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Impact of HIV/AIDS on labour productivity in Nigeria

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Abstract

Background: Undoubtedly, HIV/AIDS negatively affects labour productivity. The negative impact of HIV/AIDS on labour productivity arises from its adverse effect on health, experience level, and size of labour force. Labour productivity is adversely affected as the worsening HIV/AIDS epidemic shifts the age structure in favour of younger and less experienced workers. Thus, the paper examined the impact of HIV/AIDS on labour productivity in Nigeria using annual time series data for the period 1990 to 2018.

Method: To determine the long-run and short-run dynamic relationships between the variables, an ARDL bound testing approach to cointegration was employed.

Findings: The results revealed that there is a long-run relationship between HIV/AIDS and labour productivity in Nigeria. In the short-run, there is a negative but insignificant relationship between HIV/AIDS and labour productivity in Nigeria. A percentage increase in HIV/AIDS caused labour productivity to decrease by about 0.14% in the short-run.

Conclusion: Therefore, the paper recommends that the government should ensure the sustainability of free Antiretroviral Therapy to People Living with HIV/AIDS. Also, the government should ensure that the Work Place Policies are adhered to protect the People Living with HIV/AIDS against any form of discrimination at the workplace.

Keywords: HIV/AIDS, Labour productivity, Nigeria

Introduction

Human Immunodeficiency Virus (HIV) and Acquired Immune Deficiency Syndrome (AIDS), remain foremost global health and development challenges. The number of people living with HIV worldwide has continued to grow, reaching an estimated 33.4 million in 2008 (UNAIDS, 2009). Globally it is estimated that 2.7 million new infections and 2 million AIDS-related deaths occurred in 2008 (UNAIDS, 2008). In the most heavily affected nations, of which Sub-Saharan Africa has a disproportionately high number, HIV has reduced life expectancy by more than 20 years, slowed economic growth, and deepened household poverty. Indeed, "AIDS is "a supremely complex issue that demands an unparalleled response" (UNAIDS, 2010).

In 2008 an estimated 1.9 million people became newly infected in Sub-Saharan Africa, bringing the total number of people living with HIV in the region to 22.4 million. However, there was a slight increase in the number of people living with HIV in Sub-Saharan Africa due to an increase in longevity from improved access to HIV treatment. This notwithstanding, the challenge posed by HIV remains phenomenal: for every 2 new persons placed on antiretroviral 5 new individuals get infected.

In Nigeria, HIV prevalence is estimated at 3.6% based on a general population survey. The HIV prevalence among pregnant women (antenatal care sentinel survey) was 4.6% (FMOH, 2012) which indicates an improvement from 5.8% in 2001. The current estimate of people living with HIV in Nigeria is 2.98 million implying that over 95% Nigerians are uninfected. This scenario thus underscores the need for laying premium on HIV prevention efforts; while concomitantly addressing the challenge of treatment needs for those infected and mitigating other impacts of the infection on all categories of affected people.

HIV/AIDS damages businesses through absenteeism, fall in productivity, labour force turnover, and the subsequently added costs to operations. Moreover, company costs for healthcare, funeral benefits, and pension fund commitments rise as people take early retirement or die from AIDS-related illnesses. HIV/AIDS has a negative impact on labour productivity in Nigeria. The negative impact of HIV/AIDS on labour productivity arises from its adverse effect on health, experience level, and size of the labour force. Average experience is adversely affected as the worsening HIV/AIDS epidemic shifts the age structure in favour of younger and less experienced workers. For instance, when the HIV prevalence in Nigeria rose from 1.8% in 1991 to 5.8% in 2001 (FMOH, 2012), the GDP growth rate decreased from 12.8% in 1990 to 4.4% in 2001 (World Development Indicator, 2014).

Also, there is a direct link between HIV/AIDS and economic growth through its impact on productivity, which in turn affects economic growth. The effect of HIV/AIDS on human, social, and physical capital is likely to manifest itself in terms of productivity (Were and Nafula, 2003). This is because the majority of HIV infected people are in their most productive ages. This group constitutes the highest proportion of the working population (Were and Nafula, 2003). For instance, when the HIV prevalence in Nigeria has risen from 1.8% in 1991 to 5.8% in 2001 (FMOH, 2010), labour participation rate decreased from 56.8% in 1990 to 54.6% in

2004 (International Labour Organization, 2012).

