TRADE LIBERALIZATION, HUMAN CAPITAL AND ECONOMIC GROWTH IN NIGERIA: A STRUCTURAL VECTOR AUTOREGRESSIVE MODEL

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ABSTRACT

The study examined the impact of trade liberalization, human capital, and economic growth in Nigeria. The Structural Vector Autoregressive (SVAR) technique was utilized by applying quarterly time series data from 1986 to 2019 to determine the impact of trade liberalization on economic growth through human capital in Nigeria. The findings revealed the positive and significant impact of trade liberalization on human capital. Also, trade liberalization has a positive and significant impact on economic growth during the study period. Furthermore, human capital has positive and insignificant impact on economic growth in Nigeria. The Impulse Response Functions (IRFs) also revealed a positive and insignificant relationship between trade liberalization, human capital, and economic growth. Based on the findings, it is recommended that the federal government and its federating units should provide opportunities of education for people to develop knowledge, entrepreneurship, and technical skills; and the establishment of standard healthcare centers that will guarantee the healthy living conditions of the people.

Keywords: *Economic growth, human capital, Nigeria, SVAR, trade liberalization*.

JEL Classification: C32, C52, E22, F14, F040,

1. INTRODUCTION

The export sector is crucial to a country's economic well-being, serving as a primary source of foreign exchange earnings, enhancing balance of payments, and providing an attractive investment environment. Increased exports stimulate production efficiency, increase capital formation, and reduce unit costs through economies of scale, thereby fostering economic growth. In attaining these goals, in attaining these benefits, one-third of emerging economies in the world like Bangladesh, India, Japan, South Korea and Sri Lanka, have experienced positive and significant increases in economic growth because of their significant reduction in trade barriers (Jadoon, Rashid & Azeem, 2015; Khalid, 2016; Qayyum, Younas & Bashir, 2018).

Classical economists such as Ricardo (1817) and Heckscher-Ohin (1919, 1933), and the endogenous growth model proposed by Lucas (1988) posit that trade liberalization stimulates economic growth. Economic literature from these demonstrate that trade liberalization yields significant gains through various channels, including technological transfer and innovation, enhanced competition among nations, increased foreign investment inflows, factor price equalization, and capital accumulation (Jadoon, Rashid & Azeem, 2015). This suggests that trade liberalization also impacts economic growth through human capital development. Human capital has the capacity to promote economic growth by the application of acquired knowledge and good health for increased productivity and efficient allocation of resources, innovation and technological progress, and entrepreneurship.

Nigeria's economic growth has been quite uneven since 1986, with some years seeing the expansion in growth rate above 3.5 percent and others, like 1993, 1994, 1995, and 2016 and 2020, experiencing negative growth (National Bureau of Statistics, NBS, 2016; NBS, 2021). More recently, the economic outlook of Nigeria has not been too promising, especially in 2023Q4 and 2024Q3, with weak macroeconomic stability, inflation soaring to 34.2 percent, high debt profile of about ₦121.67 trillion, and unemployment rates estimated at about 33 percent (NBS, 2023; NBS, 2024).

Thus, overtime, various governments have made several efforts to grow the economy through human capital development with the introduction of National Directorate of Employment (1986), Universal Basic Education Act (2004), National Literacy Program (2006), Tertiary Education Trust Fund (TETFund) (2003), Skill Acquisition Program (SAP) (2012), National Health Insurance Scheme (NHIS) (2005), Midwives Service Scheme (2009), Human Capital Development Program (HCDP) (2020). These initiatives were targeted at providing educational opportunities, skills acquisition, and health care services to promote economic growth in Nigeria However, despite these initiatives, and the compelling suggestion from the endogenous model that human capital promotes growth, Nigeria's target of economic growth seems to be elusive probability due to high economic pressures, fiscal sustainability concerns, and inflation and exchange rate pressures. It is against this backdrop that the researchers find it imperative to assess the impact of trade liberalization on economic growth through human capital development in Nigeria, spanning from 1986 to 2019. The rest of the paper is organized as follows; Section two presents a literature review while Section three considers methodology of the study. Section four examines empirical results and findings while Section five presents conclusion and policy recommendations.

2. LITERATURE REVIEW

The study reviews the concepts of trade liberalization, human capital and economic growth, the appropriate theories for the study and previous empirical works are considered.

