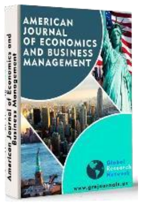

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Article

Industrial Sector Performance and Labour Force Participation in Nigeria: A Gender Perspective

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Abstract: The literature on the role of industrialization in labour force participation in Nigeria is quite scanty. Besides, there is significant disparity between male and female labour force participation rates in the country. To this end, this study investigated the impact of industrial sector performance on labour force participation in Nigeria. The total industrial sector output was disaggregated into the outputs of the various components of the Nigerian industrial sector namely; manufacturing, mining and quarrying, utility and construction sectors. Total labour force participation rate was equally disaggregated into male and female labour force participation rates. Annual time-series data for the period 1981 to 2022 were used for the study. The Augmented Dickey-Fuller (ADF) unit root test, Johansen cointegration test, error correction model (ECM), and Granger causality test were the econometric techniques used in analysing the data. The findings from the study revealed that manufacturing sector, and mining and quarrying sector outputs have significant positive impact on male labour force participation rate; construction sector output has insignificant positive impact on male labour force participation rate while utility sector output has insignificant negative impact on male labour force participation rate. On the other hand, manufacturing sector, and mining and quarrying sector outputs have significant negative impact on female labour participation rate while utility and construction sectors' outputs have insignificant positive impact on female labour force participation rate. The main conclusion from the study is that while the total industrial sector performance largely encourages male labour force participation, it largely discourages female labour force participation in Nigeria

Keywords: Industrial Sector, Labour, Force Participation, Gender

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1. Introduction

A country's industrial sector is crucial to its economic growth and development. It plays a significant role in generating employment, increasing the production of goods and services, and driving economic prosperity (Tizhe et al, 2022). In Nigeria, the industrial sector is a critical sector that contributes significantly to the country's gross domestic product (GDP) through job and wealth creation, and increased tax revenue for the government (Chukwu & Nduka, 2022). The industrial sector has equally been identified as a key sector in the country's quest for diversification from its oil dependence. It can equally enable a country to reduce its reliance on imports, improves its balance of payments, and increase its overall competitiveness (Nana et al, 2021).

The participation rate of the labour force remains an important indicator of the growth and sustainability in every economy. The participation rate of a country's labour force is a production factor that could facilitate both the national and international development efforts targeted at achieving the objective of inclusive economic growth (Olaniran-Akinyele & Bada, 2020). Nigeria is one of the largest countries in the world in terms of human population (World Population Review, 2023). A large population means availability of a large labour force; that is, a huge manpower to manage and work in the industries (Zimmer et al, 2013). Having an active labour force is one of the targets of every nation. It is in this regard that countries embrace policies that promote participation of its citizens in the labour force (Young, 2018). As observed by Man et al (2021), a country cannot be said to be successful in its macroeconomic performance without giving adequate consideration to the number of people actively available for work. Labour force participation rate is therefore an important factor in determining how production and distribution of goods and services take place in an economy. Thus, the deficiency in the labour force participation rate can hinder sustainable growth of the economy. Such deficiency can lead to long-term fall in aggregate output of the economy, thereby leading to poor macroeconomic performance. This explains why countries always make efforts that will create an enabling environment to match the growth rate of labour supply (Yusnander et al, 2020).

The industrial sector plays a significant role in labour force participation. The industrial sector leads to improvement in labour force participation by employing a portion of the workforce. As the industrial sector expands, more members of the labour force are absorbed. Also, a vibrant industrial sector will contribute to an increase in the skills of the labour force. Firms in the industrial sector usually organize on-the-job-training programmes and workshops for their staff. Corporate entities in the industrial sector also organize skills acquisition programmes in their host communities as part of their corporate social responsibilities. In addition, as the industrial capacity expands, the government generates more tax revenue from the industrial sector. An increase in tax revenue will enable the government to provide better education and healthcare facilities for the citizens. An improvement in the quality of education and healthcare provisions will improve the skills, aptitude, and vitality of the labour force. All these will help to improve labour force participation in a country (Ebhorta & Ugwu, 2014; Kalejaiye, 2022; Eromosele, 2023).

Meanwhile, there has been a great deal of concern about the discriminatory practices in the Nigeria's labour market based on gender considerations. It is generally asserted that there is discrimination against women in Nigeria's labour force participation (Nwakeze, 2010; Iweagu et al, 2015; Adeyemi et al, 2016; Adeosun & Owolabi, 2021). In specific terms, several culturally entrenched practices, beliefs, and stereotypes are held against the female gender with regards to their suitability for certain careers or jobs, eventual employment and advancement on the job. It is very difficult in some cases for women to go beyond a particular career level. Some jobs are seen as exclusively reserved for men. Most people still hold unto the belief that the place of the female gender is in the kitchen and therefore, not necessary for them to engage in paid employment outside the home. These imply that the female labour force participation is relatively low as it is determined by culturally entrenched societal norms and stereotypes (Nwakeze, 2010; Adeosun & Owolabhi, 2021).

The foregoing discussion clearly shows that the industrial sector of a country contributes to labour force participation. It is also clear that there is disparity between the male and female labour force participation rates in Nigeria. This study is therefore designed to examine the role of the industrial sector in labour force participation, and to determine whether there is any difference in the impact of the industrial sector on male and female labour force participation rates in Nigeria.

Conceptual Clarifications

Industrial Sector Performance

Industrial sector performance refers to the improvement or otherwise in the activities of the industrial sector overtime. There are several indices used in measuring the performance of the industrial sector. However, for the purpose of this study, industrial sector performance is measured in terms of the annual total output of the sector disaggregated into the total output of the various components or sub-sectors of the sector. Therefore, industrial sector performance is measured in terms of the annual outputs of the manufacturing sector, mining and quarrying sector, utility sector, and construction sector.

Labour Force Participation

The labour force or workforce refers to the total number of working age persons who are currently employed plus the number of persons who are unemployed but seeking employment. The labour force participation rate is the number of persons in the labour force expressed as a percentage of the total working-age population. It is a measure of the proportion of a country's working-age population that engages actively in the labour market, either by working or actively searching for jobs. The labour force participation rate therefore provides an indication of the size of the labour supply available to engage in production of goods and services, relative to the working age population.

