and Bosworth (1996) analyzed the factors affecting economic growth in Ghana using a growth accounting framework during 1960-97. The result showed that during 1960-97, output per worker declined by 0.12% in Ghana. At the same time, growth in factor accumulation, measured by physical capital per worker, accounted for 0.52%, and education per worker for 0.50%; however, this positive contribution by physical and human capital was more than offset by the negative contribution of total factor productivity (TFP), measured as the residual, of 1.15%. Thus, overall, the slow rate of per capita income growth in Ghana over 1960-1997 seems to be largely attributed to productivity (TFP) rather than to production inputs. Vera-Martin (2000) estimated the sources of growth for three Sahelian economies, Mali, Niger, and Senegal using cointegration techniques. The study indicates that capital and labor force account for the bulk of growth in these economies. Error-correction models are estimated to examine the determinants of short-run dynamics. The labor force is found to contribute to growth primarily over the long run, while capital is found to be, particularly important short-run determinant of output in Mali and Niger. Erasmus and Ricci (2003) analyzed the sources of growth in Swaziland during 1980-2001 using a growth accounting framework. The analysis suggests that the country's rapid growth prior to 1994 was due to factor accumulation, but especially to capital accumulation. The poor growth performance since 1994 was due to a decline in the contribution of both factor accumulation and TFP growth, particularly capital accumulation. During 1994-2001, TFP growth accounted for half of overall output growth. Sekkat (2002) analyzed the Macroeconomic sources of growth in Morocco using the growth accounting approach. The study showed that the contribution of labor remains constant across sub-periods, while the contribution of capital and TFP decreases remarkably. The contribution of TFP decreases more than the capital and during

the 1990s it is even negative. Arora and Bhundia (2003) attempt to provide estimates of potential output growth in post apartheid South Africa using both time trend techniques and the growth accounting approach. The results from growth accounting and regression analysis suggest that an increase in trend GDP growth after apartheid in 1994 is attributable to higher TFP growth driven by trade liberalization and greater private sector participation. Moreover, the turn-around in TFP performance in the recent period reflects in part, changes in policy and institutions. Amin *et al* (2005) examined the sources of economic growth and productivity in fifty African countries using three approaches during 1960-2000, namely, the conventional growth accounting method with an aggregate production function, the translog function that estimates the second-order Taylor approximation of the general production function and the nonparametric kernel derivative estimation technique. The results from the three approaches tend to support the view that output growth in Africa is from mainly factor inputs with capital accumulation playing a more important role. It was further observed that the growth of TFP over the sample period is an important factor in the overall growth performance of these African countries. Similarly, Amin (2002) examined the sources of growth in Cameroon using the aggregate production function as the basic model for the period1961 and 1997. Both parametric and non-parametric approaches were used. The results showed that the contribution of the growth of factor inputs is greater than the contribution of total factor productivity, with capital input playing a larger role in the economy at large. At the sector level, input growth, particularly land and capital greatly influenced the primary sector output growth. The capital input tends to be the most important factor influencing output growth in both the secondary and tertiary sectors. The results suggest that factor inputs (capital and land) play more important roles than total factor productivity (TFP) growth with emphasis on increasing return to scale and input growth both in quantity and quality. The technology factor and labour are not big contributors to growth in Cameroon, which may be because of certain constraints in the economy. Danquah (2006) examined the sources of decline in growth in Ghana from 1960- 2004 using the growth accounting framework. The results of the analysis show that average real GDP growth during sample period was driven by factor accumulation with no role for TFP. The contribution of physical capital remains the most important source of output growth, with a 2.11% share for the entire period. The contribution of labour force during the period was 0.70% while the TFP growth was negative (-0.60%) during the entire period. However, the recent pickup in growth during the reforms period (1984-2004) was made possible by an improvement in TFP growth. TFP growth contributed negatively to output growth before the reforms, but it emerged as one strong driving force of Ghana's growth during the reforms.