2.1 Conceptual Clarification

Trade liberalization: According to Mohsen and Chua (2020) the lowering of tariffs and other barriers to trade is to ensure rapid increase in the flow of trade (imports and exports) across nations, and to facilitate the proper allocation of resources leading to efficient production and economic growth. In a similar vein, the endogenous growth models suggest that through knowledge diffusion and advanced technologies, liberalized trade promotes growth (Keho, 2020). Tariffs may be either *ad-valorem* or specific or a combination of the two. Non-tariffs include licenses, import quotas, voluntary export restriction, and local content requirement. In this study, trade liberalization is measured using Trade Freedom Index (TFI) and this index reveals the impact of tariffs and non-tariffs on trade and economic growth.

Human Capital

According to Law-Biaduo (2021) human capital refers to knowledge, skills, and sound health which people acquire through schools to increase literacy, technical and vocational training institutions. In this way human capital helps in enhancing economic growth through the application of knowledge and skills for productive activities. To Bachama, Hassan and Ibrahim (2021) human capital entails physical capital accumulation which can be increased with higher investment rates. Human capital has to do with both the quantity of labour and its quality targeted at enforcing economic growth in the economy. Similarly, Wang, Lin, Xiao, Bu and Li (2022) refer to human capital as productive investments such as skills, competencies, ideas and health, acquired from education, on-the-job training programs, and health care. Human capital in this study is measured using human development index (HDI).

Economic Growth: Amadeo (2018) defines economic growth as how much more the economy produces, which enhances profitability of businesses, increases in stock prices that encourage companies more capital to invest and employ more workers. In this wise, Wells (2018) explains that economic growth is expected to enhance the wellbeing or improved living standard of people in a country. In this study, economic growth is measured using real gross domestic product (RGDP).

2.2 Theoretical Review

This study employs the Heckscher-Ohlin's (1919; 1933) general equilibrium framework to provide a more comprehensive understanding of comparative advantage, addressing the unresolved issues of what drives comparative advantage and how international trade affects factor earnings in trading economies. The

Heckscher-Ohlin's theory explains that the actual basis for the pattern of production, specialization and trade between nations is the relative availability of factor endowments and factor prices. Also, the Heckscher-Ohlin's theory explains the principle of comparative advantage and promotes global resource optimization, and the dismantling of trade barriers through specialized international division of labour. It is expected that this will lead to increased trade, increased knowledge and skills which can lead to economic growth.

The endogenous growth model by Lucas (1988) was also adopted for the study. The Lucas endogenous growth model provides a framework which posits that human capital accumulation through education and skill acquisition, increased productivity, innovation and entrepreneurship, and knowledge spillovers can lead to economic growth. Thus, trade liberalization can facilitate the transfer of knowledge, technologies, and skills, which can enhance human capital accumulation. Trade liberalization can also promote economic activity which will result in increased investment in education and human capital.

2.3 Empirical Review

To determine the impact of trade openness, human capital through innovations to economic growth in the Balkan countries, Kurteŝ, Amidžič and Kursič (2023) applied the panel model with fixed and random effects on the data from 2000 to 2019. The result revealed a positive relationship between trade openness and human capital.Maitra and Chakraborty (2023) examined the trade-growth dynamics in India by augmenting the role of human capital for the liberalized trade regime. The ARDL bound testing approach was utilized and results reveal cointegrating relationship of income with export, import, exchange rate, trade openness, education and health. Lugman and Soytas (2023) also examined the asymmetric role of human capital and trade liberalization in the economic growth of Pakistan by incorporating labour and capital.Applying the nonlinear autoregressive distributed lag model (NARDL), the results suggest asymmetric impact of trade liberalization and human capital on growth in the short run and long run.

In a comparative analysis of the impact of trade openness and human capital on economic growth in 19 Asian countries from 1985 to 2017, Initsar, Yaseen, Usman, and Makhdum, (2020) applied the fully Modified Ordinary Least Squares (FMOLS) and Dynamic Ordinary Least Squares (DOLS) and results revealed that trade openness and human capital have a positive and significant impact on labour force and a negative impact on growth in Southern Asia but a positive impact on Western Asia.Erkisi and Ceyhan (2019) assessed the long term and short term relationship between economic growth and trade liberalization for 13 transition economies in Europe from 1995 to 2016. The study utilized ARDL and variables such as GDP, export, import, GFCF, FDI, and human capital. The short-term outcomes revealed that there is bidirectional causality among the

variables. Also, both in the long term and short term, trade liberalization has a positive impact on economic growth between export, import and GDP.

To ascertain the impact of trade liberalization, human capital and economic growth in Nigeria, Fahim and Rhamani (2018) utilized panel data to analyze how trade openness and human capital influence economic growth in the Middle East and North Africa (MENA) from 1990 and 2014. The result revealed that trade liberalization impacts human capital negatively in Nigeria.