For this study, the total labour force participation rate is divided into the male and female labour force participation rates. The male labour force participation rate is the total number of persons who are male in the labour force expressed as a percentage of the total working-age population of a country. Similarly, female labour force participation rate refers to the total number of women in the labour force expressed as a percentage of the total working-age population.

The Structural Transformation Theory

The structural transformation theory is concerned with the mechanism through which underdeveloped countries transform their domestic economic structures from a heavy emphasis on traditional subsistence agriculture to a more modern, more urbanized and more industrially diverse manufacturing and service economy (Abenyo, 2020). Major contributors to the structural change theory include Fischer (1939), Clark (1940), Lewis (1954), Kaldor (1957), Kuznets (1957), Chenery (1979), etc. But for this study, the Lewis (1954) "theory of economic development with unlimited supplies of labour" is considered more appropriate.

William Arthur Lewis, who won the Nobel Prize in economics between 1957 and 1963, made significant contribution to the structural transformation theory. Lewis (1954) explained the development of a less developed economy in terms of labour transition between the traditional (agricultural) sector and the modern (industrial) sector (Kindleberger, 1988). In the subsistence agricultural sector, also referred to as the traditional or indigenous sector, land is limited and mainly used for agricultural production. There is an unlimited supply of labour characterized by low or sometimes even zero marginal productivity. Wage in this sector is rated at the subsistence level (Gabardo et al, 2017). On the other hand, the modern industrial sector or capitalist sector is said to be expansionary in nature. The main motive in this sector is to maximize profit by charging a price higher than the set wages. The wage rate in the industrial sector is higher than the wage rate in the agricultural sector. Consequently, the industrial sector wage rate acts as an incentive for labour migration from the agricultural sector to the industrial sector. The wage rate is also fixed in the modern industrial sector. (Chriswick, 2018).

Therefore, as long as surplus labour exists in the economy, any amount of labour will be available to the industrial sector at the fixed wage rate. Lewis assumes that all wages are consumed and all profits are saved and invested. Thus, when the industrialists reinvest their profits by setting up new factories or expanding the productive capacity of existing ones, the stock of capital assets in the industrial sector will increase. As a result of the increase in the stock of industrial capital, the demand for labour or the marginal productivity curve of labour will shift outwards. (Kindleberger, 1988).

Following the expansion in the industrial sector, employment, output, and the share of profits (savings) in national income rise. Eventually, as the surplus labour is exhausted, the industrial sector wage rate rises. At this point, the economy crosses the boundary from a dual labour market to a single integrated labour market, and real wages rise with rising productivity, in accordance with conventional growth models (Jhingan, 2016; Chriswick, 2018).

Though several criticisms have been levelled against the theory, it has provided a deep and perceptive analysis of the various problems of underdeveloped countries.

The Model of the Allocation of Time

Most of the studies on the labour force participation of women are theoretically based on the model of allocation of time. The model was developed by Gary Becker in 1965. Gary Becker's pioneer study, "A Theory of the Allocation of Time", therefore laid the foundation for the study of household production and the allocation of time within the household (Nwakeze, 2010; Heckman, 2014).

According to Becker (1965), a household as an economic unit, produces utility-yielding commodities. "Goods" and "Time" are the basic inputs for the household production function of these commodities. Becker assumes that individuals within a household make rational decisions resulting in utility maximization through the combination of time and market goods to produce more basic commodities. He also assumes that individuals decide whether or not to participate in the labour market by comparing the value of their time to the value they place on the time spent at home (Korenman et al, 2005; Chiappori & Lewbel, 2014). Households' duties include activities like cleaning, cooking, laundry, babysitting, etc. on which no direct income is earned while labour force participation or market activities involves exchanging labour for a wage (Munongerwa, 2016).

According to Becker's model, households maximize a utility function of the form:

$U(Z_i, \ldots, Z_m)$ ………………………………………………………..………………….. 1

Each commodity Z_i is produced by the household using a production function of the form:

$Z_i = f(X_i, T_i),\ i = 1, \ldots, I$ ………………………………………………..………………. 2

where each X_i is a bundle of goods purchased at the vector of prices P_i while T_i is the amount of time spent at work. The resource constraints facing the household production function is expressed in the form:

$\sum P_i Y_i = I = wT + V$ ……………………………………………………………………… 3

where y_i are goods purchased, p_i are their prices, I is the money income, w is the wage rate per unit of time T_i and V is the amount of unearned income accruing to households (Korenman et al, 2005; Chiappori & Lewbel, 2014; Heckman, 2014). In this situation, the amount of money income lost in doing non-market activities (household chores) measures the cost of obtaining additional utility (Munongerwa, 2016).

The Becker's model advocates for specialization and division of labour within households. Assuming that male and female times are perfect substitutes for home production, then it would be more efficient to specialize. The partner with a comparative advantage in domestic production is likely to give up labour market work altogether and concentrate on domestic duties (Chiappori & Lewbel, 2014). Women are generally seen as possessing comparative advantage in household duties especially taking care of the children and therefore, would rather commit a greater proportion of their time for that, leaving the labour market activities for men. These women comparative advantage is more pronounced during the early stages of a child's life and can be expressed, for instance, in their biologically endowed ability for breast feeding (Munogerwa, 2016).

As opined by Chiappori and Lewbel (2014), over the past years, men's average earnings have been higher than that of the women, though some scholars attribute this to discrimination against women (Munogerwa, 2014). Hence, according to Becker (1965), this offers explanation as to why most women spend more time in household chores relative to labour market participation. However, according to Maponga and Mushaka (2015), even in situations where women's earnings were more than their husbands, married women still devoted a greater share of their time to household duties, though it was not equal to that of those women who were not employed at all.