Similarly, HIV/AIDS may have a negative impact on savings through its direct effect on increased health care expenditures. A fraction of HIV/AIDS-related medical costs are financed out of saving while the remaining portion is reflected by a reduction in other current expenditures (Cuddington, 1993). For instance, when the HIV prevalence in Nigeria has risen from 1.8% in 1991 to 5.8% in 2001 (FMOH, 2010), gross national savings decreased from 30.2% in 1990 to 18.5% in 2002 (IMF, 2015).

Finally, morbidity and mortality rates due to HIV/AIDS reduce the stock of physical capital (Were and Nafula, 2003). HIV/AIDS is one of the most costly diseases. Once it strikes it diverts resources from capital formation to health care provisions and other expenses relating to healthcare provision and even funeral expenses. At infection, resources will be shifted from productive investment to health sector expenditures and health care. Over time, economic development is affected to the extent that the pandemic diverts resources away from investments and reduces domestic savings (Were and Nafula, 2003). For instance, when the HIV prevalence in Nigeria rose from 1.8% in 1991 to 5.8% in 2001 (FMOH, 2010), the investment growth rate decreased from 18.0% in 1991 to 13.4% in 2004 (IMF, 2015).

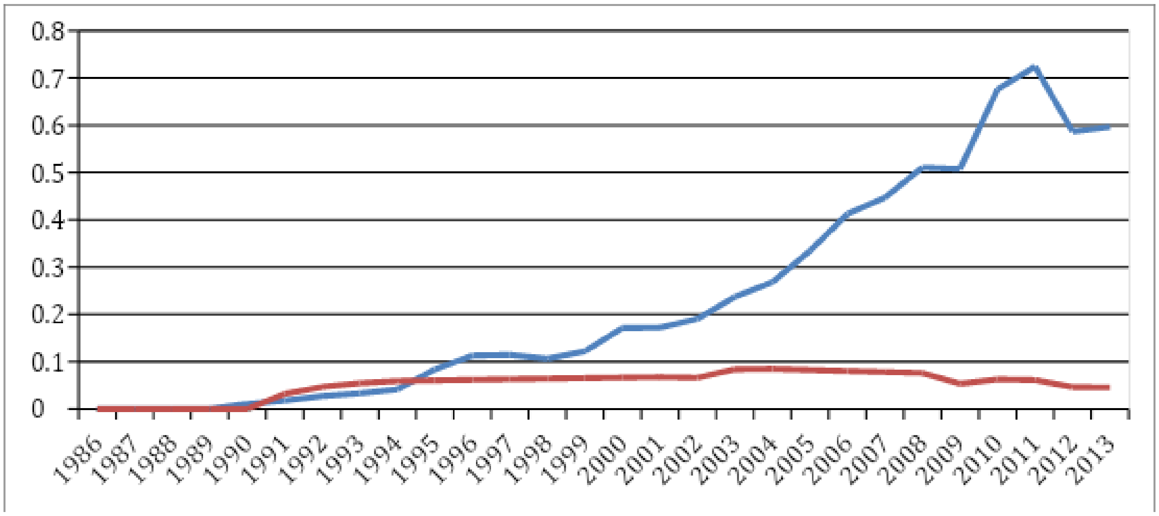
The relationship between HIV infected labour $\left(\frac{NPLWH}{LF}\right)$ and labour productivity $\left(\frac{GDP}{LF}\right)$ In Nigeria it becomes much clearer when we look at figure 1.1. The figure shows that in the period 1991 to 1994, both HIV infected labour force and labour productivity rose but the HIV infected labour force was above the labour productivity. However, from 1995 onward, both HIV infected labour force and labour productivity continue to rise but the labour productivity is above the HIV infected labour force as a result of various government interventions and policies on HIV/AIDS (Shehu, 2016). Against this background, the study examines the impact of HIV/AIDS on labour productivity in Nigeria.