In Nigeria, Dike (1995) investigated the sources of growth using a growth accounting approach and the study revealed that the GDP growth is greatly attributed to changes in factor inputs, with total factor productivity(TFP) playing a marginal role. That is, labour and capital changes contributed 94.4%, leaving 5.6% to TFP. Iyoha and Oriakhi (2002) examined the sources of economic growth in Nigeria using the growth accounting framework for the period 1960 – 1997. The study decomposed growth in per capita income into its main components - the contribution of capital per worker and total factor productivity (TFP). The result showed that the average annual growth rate of per capita income was approximately 1.96 percent, the average annual growth rate of the contribution of capital (taking the relative share of capital in output equal to 35 percent) to per capita income growth was 0.33 percent while the average annual growth rate of TFP was 1.62 percent. Similarly, Iyoha (2000) examined the sources of economic growth in Nigeria using the growth accounting framework for the period 1960 – 1997. The study decomposed growth in output into its main components - the contribution of capital per worker and total factor productivity (TFP). The result showed that within the sample period the average annual growth rate of output was approximately 3.7 percent, the average annual growth rate of the contribution of capital (taking the relative share of capital in output equal to 35 percent) to output growth was 0.8 percent, the average annual growth rate of the contribution of labour to output growth was 1.7 percent, while the contribution of TFP to output growth was 1.1 percent. The study revealed that during the 1961-1970 period, TFP growth accounted for over 92 percent of the average real output growth. TFP growth performance declined during 1971-1980 when it became negative and declined further during 1981-1987. In the last decade, TFP recovered and stood at 2.1 percent while the contribution of capital declined to 0.8 percent. Thus, during 1988-1997, TFP growth accounted for 43 percent while relative share of capital and labour accounted for 14 percent and 43 percent respectively, of real output growth.

The results of the determinants of sources of economic growth have been one of mixed. Therefore, it is crucial to re-examine the sources of economic growth in Nigeria in the light of growth accounting exercise. This study uses the growth accounting framework to evaluate the contributions of capital accumulation, TFP, and labour to the growth rate of the real output. Thus, this study contributes to the output growth literature for Nigeria.

Methodology

Data and Sources

The annual data for this study include, real gross domestic product (GDP), capital stock, employment level (labour) and total factor productivity, and were basically from secondary sources. Specifically, the data were obtained from the Penn World Tables (PWT) website, except the TFP data which were estimated. The annual data covers the sample period, 1960-2017. The choice of the period and frequency of data was because of availability of data. The real GDP at constant 2011 national prices (in million 2011US$) was used as a measures of economic growth, employment level was given as a number of persons engaged (in million), capital stock at constant 2011 national prices (in million. 2011US$) was used and total factor productivity was used as a measure of technological progress/residual/unexplained factor.

Model Specification

This study adopts the standard primal neoclassical production function of growth accounting to estimate the effect of physical capital, labour and productivity on real GDP growth. A primal production function uses changes in quantities of factors. The adoption of a primal production is predicated on the availability of data.

Consider the following neoclassical production function for the Nigeria economy:

$$Y_t = A_t K_t^{\alpha} L_t^{\beta}, \quad \text{where } 0 < \alpha, \beta, < 1 \qquad (1)$$

Where Y_t is real GDP, A_t is an index of TFP, K_t is total physical capital stock, L_t is number of labour (labour force) and *t* indicates time. Given the paucity of the relevant data, the labour force series is not adjusted for human capital stock. Thus, in this formulation, TFP reflects educational attainment, technological change and some other omitted factors. Assuming the production function is twice differentiable and subject to constant returns to scale and technical change.