Empirical Literature Review

Effiong and Udonwa (2024) examined the impact of industrialisation on employment generation in Nigeria for period 1990 to 2022. The findings showed that industrial sector output, gross fixed capital formation, foreign direct investment, and bank credit to the private sector have significant negative impact on unemployment rate while inflation has significant positive impact on unemployment rate. Adeosun et al (2023) studied the impact of industrial sector performance and human capital development on economic growth in Nigeria and established that human capital development has insignificant negative impact on GDP while industrial sector output has insignificant positive impact on GDP. Ola et al (2023) investigated the determinants of labour force participation in Nigeria. The outcome of the study indicated that life expectancy, internet and tertiary education expansion contribute significantly to labour force participation. Similarly, Man et al (2022) examined the determinants of labour force and their effects on labour force participation rate for the states in Malaysia. The findings showed that foreign labour force and unemployment rate have negative impact on labour force participation rate while the unemployed has positive impact on labour force participation rate. Urama et al (2022) studied the impact of women labour force participation on economic growth in a panel of 35 Sub-Saharan African countries. The study established that gross fixed capital formation and female labour force participation rate have positive impact on economic growth while fertility rate has negative impact on economic growth. In a related study, Abbey and Adu-Danso (2022) analysed the relationship between gender diversity and productivity in manufacturing firms in a sample of 1,082 manufacturing firms in 6 Sub-Saharan African countries. The outcome of the study indicated that gender diversity promotes firms' productivity.

Asaleye et al (2021) examined the impact of trade openness on labour market performance in Nigeria. The study found that trade openness has negative effect on employment and wages in both the agricultural and manufacturing sectors. Anyanwu and Adesanya (2021) examined the impact of female labour force participation on economic growth in Nigeria. The findings showed that female labour force participation rate has insignificant negative impact on economic growth while male labour force participation rate has significant positive impact on economic growth. In their study on the impact of labour force participation on manufacturing sector productivity in Nigeria, Babasanya et al (2020) established that labour force participation rate and national savings have significant positive impact on manufacturing sector output. Similarly, George-Anokwuru and Bosco (2020) found that labour force participation rate has significant positive impact on industrial sector output in Nigeria. Tizhe et al (2022) found that manufacturing sector performance makes negative contribution to job creation in Nigeria. Kenny (2019) studied the determinants of manufacturing sector performance and the contribution of the sector to economic growth in Nigeria. The study found that labour force, gross fixed capital formation, and exchange rate have positive impact on manufacturing sector value-added. Obodoechine (2019) found that female labour force participation rates in agriculture, services and industrial sector have significant positive impact on real GDP in a panel of 21 African countries. Obienyi et al (2018) established that health outcomes have significant positive impact on labour productivity while labour productivity have significant positive impact on industrial output in Nigeria.

From the empirical literature reviewed, it is observed that there are few studies that examined the impact of labour force participation on manufacturing or industrial sector performance in Nigeria. However, it was difficult to find studies that examined the impact of industrial sector output performance on labour force participation in Nigeria. This study is therefore unique in the sense that it disaggregated the total industrial sector output into manufacturing sector, mining and quarrying sector, utility sector and construction sector outputs and examined their separate impacts on male and female labour force participation rates. This approach will help to determine how the various sub-sectors of the industrial sector affect male and female labour force participation rates.

2. Materials and Methods

Model Specification

To conduct this study, two models were specified to reflect the impact of the disaggregated industrial sector outputs on male and female labour force participation rates. The model were specified based on W. A. Lewis (1954) variant of the structural transformation theory and the analytical model used by Ola et al (2023) which is expressed as follows:

LFPR = f(TER, SEC, LEXR, LTW, OPN, SEIN, INT, ERA) ……………………………… 4

where LFPR = Labour Force Participation Rate

TER = Tertiary Education

SEC = Secondary Education

LEXR = Life Expectancy Rate

LTW = Labour Tax Wedge

OPN = Trade Openness

SEIN = Ratio of Service to Industry

INT = Number of Internet Users

ERA = Dummy Variable for Era of Tertiary Education Expansion

The adopted model is modified to allow for the inclusion of the variables of the present study. Hence, the models used for this are specified as follows.

Model 1: Male Labour Force Participation Model

The functional form of the model on which the econometric equation is build is expressed as follows:

MLFPR = f(MSO, MQSO, UTSO, CONSO) ……………………………………………….. 5

where MLFPR = Male Labour Force Participation Rate

MSO = Manufacturing Sector Output

MQSO = Mining and Quarrying Sector Output

UTSO = Utility Sector Output

CONSO = Construction Sector Output

f = Functionality Notation

MLFPR is the dependent variable while MSO, MQSO, UTSO and CONSO are the explanatory variables.

The ordinary least squares regression equation based on the functional relation above is specified as follows:

$MLFPR = a_0 + a_1MSO + a_2MQSO + a_3UTSO + a_4CONSO + U$ ………………………….…… 6

Were a_0 is the regression constants, a_1, a_2, a_3 and a_4 are the parameter estimates of the explanatory variables while U is the error term. All the variables are as earlier defined. Equation 6 can be transformed into a logarithmic form as follows:

$MLFPR = a_0 + a_1LOGMSO + a_2LOGMQSO + a_3LOGUTSO + a_4LOGCONSO + \varepsilon$ ……… 7

where LOG refers to the natural logarithm of the variables while ε is the log transformed error term. All other variables are as earlier interpreted.

Model II: Female Labour Force Participation Model

The functional form of the model is specified as follows:

FLFPR = f(MSO, MQSO, UTSO, CONSO) ………………………………………………… 8

where FLFPR = Female Labour Force Participation Rate. FLFPR is the dependent variable. All other variables remain as earlier defined.

The econometric form of the model above is expressed as follows:

$FLFPR = \beta_0 + \beta_1MSO + \beta_2MQSO + \beta_3UTSO + \beta_4CONSO + U$ …………………………… 10

where β_0 is the regression constant while β_1, β_2, β_3 and β_4 are the parameter estimates of the explanatory variables. All other variable are as earlier defined. Transforming equation 10 into logarithmic form, we have:

$FLFPR = \beta_0 + \beta_1LOGMSO + \beta_2LOGMQSO + \beta_3LOGUTSO + \beta_4LOGCONSO + \varepsilon$ ……. 11

where LOG is the natural logarithm of the variables. All other variables are as earlier defined

A Priori Theoretical Expectations

Based on a priori reasoning, the following signs of the parameter estimates are expected.