Literature review on labour and productivity

Labour is the total human effort used in the productive process. It can also be defined as the strength expanded on the creation of goods and services. It includes the number of hours worked and physical strength. Labour can be services that have value and exchange. Labour productivity, therefore, is a revealing indicator of several economic indicators as it offers a dynamic measure of economic growth, competitiveness, and living standards within an economy. It is the measure of labour productivity (and all that this measure takes into account) which helps explain the principal economic foundations that are necessary for both economic growth and social development (OECD, 2008).

HIV stands for Human Immunodeficiency Virus. It is a virus that causes AIDS. The acronym AIDS stands for Acquired Immune Deficiency Syndrome. When a person is infected with this virus, his or her body fluids such as; blood, semen,nvaginal secretions will contain the virus. The virus stays in the body and slowly destroys the body's defense mechanisms. The duration of time it takes for a person infected to fall ill varies and takes between several months to seven years. Therefore an infected person can spread the virus unknowingly (Akisolu, 2004). When HIV destroys the body's immune system, the symptoms of AIDS begin to manifest. At this

Figure 1.1: Trend in Labour Productivity and HIV Infected Labour in Nigeria



Source: Shehu (2016)

At this stage of full-blown AIDS, the body's natural defense system is weakened and the infected person becomes vulnerable and is at the mercy of all kinds of infections such as; persistent cough, skin infections, and unexplained weight loss (Shaffer, 1994).

Until the early 1990s, the empirical economic growth literature focused exclusively on the role of capital and labour. The latter often augmented by schooling and technological change, but hardly ever on health as a key element of human capital (Baro, 1991). Even where a relationship has been found between indicators of health and income per capita, it has either been discounted or thought to be an indication of the impact of economic development on health. The standard perspective of this earlier literature appears to have been that of Preston (1976) who noted that key role of economic development in improving life expectancy.

Studies conducted by UNAIDS (2003) revealed that HIV/AIDS appear to be having devastating effects on the economies of East and South African countries. Bloom, Canning, and Sevilla (2004) found that a one-year improvement in the population's life expectancy contributes to a 4% increase in output. In another study, the same authors estimate that a one percentage point increase in adult survival rates boosts labour productivity by about 2.8% formal analysis suggest that a country can, on average, expect to see per capita income grow by an extra 0.3 – 0.5% points a year for every 5 years it adds to its life expectancy. This is a considerable boost, given that between 1965 and 1990 global income per capita grew by an average of 2.0% per year (Bloom, Canning and Malaney, 2000).
Health affects labour productivity. Healthier workers are more energetic, have better attendance records, and are likely to have higher mental capacity and morale. In developing countries, in particular, manual work makes up a large production of output, and physical endurance and strength rely crucially on sound health. A major study by Weil (2007) shows that health differentials accounted for 17% of the difference in workers' productivity between countries

giving health roughly the same influence on productivity as physical capital (8%) and education (21%). Several micro-economic studies support this finding Strauss and Thomas (1998). The second channel from health to wealth involves the effect of health on education. Healthy children are better able to attend school and learn and have more to gain by doing so because they can expect to live and work longer, and healthy families impose fewer burdens on children of having to care for sick relatives. An extra year of life expectancy is estimated to increase schooling levels by 0.25 years.

According to Bloom et al. (2004), health improvements spur an increase in savings thereby enabling greater investments in physical capital which spurs economic growth. East Asia's dramatic savings boom between 1950 and 1990, which contributed greatly to its unprecedented economic growth was driven by the region's rapidly improving life expectancy and by the increased production of people in the age groups that save the most. Were & Nafula (2003) explored the different channels through which HIV/AIDS affects economic growth in Kenya for the period 2002 to 2006. Using macroeconomic models of Kenya, the study employed simulation analysis. The results show that HIV/AIDS, through its effect on labour productivity and loss of earnings, affects economic growth. Additionally, the associated high cost of health care implies foregoing economic growth if the resources could have been invested productively. Coulibaly (2005) examined the impact of HIV/AIDS on the labour force in Sub-Saharan Africa from 1986 to 2003 using simulation analysis, the study concludes that HIV/AIDS has altered some of the main labour force characteristics of the countries most affected by the disease. Although the effect on the size of the labour force is not yet obvious in absolute values, HIV/AIDS has reduced the rate of growth of the economically active population. The pandemic has modified the sex and age distribution of the labour force participation rate in severely affected countries. With regards to the age distribution of labour force participation, 15-24-year-olds recorded the highest increase in countries with high prevalence rates, confirming that young people tend to join the labour force to replace workers leaving it.