The reviewed literature highlights several methodological and thematic gaps. Most of the studies focused either on the aggregative impact of trade liberalization on economic growth or its effect on non-oil exports without explicitly linking the two in a transmissible framework. Also, studies using models such as ARDL do not account for simultaneous interactions and structural shocks which are helpful for policy decisions. This study fills the gap by adopting the Structural Vector Autoregressive (SVAR) model to empirically examine how trade liberalization impacts economic growth through the human capital channel in Nigeria over the period of 1986 to 2023. This methodology has helped to address the direct relationship between trade liberalization and growth and quantifies the intermediating role of human capital, suggesting a clearer understanding of trade policy outcomes in the Nigerian economy.

3.0 METHODOLOGY

3.1 Research Design

To evaluate the impact of trade liberalization on economic growth through human capital in Nigeria, the researchers utilized the quantitative approach using Structural Vector Autoregressive analysis (SVAR) technique. The SVAR is applied for its macroeconomic impact and the transmission of the impact from one variable to the other.

Also, the study adopts post ex-facto data by utilizing quarterly time series data from 1986 to 2019. The period marks the beginning of trade liberalization efforts with the introduction of Structural Adjustment Program (SAP) in 1986, and 2019 marks the period of economic recovery and growth plans under President Muhammadu Buhari.

In the study, trade liberalization is considered because trade theories suggest that it can lead to increased productivity and economic growth. Human capital is considered as a critical component of economic growth and serves as a channel of transmission from trade liberalization to growth. And, economic growth is a key indicator of a country's development.

The data on RGDP and capital formation were obtained from various issues of Central Bank of Nigeria (CBN) and NBS, and data on trade liberalization were obtained from the World Development Indicators 2020 and the

Penn World Database. Furthermore, trade liberalization is measured by Trade Freedom Index (TFI), human capital (HUMC) is measured using human development index (HDI) and economic growth is measured using RGDP. The data for the variables were changed to logarithmic returns in order to achieve mean reverting relationships and to make econometric testing procedures seamless.

3.2 Model Specification

The tents of the model are drawn from Hecscher-Ohlin's theory (1919, 1933) and the endogenous growth model by Lucas (1988) which emphasizes physical and human capital as drivers of economic growth. Therefore, the general form of the model is expressed as;

From the collapse of barriers to trade, the following equation for the model is stated as;

$$RGDP = f(TFI, HUMC) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (1)$$

Where;

f = Functional form, $RGDP$ = Real Gross Domestic Product, TFI = Trade Freedom Index, $HUMC$ = Human Capital = HDI.

In structural vector autoregressive (SVAR) form, we have:

$$Y = [tfi\ humc\ rgdp]' \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (2)$$

The variables are entered into the model in level form. Therefore, the transposed matrix is:

$$rgdp_t = f(rgdp_{t-1}, humc_{t-1}, tfi_{t-1,}) \ldots\ldots\ldots\ldots\ldots\ldots \quad (3)$$

$$humc_t = f(rgdp_t, rgdp_{t-1}, humc_{t-1}, tfi_{t-1}) \ldots\ldots\ldots\ldots\ldots\ldots \quad (4)$$

$$tfi_t = f(rgdp_t, rgdp_{t-1}, humc_t, humc_{t-1}, tfi_{t-1}) \ldots\ldots\ldots\ldots\ldots\ldots \quad (5)$$

Exposition of the over-parameterized SVAR (1) system of equations (3) to (4) becomes:

$$rgdp_t = \psi_{11}^1 rgdp_{t-1} + \psi_{12}^1 humc_{t-1} + \psi_{13}^1 tfi_{t-1} + \psi_{12}^0 humc_t + \psi_{13}^0 tfi_t + v_{1t}) \ldots\ldots \quad (6)$$

$$humc_t = \psi_{21}^1 rgdp_{t-1} + \psi_{22}^1 humc_{t-1} + \psi_{23}^1 tfi_{t-1} + \psi_{21}^0 rgdp_t + \psi_{23}^0 tfi_t + v_{2t}) \ldots\ldots \quad (7)$$

$$tfi_t = \psi_{31}^1 rgdp_{t-1} + \psi_{32}^1 humc_{t-1} + \psi_{33}^1 tfi_{t-1} + \psi_{31}^0 rgdp_t + \psi_{32}^0 humc_t + v_{3t}) \ldots\ldots \quad (8)$$