Model I: $a_1 > 0$, $a_2 > 0$, $a_3 > 0$, $a_4 > 0$

Model II: $\beta_1 > 0$, $\beta_2 > 0$, $\beta_3 > 0$, $\beta_4 > 0$

The implication of the above signs of the parameter estimates is that a positive (greater than zero) relationship is expected between each of the dependent variables and the explanatory variables.

Description of Variables

Dependent Variables

i) Male Labour Force Participation Rate

This is the percentage of the labour force who are males. It is the total number of persons in the labour force who are males expressed as a percentage of Nigeria's total working-age population. It is measured in percentage.

ii) Female Labour Force, Participation Rate

This refers to the total number of women in the labour force expressed as a percentage of the total working-age population of Nigeria. It is measured in percentage.

Explanatory Variables

i) Manufacturing Sector Output

This refers to the monetary value of the total quantity of goods produced by the manufacturing sector in Nigeria in a year. It is measured in billions of naira.

ii) Mining and Quarrying Sector Output

This refers to the monetary value of crude oil and natural gas, coal mining, metal ores and quarrying, and other minerals produced in Nigeria in a year. It is measured in billions of naira.

iii) Utility Sector Output

This is the monetary value of electricity, gas, steam, air conditioner, water supply, sewage and waste management in Nigeria during a particular year. It is measured in billions of naira.

iv) Construction Sector Output

This is the total monetary worth of the construction industry in Nigeria in a year. It is measured in billions of naira.

Nature and Sources of Data

This study made use of annual time-series data from 1981 to 2022. They were obtained from secondary sources including the Central Bank of Nigeria annual statistical bulletin for 2022, the Central Bank of Nigeria annual reports and statements of accounts (various years), and the World Bank Development Indicators (various years)

Techniques of Data Analysis

This study made use of time-series data, and there are certain properties associated with time-series data such as non-stationarity (unit root) and spurious regression. The ordinary least squares regression technique assumes that the underlying time-series data are stationary. However, in real life, most macroeconomic time-series data are not stationary. Consequently, the actual estimation procedure was preceded by the test for stationary which was conducted using the Augmented Dickey-Fuller (ADF) unit root test. In its general form, the ADF unit root test is conducted using the following regressions:

$$\Delta ss Y_t = a_0 + a_1 Y_{t-1} + \sum_{n=1}^{n} a_1 \Delta Y_i + \varepsilon_t \quad \ldots 12$$

$$\Delta Y_t = a_0 + a_1 Y_{t-1} + \sum_{n=1}^{n} a_1 \Delta Y_i + \delta_t + \varepsilon_t \quad \ldots 13$$

where Y_t is a time-series, t is a linear trend, Δ is the first difference operator, α_0 is a constant, n is the optimum number of lags in the dependent variable, and ε_t is random variable. The ADF unit root test rejects the null hypothesis of unit root (i.e., series is not stationary) in favour of the alternative hypothesis of no unit root (i.e., series is stationary).

Based on the result of the stationarity test, the Johansen cointegration test was used to test the presence or otherwise of long-run relationships among the variables of the study. The test was developed by Johansen (1988) and Johansen and Juselius (1990) based on the vector autoregressive (VAR) model. The test starts with a P-lag VAR model as follows:

$$Y_t = A_1 Y_{t-1} + A_2 Y_{t-2} + \text{---} + A_p Y_{t-p} + \beta X_t + \varepsilon_t \quad \ldots 14$$

where Y_t is a K-vector of non-stationary endogenous variables which are generally integrated of order one; X_t is a d-vector of exogenous deterministic variable; A_1, A_2, A_p and β are matrices of coefficients to be estimated; while ε_t is a vector of innovation that may be simultaneously correlated with their own lagged values and with variables on the right hand side. Considering that many economic time-series are non-stationary, the VAR model is represented as follows:

$$\Delta Y_t = \underline{\pi}\, Y_{t-1} + \sum_{i=1}^{p-1} \Upsilon_i \Delta Y_{t-1} + \beta X_t + \varepsilon_t \quad \ldots 15$$

$$\text{where } \underline{\pi} = \sum_{i=1}^{p-1} A_{i-1} \quad \text{and} \quad \Upsilon = -\sum_{j=i+1}^{p} A_j$$

The standard test statistics proposed by Johansen (1988), and Johansen and Juselius (1990) to determine the number of cointegrating vectors are the trace and maximum eigen statistics. These are as shown below.

$$\lambda_{trace}(r) = -T \sum_{i=r+1}^{p-1} \log(1-\lambda_t) \quad \ldots 16$$

$$\lambda_{max}(r/r+1) = -T \log(1-\lambda_{r+1}) \quad \ldots 3.13$$

where T is the sample size and λ's are the estimated eigen values from the matrix. The trace statistic tests the null hypothesis of r cointegrating equations against the alternative hypothesis of n cointegrating equations. On the other hand, the max-eigen statistic tests the null hypothesis of r cointegrating equations against the alternative hypothesis of r+1 cointegrating equations.