Similarly, Fox et al. (2004) examined the impact of HIV/AIDS on labour productivity in Kenya from 1997 to 2002 using longitudinal regression analysis. The result shows that HIV-positive workers plucked less tea in the 18 months preceding AIDS-related termination and used more leave in the 3 years before termination. After adjusting for age and environmental factors, cases plucked between 4.11 and 7.93 kg/day less in the last year and a half before termination. Cases used between 9.2 and 11.0 more sick leave days, between 6.4 and 8.3 more annual leave days, between 19.9 and 11.8 more casual leave days, and spent between 19.2 and 21.8 more days doing less strenuous tasks in the 2 years before termination than did comparison pluckers. Tea pluckers who terminated because of AIDS-related causes earned 16.0% less in their second year before termination and 17.7% less in the year before termination. Iyal, Purokayo & Gabdo (2012) investigated the determinants and the impact of HIV/AIDS on households in Adamawa State using a sample of 120 affected with HIV/AIDS. Using descriptive statistics and logistic regression, the study found that HIV/AIDS had an adverse impact on a household's productivity, income, saving, and capital formation.

Furthermore, Dipeolu (2014) explored the behavioural antecedents and intentions of employers of labour in the Ibadan North Local Government using a sample of 400 respondents. The study utilized primary data and analyzed using descriptive statistics. The results revealed that large majority, 79.0%, in the public sector and 72.9% in the private sector knew that an infected healthy-looking person could harbour and transmit HIV to others. A majority, 80.0%, of which 2.3% with no formal education, 1.0% primary education, 13.5% high school education, 41.5% bachelor, 21.0% postgraduate, and 0.8% with other qualifications were of the view that workers infected with HIV should not be sacked. Slightly less than half (48.0%) would keep their staff's HIV status secret while more than half, 57.0%, would not recruit People Living With HIV/AIDS. More respondents in the public sector (47.8%) claimed to have ever organised HIV/AIDS-related educational programmes for staff than the private sector (42.1%) ($p<0.05$). Almost equal respondents (36.8%) in the public sector and (36.2%) in the private sector would require a mandatory test for HIV before employment. Finally, only 1.8% in the public sector and 6% in the private sector reported that their organisations had a workplace HIV and AIDS policy ($p<0.05$). Shehu (2016) examined the impact of HIV/AIDS on total output, labour productivity, gross national savings, and investment growth in Nigeria using time series data for the period 1986-2013. The study employed the ARDL bound test approach to cointegration to determine the long-run relationship and short-run dynamic interactions among the variables. The results revealed that there is no evidence of a long-run negative effect of HIV/AIDS on total output and labour productivity in Nigeria. Also, in the long run, there is no evidence of the negative effect of HIV/AIDS on gross national savings and investment growth in Nigeria. In the short run, HIV/AIDS has been found to have a negative thought of the statistically insignificant effect on total output and labour productivity in Nigeria. The result further indicates that in the short run, HIV/AIDS has a negative and statistically significant effect on gross national savings and investment growth in Nigeria.

Theoretical Framework

The endogenous growth model, unlike the neoclassical growth model, disagreed that technological progress is exogenous, but they believe that it is endogenous, and went further to concentrate on the factors that can cause technological progress. Romer (1990) remarked that technological progress is the outcome of knowledge accumulation. This process is considered to be the core element that drives economic growth in the long run. Thus, an economy with knowledge accumulation experiences positive externalities and increasing returns to scale. One of the main postulations of Romer is that in the long-run, a society that has developed science and technology will grow faster than the one that has not. Proponents of the Endogenous growth model recognized the role of human capital investment in the growth process. According to Lucas (1988) and Romer (1990), higher investment in human capital will engender a higher growth rate of per capita income (Rolle and Uffie, 2015).

Romer, Mankiw, and Weil (1992) incorporated human capital into the basic Solow model thereby expanding the model. The Augmented Solow model resurrected the neoclassical growth models. The aggregate production function is given as follows:

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$Y_t = AL_t^{1-\alpha-\beta} K_t^{\alpha} H_t^{\beta}$ ……………….….3.1

Where Y is output, A is the level of total factor productivity, L is physical capital, H is human capital, α and β are factors contributing to output.