Collect simultaneous effects of equations (4.6) to (4.8) on the left yields;

$$rgdp_t - \psi_{12}^0 humc_t - \psi_{13}^0 tfi_t = \psi_{11}^1 rgdp_{t-1} + \psi_{12}^1 humc_{t-1} + \psi_{13}^1 tfi_{t-1} + v_{1t}) \ldots\ldots \quad (9)$$

$$-\psi_{21}^0 rgdp_t + humc_t - \psi_{23}^0 tfi_t = \psi_{21}^1 rgdp_{t-1} + \psi_{22}^1 humc_{t-1} + \psi_{23}^1 tfi_{t-1} + v_{2t}) \ldots\ldots \quad (10)$$

$$-\psi_{31}^0 rgdp_t - \psi_{32}^0 humc_{t-1} + tfi_t = \psi_{31}^1 rgdp_{t-1} + \psi_{32}^1 humc_{t-1} + \psi_{33}^1 tfi_{t-1} + v_{3t}) \ldots\ldots \quad (11)$$

The matrix algebra permits our over-parameterized SVAR model (9) to (11) to be specified as:

$$\begin{bmatrix} 1 & -\psi_{12}^{0} & -\psi_{13}^{0} \\ -\psi_{21}^{0} & 1 & -\psi_{23}^{0} \\ -\psi_{31}^{0} & -\psi_{32}^{0} & 1 \end{bmatrix} \begin{bmatrix} rgdp \\ humc \\ tfi \end{bmatrix} = \begin{bmatrix} -\psi_{11}^{1} & -\psi_{12}^{1} & -\psi_{13}^{1} \\ -\psi_{21}^{1} & -\psi_{22}^{1} & -\psi_{23}^{1} \\ -\psi_{31}^{1} & -\psi_{32}^{1} & -\psi_{33}^{1} \end{bmatrix} \begin{bmatrix} rgdp_{t-1} \\ humc_{t-1} \\ tfi_{t-1} \end{bmatrix} + \begin{bmatrix} v_{1t} \\ v_{2t} \\ v_{3t} \end{bmatrix}$$

Hence, $A_0 \quad Z_t \quad = \quad A_1 \quad Z_{t-1} \quad + \quad v_t \ldots (4.12)$

Where

A_0 = Our 3×3 matrix of simultaneous effects

Z_t = Our 3×1 column vector matrix of endogenous variables to be estimated

A_1 = Our 3×3 matrix of endogenous variables to be estimated

Z_{t-1} = Our 3×1 column vector matrix of lagged estimated endogenous variables

v_t = Our 3×1 column vector matrix of the error terms in the system

The model in equation 9 - 11 cannot be estimated using SVAR. Therefore, some parameters of the matrix A_0 as seen from equations (9 – 11) are subject to certain restrictions based on economic theory and institutional knowledge in order to resolve the problem of identification in SVAR. That is, we put $\psi_{12}^{0} = \psi_{13}^{0} = \psi_{23}^{0} = 0$ as restrictions imposed on the endogenous variables

Consequently, the general form of the SVAR model can be expressed as:

$$A_0 Y_t = A_1 Y_{t-1} + A_2 Y_{t-2} + \ldots + A_P Y_{t-P} + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (13)$$

$$\Rightarrow \quad A_0 Y_t = A_1 Y_{t-1} + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (14)$$

Where

A_0 = matrix of simultaneous effect coefficients

Y_t = vector matrix of endogenous variables to be estimated

A_1 = matrix of parameter coefficients

Y_{t-1} = vector matrix of lagged endogenous variables

$\varepsilon_t = B\eta_t$ = vector matrix of uncorrelated structural impacts on the system.

Var(ε_{it}) is set to 1 and is chosen to capture the simultaneous interaction between y_t and the standard deviation of the structural shock in model A_0. A recursive approach was used to constrain the upper elements above the diagonal pf the matrix to zero. Restricting A_0 matrix above in the recursive specification yields equation (15) - (17):

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$rgdp_t = lags + v_{1t}$ ..... (15)

$humc_t = \psi_{21}^0 rgdp_t + lags + v_{2t}$ ..... (16)

$tfi_t = \psi_{31}^0 rgdp_t + \psi_{32}^0 humc_t + v_{3t}$ ..... (17)

The parsimonious form of equations (15) to (17) are specified in a triangular matrix form below:

$$A_0 = \begin{bmatrix} 1 & 0 & 0 \\ -\psi_{21}^0 & 1 & 0 \\ -\psi_{31}^0 & -\psi_{32}^0 & 1 \end{bmatrix} \begin{bmatrix} rgdp_t \\ humc_t \\ tfi_t \end{bmatrix} = \begin{bmatrix} v_{1t} \\ v_{2t} \\ v_{3t} \end{bmatrix}$$

From our equation (4.14), where $A_0 Y_t = A_1 Y_{t-1} + \varepsilon_t$,

We set $\varepsilon_t = B\eta_t$ ..... (18)