The error correction model (ECM) was used to estimate the short-run behaviour of the variables. Particularly, the ECM was used to determine the speed of adjustment of any disequilibrium in the short-run to long-run trend. Hence, equation 7 of model I can be re-stated in ECM formulation as follows:

$$\Delta MLFPR_t = a_0 + \sum_{i=1}^{n} a_{1t}\, \Delta MLFPR_{t-1} + \sum_{i=1}^{n-1} a_{2t}\, \Delta Log\ MSO_{t-1} + \sum_{i=1}^{n-1} a_{3t}\, \Delta LogMQSO_{t-1} + \sum_{i=1}^{n-1} a_{4t}\, \Delta Log\ UTSO_{t-1} + \sum^{n-1} a_{5t}\, \Delta Log\ CONSO_{t-1} + \lambda ECM_{t-1} + \varepsilon_t \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad 18$$

Similarly, equation 11 of model II can be re-stated as follows:

$$\Delta FLFPR_t = \beta_0 + \sum_{i=1}^{n} \beta_{1t}\, \Delta FLFPR_{t-1} + \sum_{i=1}^{n-1} \beta_{2t}\, \Delta Log\ MSO_{t-1} + \sum_{i=1}^{n-1} \beta_{3t}\, \Delta Log\ MQSO_{t-1} + \sum_{i=1}^{n-1} \beta_{4t}\, \Delta Log\ UTSO_{t-1} + \sum_{i=1}^{n-1} \beta_{5t}\, \Delta Log\ CONSO_{t-1} + \lambda ECM_{t-1} + \varepsilon_t \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad 19$$

where α_0 and β_0 are the drift parameters, Δ is the first difference operator, the terms with summation ($\sum$) Sign (i.e., α_{1t} - α_{4t} for model I and α_{1t} - α_{4t} for model II) are the short-run coefficients, n is the ECM lag length, Log is the natural logarithm, λ is the coefficient of the error correction term, and ., ε_t is the white noise error term. All other variables are as earlier interpreted.

The Granger causality test was used to determine the nature of causal relationship between each of the dependent variables and each of the explanatory variables. In its general form, the Granger causality test estimates the following pair of regressions:

$$X_t = \sum_{i=1}^{n} a_i\, Y_{t-i} + \sum_{i=1} \beta_j\, X_{t-j} + U_{1t} \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad 20$$

$$Y_t = \sum_{i=1}^{n} \lambda_i\, Y_{t-i} + \sum_{i=1}^{n} X_j\, X_{t-j} + U_{2t} \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad 21$$

where it is assumed that the disturbance terms (U_{1t} and U_{2t}) are uncorrelated.

3. Results

Descriptive Statistics

The summary of the descriptive statistics result is presented in table 1.

Table 1: Descriptive Statistics Result

Variable	MLFPR	FLFPR	MSO	MQSO	UTSO	CONSO
Mean	65.90881	51.07667	4277.878	6639.942	162.8521	1189.681
Median	64.65500	55.20500	3584.520	6494.135	114.8850	769.5950
Maximum	74.90000	55.38000	6684.220	9323.750	503.8400	2680.220
Minimum	59.10000	32.39000	2898.470	4096.990	13.52000	335.7600
Std. Dev.	4.323658	6.850778	1347.255	1448.672	162.2552	853.3478
Skewness	0.840245	-1.829404	0.765161	0.138884	0.639039	0.768479
Kurtosis	3.010249	5.127293	1.947278	2.103026	1.943217	1.915438
Jarque-Bera	4.942271	31.34644	6.037693	1.543004	4.812981	6.192400

Probability	0.084489	0.000000	0.048858	0.462318	0.090131	0.045221
Sum	2768.170	2145.220	179670.9	278625.6	6839.790	49966.59
Sum Sq. Dev.	766.4546	1924.260	744118894	86044640	1079397	29856299
Observations	42	42	42	42	42	42

Source: Computed from E-view

From the descriptive statistics result in table 1, the mean values of the variables are 65.90881,51.07667, N4227.878 billion, N6639.942 billion, N162.8521 billion, and N1189.681 billion for MLFPR, FLFPR, MSO, MQSO, UTSO, and CONSO respectively.

The standard deviation statistic indicated that MLFPR with a standard deviation value of 4.323658 is the most stable variable while MQSO with a standard deviation value of N1448.672 billion is most unstable variable. From the skewness statistic, MLFPR, MSO, MQSO, UTSO and CONSO are positively skewed while FLFPR is negatively skewed. The kurtosis statistic shows that MSO, MQSO, UTSO and CONSO are platykurtic since their values are less than 3. Hence, they have thinner tails relative to normal distribution. On the other hand, MLFPR and FLFPR are leptokurtic since their values are greater than 3. This means that they have wider tails relative to normal distribution.

Stationarity Test

The result of the stationarity test which was conducted using Augmented Dickey-Fuller (ADF) unit root test is reported in table 2.

Table 2: ADF Unit Root Test Result

Variable	At Levels				At First Difference				Order of Integration
	ADF Test Statistic	Critical Values		Prob.	ADF Test Statistic	Critical Values		Prob.	
		1%	5%			1%	5%		
MLFPR	-2.3322420	-3.605593	-2.936942	0.1702	-3.611024*	-3.605593	-2.936942	0.0099	I(1)
FLFPR	-2.315551	-4.198503	-3.523623	0.4165	-5.573233*	-4.205004	-3.526609	0.0002	I(1)
MSO	-1.009331	-3.605593	-2.936942	0.7408	-4.458017*	-3.605593	-2.936942	0.0010	I(1)
MQSO	-1.014579	-3.600987	-2.935001	0.7392	-5.414112*	-3.605593	-2.936942	0.0001	I(1)
UTSO	1.3109110	-3.600987	-2.935001	0.9983	-5.695003*	-3.605593	-2.936942	0.0000	I(1)
CONSO	0.150076	-3.605593	-2.936942	0.9657	-3.541355**	-3.605593	-2.936942	0.0118	I(1)

Source: Computed from E-view

Note: * and ** denote rejection of the null hypothesis of unit root at the 1% and 5% significance levels respectively.

The ADF unit root test result in table 2 revealed that the variables are not stationary at levels. However, MLFPR, FLFPR, MSO, MQSO and UTSO become stationarity at first difference at the 1% significance level while CONSO becomes stationary at first difference at the 5% significance level. All the variables are therefore integrated of order one.

Cointegration Test

Based on the result of the stationarity test, the cointegration test was conducted using the Johansen cointegration test. The Trace and Max-Eigenvalue tests were the standard test statistics used in evaluating the result. The Johansen cointegration test results are reported in tables 3A and 3B respectively for model I and model II.