Differentiating equation (1) with time, dividing both sides by Y and rearrangement of the term yields:

$$\dot{Y}/Y = \mathring{A}/A + (F_k K/Y)^* (\acute{k}/K) + (F_L L/Y)^* (\acute{L}/L) \qquad (2)$$

Where $\dot{Y}/Y$ is the continuous time rate of growth of output, $\acute{k}/K$ is the rate of growth of capital stock, $\acute{L}/L$ is the rate of growth of labour force; F_k and F_L are the marginal product of capital and labour, respectively; and $\mathring{A}/A$ is the Hicks-neutral rate of change of technological progress.

$$\mathring{A}/A = \dot{Y}/Y - (F_k K/Y)^* (\acute{k}/K) - (F_L L/Y)^* (\acute{L}/L) \qquad (3)$$

Empirically, equation (3) is not practicable since it requires the knowledge of the social marginal products, F_k and F_L. The problem, obviously, is that F_k and F_L are unknown parameters depending on the functional form and it is these parameters that are critical in calculating TFP growth and the contributions of capital and labour.

Estimation of TFP (α)

There are two approaches in deriving the unknown parameters. The first approach involves an econometric estimation of production function and the second approach involves non parametric growth accounting (Solow Residual). The first approach involves an econometric estimation of production function where growth rate of output is regress on the growth rates of capital and labour in level form. This is to avoid losing long run properties of the data. The intercept/residual of estimation provides an estimate of the rate of technical change or TFP (TFP growth is calculated as a residual) while the coefficients of capital and labour growth rates are used to calculate the respective estimates of relative factor shares.

The second approach assumes that factors are paid their social marginal products so that F_k equals the rental price of capital and F_L equals the wage rate. Hence, $(F_k{*}K/Y)$ is equal to the relative share of capital in output while $(F_L{*}L/Y)$ is equal to the relative share of labour in output (Iyoha, 2002). $(F_k{*}K/Y)$ and $(F_L{*}L/Y)$ also stand for the elasticity of output with respect to capital and labour, respectively. Under the constant returns to scale, in which the relative shares sum to unity (i.e $F_k{*}K/Y) + (F_L{*}L/Y) = 1$ or equality of income shares of capital and labor in GDP and the elasticities of output), and switching to discrete changes in the variables. Thus, with this replacement, the growth rate of TFP may be calculated by simple subtraction. The result is what is known as the *Solow residual*.

In line with Iyoha (2000), this study adopts the second approach. According to Iyoha (2000), it was therefore decided that it would be preferable to impute the relative shares from Senhadi's (1999) cross-country analysis of sources of economic growth which includes developing countries from Africa, Asia and Latin America. In the study, it was revealed that relative capital share tends to lies between 0.3 and 0.4. A value of 0.3 was therefore chosen for Nigeria due to the state of technological development. In order to ascertain the effects of slight deviation from this relative share, a sensitivity analysis

was undertaken under which estimates of TFP were also obtain for capital share value of 0.35. hence, equation (3) may be rewritten as:

$$TFP = \Delta Y/Y - \alpha^*(\Delta K/K) - (1- \alpha)^*(\Delta L/L) \quad (4)$$

TFP is Total factor productivity, which is the estimate of the rate of technological progress, α is the relative share of capital in output and (1- α) is the relative share of labour in output. The estimated Solow residual or TFP is computed at each date by using time-series data on ΔY/Y, ΔK/K, ΔL/L and α. From the intuition behind equation (4), it can be noted that growth accounting for the TFP is a subtraction of relative share of physical capital and relative share of Labour from the continuous time rate of growth of output but physical capital and Labour should be multiplied by a scalar equivalent to their respective shares which are α = 0.3, 1- α = 0.7.

Alternatively, equation (4) may be written as:

$$TFP = (Y_t - Y_{t-1}/Y_{t-1}) - \alpha(K_t - K_{t-1}/K_{t-1}) - (1- \alpha)(L_t - L_{t-1}/L_{t-1}) \quad (5)$$