And $B = \begin{bmatrix} \sigma_1^2 & 0 & 0 \\ 0 & \sigma_2^2 & 0 \\ 0 & 0 & \sigma_3^2 \end{bmatrix}$ = unit variance, that is, var(η_t) = 1 ..... (19)

Thus;

$$A_0 = \begin{bmatrix} 1 & 0 & 0 \\ -\psi_{21}^0 & 1 & 0 \\ -\psi_{31}^0 & -\psi_{32}^0 & 1 \end{bmatrix} \begin{bmatrix} rgdp_t \\ humc_t \\ tfi_t \end{bmatrix} = \begin{bmatrix} \sigma_1^2 rgdp & 0 & 0 \\ 0 & \sigma_2^2 humc & 0 \\ 0 & 0 & \sigma_3^2 tfi \end{bmatrix} \begin{bmatrix} u_{trgdp} \\ u_{thumc} \\ u_{ttfi} \end{bmatrix}$$

The recursive system proposed by Wold (1951) ensures that A_0 is generally a lower triangular and the impacts are not correlated. Wold's proposal reduces the number of unknown parameters to the exact number of estimated equations in the overall model. This makes our normalized SVAR of the form $A_0 Z_t = A_1 Z_{t-1} + \varepsilon_t$ to reduce to $A_0 e_t = B\eta_t$. But we know that, $B\eta_t = Bu_t$, hence, the baseline line for our estimable SVAR model is specified in the reduced form of;

$A_0 e_t = Bu_t$ ..... (20)

In matrix form, we have:

$$\begin{bmatrix} 1 & 0 & 0 \\ -\psi_{21}^0 & 1 & 0 \\ -\psi_{31}^0 & -\psi_{32}^0 & 1 \end{bmatrix} \begin{bmatrix} e_{trgdp} \\ e_{humc} \\ e_{itfi} \end{bmatrix} = \begin{bmatrix} \sigma^2{}_{rgdp} & 0 & 0 \\ 0 & \sigma^2{}_{humc} & 0 \\ 0 & 0 & \sigma^2{}_{tfi} \end{bmatrix} \begin{bmatrix} u_t{}^{rgdp} \\ u_{thumc} \\ u_t{}^{tfi} \end{bmatrix}$$

$A_0 \qquad e_t \quad = \quad B \qquad u_t$ ..... (4.21)

Where A_0 = matrix of simultaneous long term effects

e_t = matrix of column vectors of the endogenous variables to be estimated

B = Structural impact matrix of the model

u_t = matrix of column vector of error terms in the model

Therefore, our "S" matrix is expressed thus;

$$e_t = A_0 B u_t = \begin{bmatrix} e_{t^{rgdp}} \\ e_{t^{humc}} \\ e_{t^{tfi}} \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 \\ -\psi_{21}^{0} & 1 & 0 \\ -\psi_{31}^{0} & -\psi_{32}^{0} & 1 \end{bmatrix} \begin{bmatrix} u_{t^{rgdp}} \\ u_{t^{humc}} \\ u_{t^{tfi}} \end{bmatrix}$$

This represents the initial impact of the shocks in the SVAR model. Thus, the parameters that should determine the contribution of trade liberalization to economic growth through human capital are:

i) ψ_{21}^{0} assessed the effect of human capital ($humc_t$) on economic growth ($rgdp_t$).

ii) ψ_{31}^{0} ascertained the contribution of trade liberalization (tfi_t) to economic growth ($rgdp_t$).

iii) ψ_{32}^{0} evaluated the impact of trade liberalization (tfi_t) on human capital ($humc_t$).

3.3 Descriptive Statistics

The raw data on trade liberalization, human capital, and real GDP are presented in Table 1.

Table 1: Descriptive Statistics (Raw Data)

	TFI	RGDP	HUMC
Mean	35.37	37650.30	125.59
Median	36.34	30363.19	124.01
Maximum	53.93	72044.30	154.12
Minimum	2.42	15103.11	104.27
Std. Dev.	10.37	19814.49	12.61
Skewness	-0.48	0.50	0.35
Kurtosis	3.10	1.66	2.40
Jarque-Bera	5.50	15.83	4.82
Probability	0.06	0.00	0.08
Sum	4811.62	5120440	17080.39
Sum Sq.Dev.	14523.31	5.30E+10	21474.42
Observations	136	136	136

Source: Authors' computation from E–views 10 output

Table 1 reveals that during the 136 quarterly observations of variables for the period of 1986Q1 and 2019Q4, TFI is growing on a low mean rate of 35.37 percent. This suggests low trends in output, foreign reserves, and tariff rates. Furthermore, the HUMC is growing at a mean quarterly rate of 125.59 percent. The maximum value of 154.12 percent and the minimum value of 104.27 percent suggest a low level of capital formation in the economy during the study period. Also, the mean growth rate (RGDP) is very high, standing at 37650.30 percent. In addition, the maximum value of 72044.30 percent and a minimum value of 1503.11 percent in growth rate are probably due to weak implementation of trade liberalization policy in Nigeria, which stands at 35.37 percent during the study period.