Methods

Model Specification

The study adopted the endogenous growth model specified in equation 3.1 and expanded it to capture the total number of people living with HIV/AIDS in Nigeria as shown in equation 3.2.

$$GDP = A(LF)^{b_2}(GFCF)^{b_3}(HCI)^{b_4}(NPLWH)^{b_5} \quad ...3.2$$

Where GDP is total output, A is the level of technology, LF is labour force, GFCF is gross fixed capital formation, HCI is a human capital investment, NPLWH is the number of people living with HIV/AIDS, b2, b3, b4, and b5 are factors contributing to total output.

In order to examine the impact of HIV on labour productivity in Nigeria, equation 3.2 is modified by dividing it through by LF as shown in equation 3.3:

$$\frac{GDP}{LF} = A\left(\frac{GFCF}{LF}\right)^{\frac{b_3}{b_2}}\left(\frac{HCI}{LF}\right)^{\frac{b_4}{b_2}}\left(\frac{NPLWH}{LF}\right)^{\frac{b_5}{b_2}} \quad ....3.3$$

Where $\frac{GDP}{LF}$ is labour productivity, A is level of technology, $\frac{GFCF}{LF}$ is the capital-labour ratio, $\frac{HCI}{LF}$ is human capital per labour, $\frac{NPLWH}{LF}$ is HIV infected labour, $\frac{b_3}{b_2}, \frac{b_4}{b_2}$ and $\frac{b_5}{b_2}$ represents factor contribution to output.

In order to make equation 3.5 linear, we take the natural logarithm of both sides as shown in equation 3.4:

$$In\left(\frac{GDP}{LF}\right)t = b_{02} + b_{12}T + \frac{b_3}{b_2} ln\left(\frac{GFCF}{LF}\right) t + \frac{b_4}{b_2} ln\left(\frac{HCI}{LF}\right) t + \frac{b_5}{b_2} ln\left(\frac{NPLWH}{LF}\right) t + Ut_{..} \quad ...3.4$$

Where In represents natural logarithm, $\frac{GDP}{LF}$ is labour productivity or output per worker, $\frac{GFCF}{LF}$ is the capital-labour ratio of capital per worker, $\frac{HCI}{LF}$ is human capital per worker $\frac{NPLWH}{LF}$, is HIV infected labour, b_{02} is constant or intercept, T is time trend, b_{12} is trend coefficient, $\frac{b_3}{b_2}, \frac{b_4}{b_2}$ and $\frac{b_5}{b_2}$ are the coefficients of long-run elasticities, and Ut is an error term.

Estimation Technique

The estimation technique employed by the study includes the stationarity test and Autoregressive Distributed Lag (ARDL) Bound test approach to cointegration. The stationarity test was conducted to examine the time series property of the variable using the Augmented Dickey-Fuller approach as shown in equation 3.5.

$$\Delta y_t = \alpha_0 + \alpha_1 t + \phi y_{t-1} \sum_{i=1}^{p} \beta_i + \Delta y_{t-i} + \varepsilon_{t} \text{.....} \quad 3.5$$

Where Δ is the first difference operator, α_0 is intercept or constant, α_1 is a trend coefficient t is the trend term, ρ is a lag order of the autoregressive process, and ε_t is the error term.

To empirically analyze the long-run relationships and short-run dynamic interactions between the variables, the study applies the ARDL bound testing approach to cointegration as shown in equation 3.6.

$\Delta ln\left(\frac{GDP}{LF}_t\right) = \alpha_0 + \sum_{i=1}^{p} \alpha_1 \Delta ln\left(\frac{GDP}{LF}_{t-i}\right) + \sum_{i=1}^{q} \alpha_2 \Delta ln\left(\frac{GFCF}{LF}_{t-i}\right) + {}_3 \sum_{i=1}^{q} \alpha\, \Delta ln\left(\frac{HCI}{LF}_{t-i}\right) +_4 \Delta ln\left(\frac{NPLWH}{LF}_{t-i}\right) + \beta_1 ln\left(\frac{GDP}{LF}_{t-1}\right) + \beta_2 ln\left(\frac{GFCF}{LF}_{t-1}\right) + \beta_3 ln\left(\frac{HCD}{LF}_{t-1}\right) \sum_{i=1}^{q} \alpha + \beta_4 ln\left(\frac{NPLWH}{LF}_{t-1}\right) + \varepsilon_t$ ..3.6