Method of Data Analysis

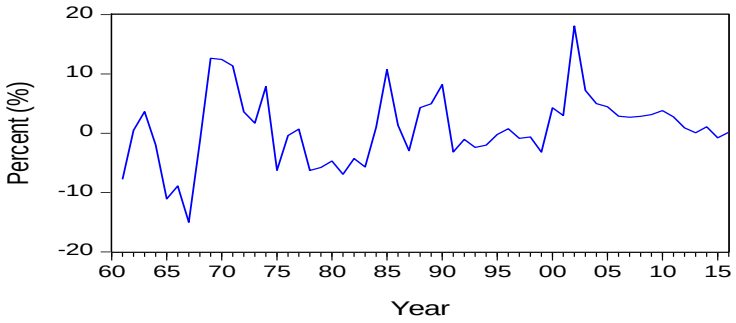
In investigating the sources of economic growth in Nigeria this study follows Iyoha (2000) who employed the standard primal neoclassical production framework of growth accounting. This framework assumes a constant return to scale, in which the relative shares sum to unity. That is, the equality of income shares of capital and labor in GDP and the output. To calculate the TFP growth and the contributions of capital and labour, the study first estimated *α*, the relative share of capital in output and *(1- α),* the relative share of labour in output. Since data for the relative factor shares are not available for Nigeria, the study followed Iyoha (2000) by imputing the relative factor shares from Senhadi's (1999) cross-country analysis of sources of economic growth which includes developing countries from Africa, Asia and Latin America. Senhadi (1999) revealed that relative capital share tends to lies between 0.3 and 0.4. In choosing the relative capital share for the calculation of TFP, the study chose a value of 0.3 as against Iyoha's (2000) 0.35. This value of 0.3 was also used to calculate the relative labour share. In order to ascertain the effects of slight deviation from this relative share of capital, a sensitivity analysis was undertaken under which estimates of TFP were also obtain for capital share value of 0.35 as against Iyoha's (2000) capital share value of 0.4. Given the values of relative factor shares, TFP is calculated as a subtraction of relative shares of physical capital and Labour from the continuous time rate of growth of output but physical capital and Labour should be multiplied by a scalar equivalent to their respective shares which are *α and 1- α* .

After the computation of the TFP or Solow residual, the average annual percentage change (growth) of output (GDP), capital stock, labour, relative factor shares and TFP were examined for the entire period- 1961-2017 and for 3 sub-period- 1961-1980, 1981-2000 and 2001-2017. Finally, the percentage contributions of capital, labour and TFP growth to total GDP growth were examined for the entire period- 1961-2017 and for 3 sub-period- 1961-1980, 1981-2000 and 2001-2017.

Results and Discussion

TFP Trend and Correlation Analysis

Figure 1: Nigeria's TFP Growth, 1961-2017



Source: Author's calculations based on equations (5).

Figure 1 illustrates the trend of TFP for Nigeria. It shows that in 1960s Nigeria highest TFP growth was about 13 percent, in 70s the highest TFP growth was about 8 percent, in 80s it was about 11 percent, in 1990s it was about 8 percent while

in 2000s highest TFP growth was about 18 percent, which is the highest within the sample size. However, between the 1976-1983 and 1991-1999 the TFP for Nigeria declined drastically. Between these years the country experienced a negative growth in TFP.

Table 1: Correlation Coefficient between GDP and Other Factors of Production, 1960-2017

Factors Production	Correlation Coefficient
Capital	0.156
Labour	0.425
TFP	0.935

Source: Author's Calculations Based on Equations (5).

Table1 shows that the growths of TFP, Capital and Labour were positively correlated with the GDP growth. The Table reveals that the TFP, Capital and Labour, and GDP growth have a correlation coefficient of 0.94, 0.16 and 0.41 respectively. This indicated that there is a strong positive relationship between growth of GDP and TFP in Nigeria while capital and labour have weak positive relationship with the GDP growth. This suggests that Nigeria experienced an increasing TFP, Capital and Labour productivity.

Aggregate Productivity Growth in Nigeria

The results from the growth accounting exercise for Nigeria over the period 1960-20017 are provided below. The analysis is based on consensus relative share of capital of $\alpha = 0.3$ and sensitivity relative share of capital of $\alpha = 0.35$.

Consensus Relative Share of Capital, $\alpha = 0.3$.