The Jarque-Bera (JB) test for normality, which uses the skewness (S) and kurtosis (K) statistics assume that for normality, the joint hypothesis should be that S = 0 and K = 3. Thus, RGDP and HUMC are positively skewed while TFI is negatively skewed. On the other hand, the kurtosis statistics show that TFI is leptokurtic (i.e K > 3) in nature while RGDP and HUMC are platykurtic (low peaked and thin tailed) (i.e K < 3) in nature. Thus, the Jarque-Bera statistics show that the sample skewness and kurtosis are different from zero (0) and three (3) respectively, implying that the probability for outliers to occur is higher than that of normal distribution. On the other hand, the p-values associated with the Jarque-Bera statistics suggest that the variables are not normally distributed. This is because the p-values of RGDP have been reported below 5% ($\alpha = 0.05$). Thus, the hypothesis for normality is rejected, suggesting that there is no evidence for statistical significance of the variables while that of TFI and HUMC are greater than 5% level of significance, suggesting that the null hypotheses for this variable cannot be rejected. Thus, data transformation (by logging) was done to achieve normality.

3.4 Unit Root Test Results

Table 2 reports unit root test results and the test option utilized is model with constant and trend.

Table 2: Unit Root Test Results using ADF and PP

	ADF With a Constant and Trend			PP With a Constant and Trend			
Variables	T-Stat.	Critical Value @ 5%	Prob. Value	Adj. T-Stat.	Critical Value @ 5%	Prob. Value	Order of Int.
TFI	-2.88	0.05	0.02	-2.88	0.05	0.00	I(0)
ΔRGDP	-2.88	0.05	0.00	-2.88	0.05	0.00	I(1)
ΔHUMC	-2.88	0.05	0.00	-2.88	0.05	0.00	I(1)

Source: Authors' extraction from e-views 10

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The absolute t-statistics and absolute critical values for ADF under constant and linear trend of HUMC and RGDP reveal stationarity at levels while the p-values for the same variables became stationary upon their first differencing. However, TFI is integrated at levels, I(0) under the ADF and PP. It may be observed that the series is of mixed order of integration such that two variables are stationary at first difference, I(1) and the other is at levels, I(0) which means that there is no long-run relationship among the variables in the model. Notwithstanding, the SVAR was applied as suggested by Blanchard and Quah (1989).

Table 3: Lag Order Selection for Model (LNRGDP, LNHUMC, LNTFI)

Lag	LogL	LR	FPE	AIC	SC	HQ
0	65.56	NA	7.83e-05	-0.94	-0.87	-0.91
1	857.25	1535.76	6.06e-10	-12.71	-12.44	-12.60
2	931.61	140.89*	2.27e-10*	-13.69*	-13.23*	-13.50*
3	933.65	3.78	2.52e-10	-13.58	-12.93	-13.32

Authors' computations from E-views 10 output

**indicates lag order selection by the criterion; LR: sequential modified LR test statistic (each at 5% level); FPE: Final Prediction Error; AIC: Akaike Information Criterion; SC: Schwartz Information Criterion; HQ: Hannan Quinn Information Criterion*

The lag order selection criteria in Table 3 reveal that lag two (2) is the optimal level for the model as indicated by the various selection criteria. Thus, lag two (2) was selected for optimal performance and adequate representation of the data set.

The tests for stability using the inverse root of characteristic polynomial reveal that all the roots have modulus that is less than one and lie inside the unit circle. See Fig 1.

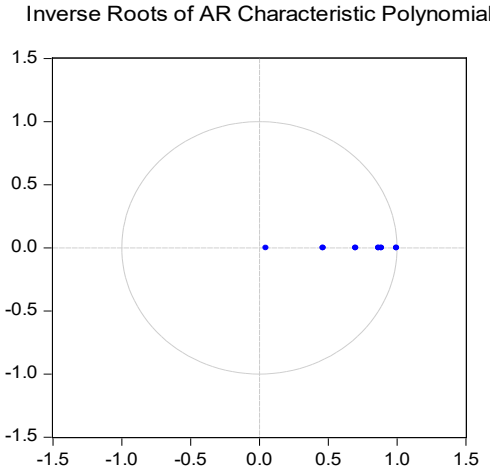

Fig 5: Inverse Roots of AR Characteristic Polynomial

Source: Culled from e-views 10 output.