Table 3A: Johansen Cointegration Test Result for Model I

Unrestricted Cointegration Rank Test (Trace)				
Hypothesized No. of CE(s)	**Eigenvalue**	**Trace Statistic**	**0.05 Critical Value**	**Prob****
None*	0.745653	117.7865	69.81889	0.0000
At Most 1*	0.549787	64.39333	47.85613	0.0007
At Most 2*	0.359664	33.27002	29.79707	0.0191
At Most 3	0.253890	15.88530	15.49471	0.0437
At Most 4	0.108129	3.462905	3.841466	0.0746
Unrestricted Cointegration Rank Test (Max-Eigen Value)				

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob**
None*	0.745653	53.39322	33.87687	0.0001
At Most 1*	0.549787	31.12332	27.58434	0.0168
At Most 2	0.359664	17.38472	21.13162	0.1546
At Most 3	0.253890	11.42239	14.26460	0.1343
At Most 4	0.108129	3.462905	3.841466	0.0746

Source: Computed from E-View

Trace test indicates 3 cointegrating equations at the 0.05 level

Max-eigenvalue test indicates 2 cointegrating equation at the 0.05 level

*denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) P-values

Table 3B: Johansen Cointegration Test Result for Model II

Unrestricted Cointegration Rank Test (Trace)				
Hypothesized No. of CE(s)	**Eigenvalue**	**Trace Statistic**	**0.05 Critical Value**	**Prob****
None*	0.699002	94.85065	69.81889	0.0002
At Most 1*	0.395182	48.02518	47.85613	0.0482
At Most 2	0.341000	28.41493	29.79707	0.0715
At Most 3	0.256913	12.15069	15.49471	0.1498
At Most 4	0.014508	0.569942	3.841466	0.4503
Unrestricted Cointegration Rank Test (Max-Eigen Value)				
Hypothesized No. of CE(s)	**Eigenvalue**	**Max-Eigen Statistic**	**0.05 Critical Value**	**Prob****
None*	0.699002	46.82547	33.87687	0.0009
At Most 1	0.395182	19.61025	27.58434	0.3687
At Most 2	0.341000	16.26424	21.13162	0.2098
At Most 3	0.256913	11.58074	14.26460	0.1274
At Most 4	0.014508	0.569942	3.841466	0.403

Source: Computed from E-View

Trace test indicates 2 cointegrating equations at the 0.05 level

Max-eigen test indicates 1 cointegrating equations at the 0.05 level

*denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) P-values

From the Johansen cointegration test results in table 3A, Trace test indicated 3 cointegrating equations while Max-eigen test indicated 2 cointegrating equations. Similarly, in table 3B, Trace test indicated 2 cointegrating equations while the Max-eigen test indicated 1 cointegrating equation. The Johansen cointegration test results therefore indicated that long-run (equilibrium) relationships exist between the explanatory and dependent variables in the two models.

Estimated Long-run Regression Results

The estimated long-run regression results were obtained from the normalized cointegrating coefficients after reversing the signs of the parameter estimates. The long-run coefficients for model I and Model II are presented in tables 4A and 4B respectively.

Table 4A: Long-Run Coefficients for Model I

MLFPR	MSO	MQSO	UTSO	CONSO
1.000000	0.009720	0.007665	-0.065409	0.000294
S.E.	(0.00222)	(0.00136)	(0.03573)	(0.00685)
t-values	(4.378378)	(5.636029)	(-1.830647)	(0.042919)

Source: Computed from E-View

Note: The figures in the first and second parentheses are the standard errors (S.E.) and the t-statistics respectively.

Table 4B: Long-Run Coefficients for Model II

FLFPR	MSO	MQSO	UTSO	CONSO
1.000000	-0.007386	-0.003432	0.033230	0.004892
S.E.	(0.00224)	(0.00163)	(0.03877)	(0.00654)
t-values	(-3.297321)	(-2.105522)	(0.857106)	(0.748012)

Source: Computed from E-View

Note: The figures in the first and second parentheses are the standard errors (S.E.) and the t-statistics respectively.

VAR Lag Order Selection Criteria

In tables 5A and 5B, the optimal lag length of the ECM models are presented for model I and model II respectively. The optimal lag length is the one that minimizes the Akaike information criterion, Schwarz criterion and Hannan-Quinn criterion, and also at which the model does not suffer auto correlation problem.

Table 5A: VAR Lag Order Selection Criteria for Model I

Endogenous variables: MLFPR MSO MQSO UTISO CONSO
Exogenous variables: C
Sample: 1981 2022
Included observations: 40

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-1254.215	NA	1.52e+21	62.96077	63.17188	63.03710
1	-1049.572	347.8937	1.93e+17	53.97860	55.24526	54.43659
2	-1010.961	55.98561*	1.04e+17*	53.29807*	55.62028*	54.13770*

Source: Computed from E-view

* 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

From table 5A, the optimal lag length for the error correction model (ECM) is lag 2 based on the Akaike information criterion.

Table 5B: VAR Lag Order Selection Criterion for Model II

Endogenous variables: FLFPR MSO MQSO UTISO CONSO
Exogenous variables: C
Sample: 1981 2022
Included observations: 39

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-1250.061	NA	6.16e+21	64.36212	64.57540	64.43865
1	-1053.570	332.5239	9.46e+17	55.56769	56.84736	56.02682*
2	-1024.820	41.28247*	8.34e+17	55.37537*	57.72142*	56.21711
3	-993.3251	37.14747	7.14e+17*	55.04231	58.45475	56.26667

Source: Computed from E-View

* 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

From table 5B, the optimal lag length for the error correction model (ECM) is lag 1 based on the Hannan-Quinn information criterion.

Estimated Short-Run (Error Correction Model) Result

The results of the estimated short-run or error correction model (ECM) for model I and model II are presented in tables 6A and 6B respectively.