Table 2A: .Aggregate Productivity Growth, 1960-20017(Average Annual Percent Change)

Factors of Production/Period		1961-2017	1961-1980	1981-2000	2001-2017
Output		4.04	3.76	2.54	6.14
Capital Stock		5.85	9.17	3.86	4.28
Labour		2.16	2.53	1.82	2.11
Relative Share of Capital	Inputs	1.75	2.75	1.16	1.28
Relative Share of Labour		1.51	1.77	1.27	1.48
Contribution of Inputs		3.26	4.52	2.43	2.76
Total Factor Productivity (TFP)		0.78	-0.76	0.11	3.38

Source: Author's Calculations Based on Equations (5)

Consensus Relative share of capital, $\alpha = 0.30$

From Table 2A, Nigeria's real GDP grew by 4.0 percent per annum on average over the period 1961 – 2017. The average growth rates of capital stock and labour are 5.9 and 2.2 percent per annum respectively over the period 1961-2017. Using consensus relative share of capital, $\alpha = 0.30$, Table 2A shows that the contribution of capital and labour to output growth increased at 1.8 percent and 1.5 percent respectively, thus the contribution of inputs grew at 3.3 percent over the entire period. Also, the residual or total factor productivity increased at the rate of 0.8 percent per annum. Examination of Table 2B reveals that over the entire period, capital and labour contributed about 43.3 and 37.4 percent of total real economic growth respectively while TFP contributed 19.3 percent of total real economic growth.

On the sub-period, the examination of Table 2A shows that during the period 1961-1980 capital stock grew at an average annual rate of 9.2 percent. According to Iyoha (2000), this high growth rate of capital stock is comparable with the rates of capital stock growth in the fast growing countries like China and the Asian tigers. However, this high growth of capital stock could not be sustained as it fluctuates and fell to 3.9 percent per annum during the period 1981-2000 and later increased to 4.3 percent per annum during the period 2000-2017. This could be attributed to exchange rate inflow fluctuation resulting from oil price instability. The labour grew at an average annual rate of 2.5 percent during the period 1961-1980 and later fell to 2.1 percent per annum during the period 2001-2017. Also, the TFP growth rate is -0.76 percent per annum during the period 1961-1980 and later increased to 3.4 percent per annum during the period 2001-2017. In term of percentage contribution as shown in Table 2B, capital and labour growth contributed 73.1 and 47.1 percent to economic growth during the period 1961 -1980 respectively. Their contributions fell to 45.7 and 50.0 percent during the period 1981-2000 respectively and the contribution later decreased further to about 20.9 and 24.1 percent during the period 2001-2017 respectively. The contribution of TFP growth to economic growth stood at -20.2 percent during the period 1961 -1980. It increased to about 4.3 percent during the period 1981-2000 and later increased to about 55 percent during the period 2001-

2017. The output performance was moderately high (4 percent) during the period 1961-1980, it fell to 2.54 percent in the period 1981-2000 and increased to 6.14 percent during the period 2001-2017. These differences in output performance could be attributed to the relationship between factor growth, relative factor shares and TFP, and declining/increasing efficiency arising from market reforms, economic liberalization and financial market innovations (Iyoha, 2000), as well as the level of application of scientific innovations, security and the business environment in the country. Poor economic policy and unstable political situation are disincentives to both local and foreign direct investment and have negative consequences on the economic growth (Bunini, 2017).

The results obtained may be interpreted as indicting that over the entire period, economic growth in Nigeria was attributed to improvement in capital stock, labour and TFP because all these factors have a positive contribution to the output growth. Moreover, the contribution of each factor shows that growth was dominated by capital stock growth. While the capital stock contributed to an average of about 43.3 percent or 1.8 percentage points of the output growth, labour contributed to an average of about 37.4 percent or 1.5 percentage points of the output growth and TFP contributed to an average of about 19.3 percent or 0.8 percentage points respectively. Thus, capital stock has been the main driver of economic growth in Nigeria over the period 1961 to 2017. However, the sub-periods results in Table 2B show that during the period 1961-1980 output growth was dominated by capital stock growth(73.1 percent) followed by labour (47.1 percent) while TFP could not account for output growth. The results indicate that the TFP growth has negative contribution (-20.2 percent) to the output growth. From 1981 to 2000 output growth was dominated by labour growth (50.0 percent) followed by capital stock growth (45.7 percent) and TFP growth (4.3 percent). Also, during the period 2001-2017 output growth was dominated by TFP growth (55.1 percent) followed by labour growth (24.1 percent) and capital stock growth (20.9 percent).