The next stage in the ARDL bound testing approach to cointegration is to estimate the coefficients of long-run cointegrating relationship and the corresponding error correction term (ECT) as shown in equation 3.7:

$\Delta ln\left(\frac{GDP}{LF}_t\right) = \alpha_0 +_1 \Delta ln + \sum_{i=1}^{q} \alpha_2 \Delta ln\left(\frac{GFCF}{LF}_{t-i}\right) + \sum_{i=1}^{q} \alpha_3 \Delta ln\left(\frac{HCI}{LF}_{t-i}\right) + \sum_{i=1}^{q} \alpha_4 \Delta ln \sum_{i=1}^{p} \left(\frac{NPLWH}{LF}_{t-i}\right) \alpha + \theta \left((ECT_{t-1}) \frac{GDP}{LF}_{t-i}\right) + \varepsilon_t$.......3.7

Where Δ is the first difference operator, α_1 is constant or intercept, α_1-α_4 are the short-run coefficients, β_1-β_4 are the long-run coefficients, θ is the coefficient of the speed of adjustment, ECT is the error correction term, ε is the error term.

Variables of the Study

Dependent Variable

Labour Productivity $\left(\frac{GDP}{LF}\right)$ refers to the output per unit of labour. In this study, it was used as a dependent variable measured as output per worker expressed as a ratio of GDP to labour force.

Independent Variables

The independent variables for the study include; capital-labor ratio, human capital per labour, and HIV infected labour:

Capital-Labour Ratio $\left(\frac{GFCF}{LF}\right)$ is the proportion of capital to labour inputs in an economy. In this study, it was measured as an investment per worker expressed as a ratio of gross fixed capital formation to labour force. Human Capital per labour $\left(\frac{HCI}{LF}\right)$ is the investment per unit of labour. In this study, it was measured as expenditure on human capital per worker expressed as a ratio of human capital investment to labour force. Finally, HIV infected labour $\left(\frac{NPLWH}{LF}\right)$ was expressed as a ratio of the total number of people living with HIV to the labour force.

Data Collection

The study employed secondary data obtained from various sources which include; Central Intelligence Agency (CIA) World Fact book, International Labour Organization (ILO), and Federal Ministry of Health Technical Report, 2010. These data include; labour force, investment, and HIV/AIDS prevalence rate.

Data analysis and Discussion

This section contains the analysis and discussion of the results. These include the stationarity test, bound test for cointegration, error-correction model, and diagnostic check. In order to examine the time-series properties of the data, the stationarity test was conducted using the Augmented Dickey-Fuller (ADF) approach. The result of the stationarity test presented in table 4.1 shows that all the variables are stationary at their first difference at the 1% level of significance except $\frac{GFCF}{LF}$ which is stationary at a 5% level of significance.

Before estimating the ARDL model, it is paramount to determine the maximum lag for the model. As such, various model selection criteria were estimated from the VAR model at a level as shown in table 4.2. The result shows that most of the lag selection criteria suggested choosing lag three.

Table 4.1: Stationarity Test

	ADF Stat		
Variables	**At Level**	**At 1st Diff**	**Inference**
$\frac{GDP}{LF}$	-0.177506	-4.136189*	I_1
$\frac{GFCF}{LF}$	-2.457739	-3.449440**	I_1
$\frac{HCI}{LF}$	3.024562	-5.611559*	I_1
$\frac{NPLWH}{LF}$	-2.355476	-4.612302*	I_1

Source: Researcher's Computation

Table 4.2: Lag Selection Criteria

Endogenous variables: $\frac{GDP}{LF}, \frac{GFCF}{LF}, \frac{HCD}{LF}, \frac{NPLWH}{LF}$					
Lag	LogL	LR	FPE	AIC	SC
0	242.1068	NA	1.53e-16	-25.06387	-24.86504
1	298.1820	82.63726	2.37e-18	-29.28232	-28.28817
2	332.1489	35.75455*	4.73e-19	-31.17357	-29.38410
3	359.3747	17.19528	3.54e-19*	-32.35524*	-29.77045*