Estimation of SVAR for the Model

The result of the recursive SVAR is shown in Table 4.

Table 4: Recursive SVAR Result for the Model

	TFI	HUMC	RGDP	PROB
TFI	1	0	0	0.6468
HUMC	0.08	1	0	0.0013
RGDP	3.26	0.12	1	0.0016

Source: Authors' computation from E-views 10 output

Since e-views 10 uses matrix format, the coefficients were multiplied by -1 to arrive at the stated coefficients. Thus, the result in Table 4 reveals that human capital (HUMC) and trade liberalization TFI) are contemporaneously positively correlated by 0.08%. This implies that human capital is directly sensitive to trade liberalization in Nigeria. The relationship between TFI and HUMC is statistically significant because the p-value of 0.0013 is less than 0.05 critical value. This result is in line with the findings of Maitra and Chakraborty (2023) that trade liberalization positively impacts human capital development in Nigeria.

The result in Table 4 also reveals that a 1% shock on trade liberalization (TFI) will lead to a contemporaneous increase of about 3.26% in the rate of economic growth (RGDP) in Nigeria and this is statistically significant because 5% critical level is greater than the p-value of 0.0016. This finding is line with the results of Maitra and chakraborty (2023) that the higher the degree of trade liberalization in Nigeria, the higher will be the rate of growth in the economy.

Furthermore, the result reveals a contemporaneously positive shock of about 0.12% between human capital (HUMC) and economic growth (RGDP) in Nigeria. This means that there is a direct correlation between human capital and economic growth such that positive changes in the volume of human capital are likely to cause positive changes in Nigeria's growth rate. This finding is in line with Initsar et al. (2020) that human capital has

a positive impact on growth. However, the relationship between human capital and economic growth is statistically insignificant at 5% critical level and p-value of 0.6484.

3.6 SVAR Post-Estimation Tests for Model

The post diagnostic tests for the SVAR model are included.

The VAR Residual Serial Correlation LM Test for Model

Table 5: VAR Residual Serial Correlation LM Test Results for Model Two

Lag	LRE* stat	Df	Prob.	Rao F-stat	Df	Prob
1	5.52	9	0.78	0.61	(9,294.6)	0.78
2	5.43	9	0.79	0.60	(9,294.6)	0.79

Source: Extracted from E-views 10 Output

The VAR Residual Serial Correlation LM test at lag 2 reveals that LRE* statistics has a value of 5.43 with p-value of 0.79 while RAO F-statistics at the same lag length has a value of 0.60 with p-value 0.79, which indicate that the null hypothesis of no serial correlation cannot be rejected at 5% critical value, implying the absence of serial correlation among the variables.

The VAR Residual Heteroskedascity Tests

Table 6: VAR Residual Heteroskedasticity Tests (Levels and Squares) for Model

Joint test:	Chi-sq	Df	Prob
	62.60	72	0.77

Source: Authors' extraction from E-views 10 Output

Table 6 reveals VAR Residual heteroskedasticity tests of the estimated model with levels and squares. At a chi-square value of 62.60 with a p-value of 0.77 greater than 0.05 critical value implies that there is no incidence of heteroskedasticity in the model.

3.7 Impulse Response Functions

The impulse responses for the recursive VAR, ordered TFI, RGDP and HUMC are plotted in

Figure 2 (a, b, & c).

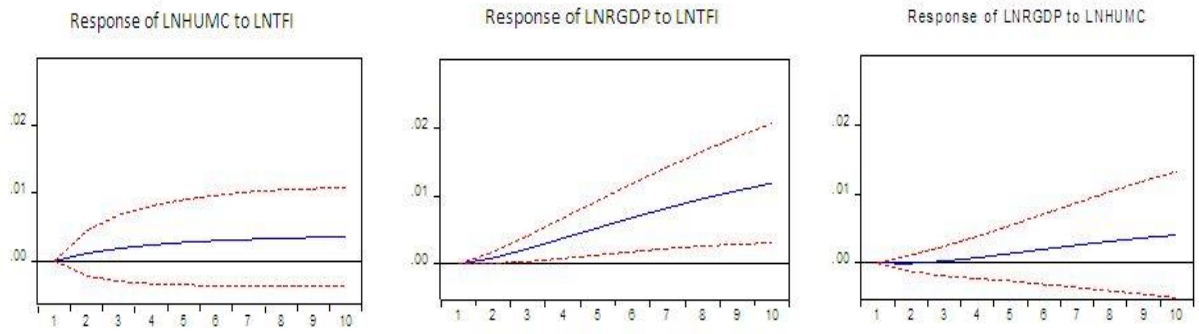

Fig 2a Fig 2b Fig 2c

Fig 2a reveals that a shock on TFI leads to a positive impact on HUMC and this appears to be permanent till the end of the forecast period. This suggests that trade liberalization has a positive and significant impact on human capital in Nigeria during the study period.