Table 2B: Total GDP Growth and Factor Growth Contribution in Nigeria, 1960-20017(%)

Factors of Production/Period	1961-2017	1961-1980	1981-2000	2001-2017
Output	100.00	100.00	100.00	100.00
Inputs	80.70	120.21	95.67	44.95
Capital	43.32	73.14	45.67	20.85
Labour	37.38	47.07	50.00	24.10
TFP	19.30	-20.21	4.33	55.05

Source: Author's Calculations Based on Equations (5)

Consensus Relative share of capital, α = 0.30

Sensitivity Analysis on α = 0.35

Given the fact that the value of α was assigned, it was important to carry out sensitivity analysis to ascertain the likely effect of a change in the value of α. Hence, results were generated for α = 0.35. The results are represented in Table 3.

Table 3A: .Aggregate Productivity Growth, 1960-20017(Average Annual Percent Change)

Factors of Production/Period		1961-2017	1961-1980	1981-2000	2001-2017
Output		4.04	3.76	2.54	6.14
Relative Share of Capital	Inputs	2.04	3.20	1.35	1.50
Relative Share of Labour		0.76	0.89	0.64	0.74
Contribution of Inputs		2.80	4.09	1.99	2.24
Total Factor Productivity (TFP)		1.24	-0.33	0.55	3.90

Source: Author's Calculations Based on Equations (5)

High Relative share of capital, α = 0.35.

It is observed that while relative share of capital, relative share of labour and TFP react to changes in α, the effects are conspicuous. Relative share of capital and TFP growth rise from 1.75 and 0.78 for α = 0.30 to 2.04 and 1.24 for α = 0.35 respectively while relative share of labour growth fall from 1.51 for α = 0.30 to 0.76 for α = 0.35. Also, for α = 0.30, capital stock, labour and TFP growth contribute 43.3 percent, 37.4 percent and 19.3 percent to economic growth respectively while at α = 0.35, capital stock, labour and TFP growth contribute 50.5 percent, 18.8 percent and 30.7 percent to economic growth respectively. Therefore, it is obvious that for Nigeria, capital stock, labour and TFP growth are responsive to changes in the relative share of capital.

Table 3B: Total GDP Growth and Factor Growth Contribution in Nigeria, 1960-20017(%)

Factors of Production/Period	1961-2017	1961-1980	1981-2000	2001-2017
Output	100.00	100.00	100.00	100.00
Inputs	69.31	108.78	78.35	36.48
Capital	50.50	85.11	53.15	24.43
Labour	18.81	23.67	25.20	12.05
TFP	30.69	-8.78	21.65	63.52

Source: Author's Calculations Based on Equations (5)

High Relative share of capital, α = 0.35

Conclusion and Policy Recommendations

This study investigated sources of economic growth in Nigeria using annual data for 1960 -2017. Specifically, the study focused on evaluating the contribution of capital, labour and total factor productivity to economic growth in Nigeria using growth accounting framework of the standard neoclassical production function. Additionally, in order to establish the relationship between capital, labour and total factor productivity, and economic growth, correlation coefficients between the variables were estimated.

The results showed that the growths of capital, labour and total factor productivity were positively correlated with economic growth. The results also revealed that TFP has a strong positive correlation coefficient of 0.92 while capital and labour have correlation coefficients that are less than 0.5. Given the sub-periods, the results showed that economic growth was fluctuating in the same direction with the TFP growth whereby the highest economic growth was realized when TFP was highest. Hence, this suggests that the TFP was the main driver of economic growth in Nigeria.