Table 6A: Parsimonious Error Correction Model Result for Model I

Dependent Variable: D(MLFPR)
Method: Least Squares
Sample (adjusted): 1984 2022
Included observations: 39 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.201473	0.128436	-1.568660	0.1272
D(MLFPR(-1))	0.494215	0.151313	3.266183	0.0027
D(MLFPR(-2))	0.169474	0.162837	1.040759	0.3063
DLOG(MSO)	1.792421	1.391499	1.288122	0.2076
DLOG(MSO(-1))	-1.051328	1.215442	-0.864976	0.3939
DLOG(MQSO(-2))	-2.599837	1.423045	-1.826954	0.0777
DLOG(UTSO(-2))	0.663422	0.500728	1.324914	0.1952
DLOG(CONSO(-2))	-0.749641	1.223980	-0.612462	0.5448
ECM(-1)	-0.546287	0.134905	-4.049418	0.0003

R-Squared = 0.619330 Adjusted R-Squared = 0.491152
F-Statistic = 4.051615 Prob(F-statistic = 0.002304 D-W = 1.93838

Source: Computed from E-View

Table 6B: Parsimonious Error Correction Model Result for Model II

Dependent Variable: D(FLFPR)
Method: Least Squares
Sample (adjusted): 1984 2022
Included observations: 39 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.919113	0.246958	3.721744	0.0010
D(FLFPR(-2))	0.254528	0.104117	2.444627	0.0216
DLOG(MSO)	-6.259052	2.473493	-2.530450	0.0178
DLOG(MSO(-1))	3.307609	2.459701	1.344720	0.1903
DLOG(MSO(-2))	4.851940	2.244961	2.161258	0.0401
DLOG(MQSO)	4.246235	2.778155	1.528437	0.1385
DLOG(MQSO(-1))	3.961437	2.636310	1.502645	0.1450
DLOG(UTSO)	-1.006275	0.925709	-1.087033	0.2870
DLOG(UTSO(-2))	-2.077633	1.012238	-2.052514	0.0503
DLOG(CONSO)	9.347320	2.990853	3.125302	0.0043
DLOG(CONSO(-1))	-14.95158	3.334462	-4.483957	0.0001
DLOG(CONSO(-2))	-4.853684	2.576046	-1.884161	0.0708
ECM(-1)	-0.640702	0.143719	-4.458017	0.0001

R-Squared = 0.800538 Adjusted R-Squared = 0.708478
F-Statistic = 8.695867 Prob(F-statistic) = 0.000002 D-W = 1.965623

Source: Computed from E-View

From the short-run results in tables 6A and 6B, the error correction terms (ECM(-1)) turned up with the right negative signs and they are also statistically significant at the 0.05

level of significance. In terms of magnitude, the coefficient of the error correction term in table 6A is -0.546287. This implies that any disequilibrium in the short-run is reconciled to long-run equilibrium trend of male labour force participation rate with a speed of adjustment of about 54 percent within a year in the current period. Similarly, the coefficient of the error correction term in table 6B is -0.64702. The implication is that about 64 percent of any disequilibrium in the short-run is adjusted to the long-run trend of the female labour force participation rate model within in the current period.

Granger Causality Test Results

The results of the pairwise Granger causality tests for model I and model II are presented in tables 7A and 7B respectively.

Table 7A: Granger Causality Test Result for Model I

Sample: 1981 2022
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
LOG(MSO) does not Granger Cause MLFPR	40	3.51849	0.0405
MLFPR does not Granger Cause LOG(MSO)		2.22067	0.1236
LOG(MQSO) does not Granger Cause MLFPR	40	1.29009	0.2880
MLFPR does not Granger Cause LOG(MQSO)		0.29141	0.7490
LOG(UTSO) does not Granger Cause MLFPR	40	0.47958	0.6231
MLFPR does not Granger Cause LOG(UTSO)		1.03388	0.3662
LOG(CONSO) does not Granger Cause MLFPR	40	0.84152	0.4396
MLFPR does not Granger Cause LOG(CONSO)		2.68862	0.0820

Source: Computed from E-View

Table 7B: Granger Causality Test Result for Model II

Sample: 1981 2022
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
LOG(MSO) does not Granger Cause FLFPR	40	2.85993	0.0707
FLFPR does not Granger Cause LOG(MSO)		1.69006	0.1992
LOG(MQSO) does not Granger Cause FLFPR	40	1.17843	0.3197
MLFPR does not Granger Cause LOG(MQSO)		1.11395	0.3396
LOG(UTSO) does not Granger Cause FLFPR	40	1.82491	0.1762
MLFPR does not Granger Cause LOG(UTSO)		1.14155	0.3309
LOG(CONSO) does not Granger Cause FLFPR	40	6.69928	0.0034
MLFPR does not Granger Cause LOG(CONSO)		6.10409	0.0053

Source: Computed from E-View

The Granger causality test result in table 7A indicated one unidirectional causality from manufacturing sector output to male labour force participation rate. For table 7B, the Granger causality test result showed a bidirectional causality between construction sector output and female labour force participation rate.

Post Estimation Test Results

Some of the assumptions underlying the classical linear regression model (CLRM) are tested in this section. These tests include serial correlation, heteroscedasticity, and normality tests. The results and decisions of the aforementioned tests are presented in table 8A and 8B for model I and model II respectively.

Table 8A: Post Estimation Tests Results for Model I

Test	Value	Prob.	Decision
Breusch-Godfrey Serial			Accept Ho (No Serial Correlation)

Correlation LM Test F-statistic	0.524614	0.5975	
Heteroscedasticity (Breusch-Pagan-Godfrey) Test F-statistic	1.037809	0.1757	Accept Ho (residuals have constant variance, i.e, model is homoscedastic)
Normality (Jarque-Bera) Test F-statistic	0.456048	0.796105	Accept Ho (data normally distributed)

Source: Computed from E-View

Table 8B: Post Estimation Tests Results for Model II

Test	Value	Prob.	Decision
Breusch-Godfrey Serial Correlation LM Test F-statistic	2.030222	0.1532	Accept Ho (No Serial Correlation)
Heteroscedasticity (Breusch-Pagan-Godfrey) Test F-statistic	1.149262	0.3664	Accept Ho (residuals have constant variance, i.e, model is homoscedastic)
Normality (Jarque-Bera) Test F-statistic	0.451513	0.797912	Accept Ho (data normally distributed)

Source: Computed from E-View

Note: For each of the tests in tables 8A and 8B, the null hypothesis (Ho) was not rejected sine the probability value for each of the tests is greater than 0.05.