Source: Researcher's Computation

*Note that: * indicates lag order selected by the criterion, LR: sequential modified LR test statistic (each test at 5% level), FPE: Final prediction error, AIC: Akaike information criterion, SC: Schwarz information criterion, HQ: Hannan-Quinn information criterion*

In order to determine the existence of a long-run relationship between the variables, the ARDL bound test for cointegration was conducted. The result of the cointegration test was presented in table 4.3 which shows that the F-statistics value of 32.52 is higher than the critical upper bound value of 3.87 at a 5% level of significance. Therefore, it can be concluded that the variables are cointegrated which implies that there is a long-run relationship between the variables. Since the variables are confirmed to be integrated, the next stage is to estimate the ARDL error correction model. The result presented in table 4.4 shows that there is a positive and significant relationship between Gross Fixed Capital Formation per Labour $\left(\frac{GFCF}{LF}\right)$ and labour productivity $\left(\frac{GDP}{LF}\right)$ in the current period at a 1% level of significance in Nigeria in the short-run. A percentage increase in $\left(\frac{GFCF}{LF}\right)$ caused $\left(\frac{GDP}{LF}\right)$ to increase by about 0.42%.

Table 4.3: ARDL Bounds Test for Cointegration

		Null Hypothesis: No levels Relationship		
Test Statistic	Value	Level of Sig	I(0)	I(1)
F-statistic	32.52	10%	2.63	3.35
K	2	5%	3.1	3.87
		1%	4.13	5

Source: Researcher's Computation

However, the result shows that there is a negative but insignificant relationship at 5% level of significance between the number of labour force affected by HIV/AIDS $\left(\frac{NPLWH}{LF}\right)$ and labour productivity $\left(\frac{GDP}{LF}\right)$ in Nigeria in the short-run. A percentage increase in the number of labour affected by HIV/AIDS $\left(\frac{NPLWH}{LF}\right)$ in the past three years caused labour productivity $\left(\frac{GDP}{LF}\right)$ in the current period to decrease by about 0.14%. This implies that a percentage increase in the number of labour affected by HIV/AIDS $\left(\frac{NPLWH}{LF}\right)$ in the current period will have a negative effect on labour productivity $\left(\frac{GDP}{LF}\right)$ in the next three years.

Furthermore, the result also shows that the coefficient of error correction terms (ECT) is negative and statistically significant at the 1% level of significance. This implies that the short-run disequilibrium will converge to equilibrium in the long-run at a speed of about 133%. The R^2 value of 0.998428 implies that the independent variables accounted for about 99.8% of the variation in the dependent variable the remaining is captured by the residual. However, the D-W value of 3.178035 indicated the presence of autocorrelation in the model but this did not affect the validity of the result.

Another diagnostic test result presented in table 4.5 shows that model is free from serial correlation and heteroskedasticity while the Jarque-Bera normality test indicated that the residuals of the model are normally distributed at 5% level of significance. Also, the Ramsey RESET test for specification error shows that the model is correctly specified.

The parameter instability test results presented in figure 4.1 show that the recursive estimate revealed the satisfactory plot of cumulative sum at 5% level of significance while the cumulative sum of squares plot was not satisfactory but the model remains valid and acceptable.

Conclusion

The study examines the impact of labour productivity on HIV/AIDS in Nigeria using time series data for the period from 1990 to 2018. Autoregressive Distributive Lag (ARDL) bound test for cointegration was employed to test the existence of a long-run relationship between labour productivity and HIV/AIDS in Nigeria. The results revealed that there is a long-run relationship between HIV/AIDS and labour productivity in Nigeria. The results also revealed that there is a negative but insignificant relationship between HIV/AIDS and labour productivity in Nigeria. The insignificant impact of HIV/AIDS on labour productivity in Nigeria might be as a result of the efforts put forward by Government as well as International Donors and agencies to mitigate the severity of the disease through the provision of free treatment and care for the infected people. Therefore, it can be concluded that Nigeria has succeeded in mitigating the impact of HIV/AIDS on labour productivity. However, notwithstanding, the government should continue to ensure the sustainability of free Antiretroviral drugs. Also, the government should ensure that the Work Place Policies are strictly adhered to protect the People Living With HIV/AIDS against any form of discrimination as a result of their HIV status.