Furthermore, the results from the growth accounting framework revealed that capital, labour and TFP growth accounted for about 43.3 percent, 37.4 percent and 19.3 percent of real economic growth respectively, during the entire period. Therefore, capital was found to be the major driver of economic growth in Nigeria during the period 1961-2017. In the case of the sub-periods, capital was the major driver of economic growth in Nigeria during the first sub-period, 1961-1980. Out of total real economic growth of 3.76 percent, capital growth was 2.75 percent which signifies about 73 percent contribution to real economic growth. However, during the period 1981-2000, labour was the major driver of economic growth, followed by capital. Labour accounted for about 50 percent of real economic growth while TFP growth contribution deteriorated as it was negative. Also, TFP was major driver of economic growth during the period 2001-2017. TFP growth accounted for about 55 percent of total economic growth during the period.

Based on the findings, the study therefore recommends as follows:

Design and Implementation of Appropriate Policies: for there to be strong and sustained economic growth, capital stock, human capital and technological needs of the country must be addressed. Therefore, policies that encourage physical capital, human capital and technological development through domestic and foreign investments should be adopted, nurtured, sustained and intensified. Also, the policies should be geared towards encouraging investment in potential sectors of the economy in order to employ the majority of the workforce. Strong productive performance is a policy issue and it is expected that appropriate policies are adopted and implemented for efficient and effective allocation and utilization of resources or factors of production.

For further study, given that the quantity and quality of labour (labour education) is a determinant factor of labour productivity, therefore there is need for further exploration of sources of growth that incorporate human capital. Improvements in the quality of labour increase the human capital. Increases in the accumulation of human capital mean increased skills and capabilities of workers. These are acquired through schooling, experience and training, as well as improvements in health and nutrition. This accumulation of human capital tends to increase labour contribution to productivity growth.

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Appendix

Table A-1: International Comparison: Real GDP Growth

Country/Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Avg % of GDP Change
East Asia													
Singapore	8.9	9.1	1.8	-0.6	15.2	6.2	3.7	4.7	3.3	2.0	1.7	2.2*	4.6
South Korea	5.2	5.5	2.8	0.7	6.5	3.7	2.3	2.9	3.3	2.6	2.7	3.0*	3.4
Hong Kong	7.0	6.5	2.1	-2.5	6.8	4.8	1.7	3.1	2.7	2.4	1.4	1.9*	3.2
Taiwan	5.6	6.5	0.7	-1.6	10.6	3.8	2.1	2.2	3.9	0.7	1.0	1.7*	3.1
China[1]	12.7	14.2	9.6	9.2	10.6	9.5	7.9	7.8	7.3	6.9	6.6	6.2*	9.3
Africa													
South Africa	5.6	5.4	3.2	-1.5	3.0	3.3	2.2	2.5	1.7	1.3	0.3	0.8*	2.3
Botswana	8.4	8.3	6.2	-7.7	8.6	6.0	4.5	11.3	4.1	-1.7	2.9	4.1*	4.6
Kenya	5.9	6.9	0.2	3.3	8.4	6.1	4.6	5.7	5.3	5.6	6.0	5.3*	5.3
Ghana	6.3	4.4	9.2	4.9	7.9	14.1	9.3	7.3	4.0	3.9	3.3	7.4*	6.8
Nigeria	6.7	7.3	7.2	8.4	11.3	4.9	4.3	5.4	6.3	2.7	-1.8	0.7*	5.3
Latin America													
Argentina	8.1	9.0	4.1	-5.9	10.1	6.0	-1.0	2.4	-2.5	2.5	-1.8	2.7*	2.8
Brazil	4.0	6.1	5.1	-0.1	7.5	3.9	1.9	3.0	0.1	-3.9*	-3.3*	0.5*	3.5
Chile	5.8	5.2	3.3	-1.1	5.8	5.8	5.5	4.0	1.8	2.3	1.7*	2.0*	3.8

Source: IMF World Economic Outlook 2016. *Estimate. [1]Asia-Pacific