4. Discussion

i. Estimated Long-Run Regression Result for Model I (Male Labour Force Participation Rate Model)

From the estimated long-run regression result for model I in table 4A, manufacturing sector output has a significant positive impact on male labour force participation rate. In terms of size, one percent increase in manufacturing sector output is associated with 0.0000972 percent average increase in male labour participation rate. Mining and quarrying sector output has significant positive impact on male labour force participation. Thus, one percent increase in mining and quarrying sector output leads to an average increase of 0.00007665 percent in male labour force participation rate. Similarly, construction sector output has insignificant positive impact on male labour force participation rate. A one percent increase in construction sector output is associated with an average increase of 0.00000294 percent in male labour force participation rate. On the other hand, utility sector output has insignificant negative impact on male labour force participation rate, with a one percent increase in its value producing an average decrease of 0.00065409 percent in male labour force participation rate.

ii. Estimated Long-Run Regression Result for Model II (Female Labour Force Participation Rate Model)

From table 4B, the estimated long-run regression result for model II showed that manufacturing sector output has significant negative impact on female labour force participation rate. A one percent increase in manufacturing sector output is associated with an average decrease of 0.00007386 percent decrease in female labour force participation rate. Similarly, mining and quarrying sector output produces a significant negative impact on female labour force participation rate. A one percent increase in mining and quarrying sector output is associated with an average decrease of 0.00003432 percent in female labour force participation rate. On the other hand, utility sector output produces an insignificant positive impact on female labour participation rate. Hence, one percent increase in utility sector output is associated with an average increase of 0.00003323 percent in female labour participation rate. Likewise, construction sector out has insignificant positive impact on female labour force participation rate. A one percent increase in construction sector output is associated with an average increase of 0.00004892 percent in female labour force participation rate.

iii. **Estimated Short-Run Regression Result for Model I**

The estimated short-run regression result for model I in table 6A showed that male labour force participation rate lagged by one period has significant positive impact on male labour force participation rate in the current period while period two lagged value of male labour force participation rate has insignificant positive impact on male labour force participation rate in the current period. Manufacturing sector output in the current period has insignificant positive impact on male labour force participation rate in the current period while manufacturing sector output lagged by one period has insignificant negative impact on male labour force participation rate. Mining and quarrying sector, and construction sector outputs in period two have insignificant negative impact on male labour force participation rate while utility sector output in period 2 has insignificant positive impact on male labour force participation rate.

The short-run regression result for model I also showed that the coefficient of multiple determination (R-squared) is 0.619330. This means that the explanatory variables jointly account for about 61 percent of the total variations in male labour force participation. The adjusted R-squared measures the penalty for including irrelevant explanatory variables in the model. Hence, with an estimated adjusted R-squared of 0.491152, the implication is that if additional explanatory are introduced to the model, they will jointly account for about 49 percent of the total variations in the dependent variables due loss of degree of freedom. The estimated F-statistic is 4.051615 with a probability value of 0.0022304. This means that the overall estimated regression model is statistically significant at the 0.05 level of significance.

iv. **Estimated Short-Run Regression Result for Model II**

From the estimated short-run regression result for model II in table 6B, female labour force participation rate lagged by 2 periods has significant positive effect on female labour force participation in the current period. Manufacturing sector output in the current period has significant negative impact on female labour force participation rate. Manufacturing sector output in period one has insignificant positive impact on female labour force participation rate while its lagged value in period two has significant positive impact on female labour force participation rate. Mining and quarrying sector output in the current period and its lagged value in period one have insignificant positive impact on female labour force participation rate. Utility sector outputs in the current period and its value lagged by two periods have insignificant and significant negative impact respectively on female labour force participation rate. Construction sector output in the current period and its lagged value in period one have significant positive and significant negative impact respectively on female labour force participation while lagged value of construction sector output in period 2 has insignificant negative impact on female labour force participation rate.

The estimated R-squared for model II is 0.800538. This implies that the explanatory variables are jointly responsible for about 80 percent of the total variations in female labour force participation rate. The adjusted R-squared is 0.708478 which implies that if additional explanatory variables are introduced to the model, they will all account for about 70 percent of the total variations in female labour force participation rate due to loss of degree of freedom. The estimated F-statistic is 8.695867 with a probability value of 0.000002. The implication is that the overall estimated model is significant at the 0.05 level of significance.

The Granger causality test result for model I in table 7A indicated a unidirectional causality from manufacturing sector output to male labour force participation rate. For model II, the Granger causality test result in table 7B established a bidirectional causality between construction sector output and female labour force participation rate.

5. Conclussions

Based on the findings from the study, the following conclusions are drawn.

i) Manufacturing, and mining and quarrying sectors' performance significantly encourage male labour force participation while construction sector performance stimulates male labour force participation in an insignificantly manner in Nigeria.
ii) Utility sector performance insignificantly discourages male labour force participation in Nigeria.
iii) Manufacturing, and mining and quarrying sectors' performance strongly discourage female labour force participation while utility and construction sectors' performance insignificantly stimulate female labour force participation in Nigeria.
iv) Total industrial sector performance largely encourages male labour force participation while it largely discourages female labour force participation in Nigeria.

Based on the outcome of the study, the following policy measures are recommended.

i) There is the need to improve the performance of the industrial sector (especially, the manufacturing, mining and quarrying, and construction sub-sectors) so as to improve its contribution to male labour force participation.
ii) To improve female labour force participation through industrialisation, the performance of the industrial sector (especially the utility and construction sub-sectors) should be improved upon to significantly contribute to female labour force participation.
iii) To further stimulate female labour force participation in the country, there is the need to improve women education. In this context, there is the need to embark on a nationwide public enlightenment campaign to sensitize the people on the importance of women education and to discourage the culturally entrenched discrimination against women education and employment in the country.
iv) The government at all levels and corporate entities in the country should embark on skill acquisition programmes. To this end, skill acquisition and training centres should be established across the country. This will ensure that members of the Nigerian workforce acquire the necessary skills and competencies that will improve their participation in productive enterprises.

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