Table 4.4: ARDL Error Correction Model

Dependent Variable: D$ln\left(\frac{GDP}{LF}\right)$				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D$ln\left(\frac{GDP}{LF}(-1)\right)$	0.408071	0.026288	15.52328	0.0006
D$ln\left(\frac{GDP}{LF}(-2)\right)$	0.072812	0.031179	2.335273	0.1017
D$ln\left(\frac{GDP}{LF}(-3)\right)$	-0.122928	0.027937	-4.400134	0.0218
D$ln\left(\frac{GFCF}{LF}\right)$	0.429733	0.023822	18.03935	0.0004
D$ln\left(\frac{GFCF}{LF}(-1)\right)$	-0.735244	0.037771	-19.46584	0.0003
D$ln\left(\frac{GFCF}{LF}(-2)\right)$	-0.269078	0.032293	-8.332349	0.0036
D$ln\left(\frac{GFCF}{LF}(-3)\right)$	-0.356163	0.031885	-11.17011	0.0015
D$ln\left(\frac{NPLWH}{LF}\right)$	0.417024	0.037672	11.06991	0.0016
D$ln\left(\frac{NPLWH}{LF}(-1)\right)$	-0.301161	0.038527	-7.816955	0.0044
D$ln\left(\frac{NPLWH}{LF}(-2)\right)$	-0.027614	0.039772	-0.694298	0.5374
D$ln\left(\frac{NPLWH}{LF}(-3)\right)$	-0.143670	0.055808	-2.574363	0.0822
ECT(-1)	-1.332654	0.045634	-29.20294	0.0001
R-Squared	0.998428			
D-W Stat	3.178035			

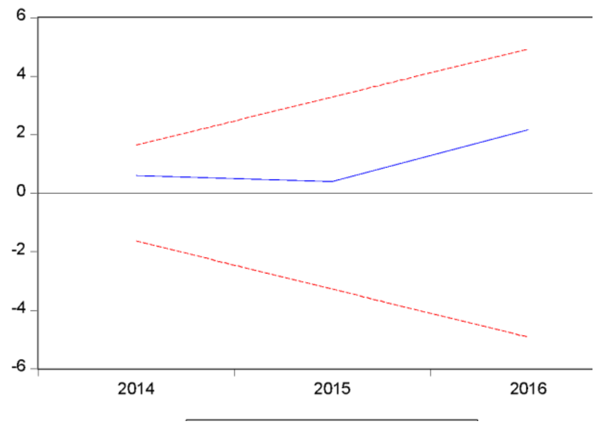
Source: Researcher's Computation

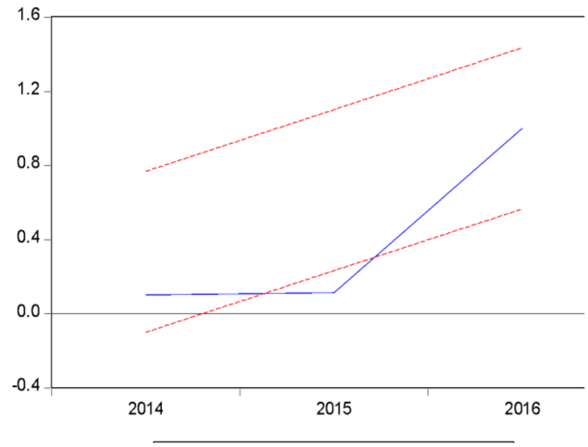
Table 4.5: Diagnostic Test

Breusch-Godfrey Serial Correlation LM Test	
F-statistic (Prob)	1.477701 (0.5028)
Heteroskedasticity Test: Breusch-Pagan-Godfrey	
F-statistic (Prob)	0.368467 (0.9154)
Normality Test	
Jarque-Bera (Prob)	2.6767
Specification Error Test	
Ramsey RESET Test (Prob)	2.0370 (0.1785)

Source: Researcher's Computation

Figure 4.1: Parameter Instability Test





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