In Fig 2b, a shock on HUMC leads to a positive impact on RGDP and the impact appears to be permanent This suggests that human capital has a positive and significant relationship with economic growth in Nigeria with a tendency for more improvement in the long run.

Also, Fig 2c reveals that a shock on TFI leads to a positive and permanent impact on RGDP both in the short run and long run. This implies that trade liberalization holds the capacity to impact economic growth positively if the policy is well implemented and properly harnessed.

The Forecast Error Variance Decomposition of Trade Liberalization

This explains the forecast error variance decomposition of trade liberalization, human capital and economic growth in Nigeria.

Table 7a: Forecast Error Variance Decomposition of Economic Growth

Period	S.E	RGDP	HUMC	TFI
1	0.00	100.00	0.00	0.49
3	0.01	98.40	0.02	1.56

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6	0.03	92.88	0.46	6.64
9	0.05	86.21	1.24	12.54

Source: Culled from E-views 10 Output.

The forecast error variance decomposition of RGDP shows innovation of RGDP as exclusively generated by its own shock and to the other variables. The forecast error variance decomposition in Table 7a suggests that there is minimal variation of RGDP in the short run but shows tendency to decrease in the long run. Also, HUMC shows minimal variation in the short run but reveals tendency for maximal variation in the long run. The forecast error variance decomposition of TFI reveals minimal variation in the short run but maximal variation in the long run. The results imply that these variables are good predictors of RGDP during in the forecast horizon.

Table 7b: Forecast Error Variance Decomposition of Human Capital

Period	S.E	RGDP	HUMC	TFI
1	0.02	0.04	99.95	0.02
3	0.04	0.05	99.66	0.27
6	0.05	0.20	98.76	1.03
9	0.05	0.56	97.44	1.99

Source: Extracted from E-views 10 Output.

The forecast error variance decomposition shows innovation of HUMC as exclusively generated by its own shock and to the other variables. The forecast error variance decomposition in Table 7b suggests minimal variation of HUMC throughout the forecast horizon. Similarly, RGDP shows minimal variation in the short run and the long run during the forecast horizon. The forecast error variance decomposition of TFI reveals minimal variation in the short run but weak signs of improvement in the long run. The results imply that both RGDP and TFI are positive but insignificant predictors of HUMC during the forecast horizon.

Table 7c: Forecast Error Variance Decomposition of Trade Liberalization

Period	S.E	RGDP	HUMC	TFI
1	0.08	6.84	0.14	93.01
3	0.17	4.36	0.06	95.56
6	0.23	2.73	0.10	97.08
9	0.26	2.25	0.47	97.26

Source: Authors' extraction from E-views 10 Output.

Table 7c shows the innovation on trade liberalization (TFI) is exclusively generated by its own innovations and to the other variables. The forecast error variance decomposition in Table 7c suggests that there is maximal

variation of TFI in the short run and minimal variation in the long run. Also, HUMC shows minimal and asymmetrical variations throughout the forecast horizon. The forecast error variance decomposition of RGDP reveals maximal variations in the short run but minimal variations in the long run. The results imply that these variables are good predictors of TFI.

Conclusion and Policy Recommendations

Applying SVAR, the study evaluated the impact of trade liberalization on economic growth through human capital in Nigeria. The SVAR results revealed that trade liberalization has positive and significant contemporaneous impact on human capital in Nigeria.. Also, the findings reveal a positive but insignificant impact of trade liberalization on economic growth in Nigeria. Furthermore, the result reveals a positive but insignificant impact of human capital on economic growth in Nigeria. The impulse response functions reveal a positive but insignificant relationship between trade liberalization and human capital in Nigeria. Even though the impact of trade liberalization on economic growth through human capital is insignificant, the findings have positive implications for policy makers seeking to leverage trade liberalization for sustainable economic growth in Nigeria. Based on the findings, it is recommended that;

1. The federal government and the various state governments, through their respective ministries of education, in synergy with the organized private sectors should provide the required opportunities of education for people to develop their level of innovation and technological absorbing capacity. This will likely boost economic growth through human capital.
2. The federal government and the various state governments, through their respective ministries of health should prioritize the establishment of standard hospitals that will guarantee the healthy living conditions of the people. This will promote strong human capital base that will promote economic growth in Nigeria.

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