Exploring the Drivers of Labour Force Participation in Nigeria: A Multi-Variable Analysis

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Abstract

This study employed a comprehensive multi-variable analysis to explore the drivers of labour force participation in Nigeria. Objective was to explore the intricate interrelationships among key socioeconomic factors, including Access to Electricity (AE), Oil Revenue (OR), Total Secondary School Enrollment (TSSE), Total Unemployment (TU), and the Total Labor Force Participation Rate (TLFPR) in Nigeria. The study utilized data from the World Bank spanning 2000 to 2020. An ex post facto design guided the study, diagnostic tests to validate assumptions, ensuring the reliability of regression results employed. The findings revealed several crucial insights. Firstly, Access to Electricity (AE) did not exhibit a statistically significant relationship with TLFPR (Coeff. =-0.216785; p-value=0.2612). In contrast, Oil Revenue (OR) demonstrated a statistically significant connection with TLFPR (Coeff. = of 0.000623; p-value=0.0151). Furthermore, Total Secondary School Enrollment (TSSE) also showed a statistically significant relationship (Coff. =0.194391; p-value= 0.0292). Lastly, Total Unemployment (TU) did not display a significant relationship with TLFPR (Coeff. = -0.256802; p-value = 0.5683). In conclusion, this study provided valuable insights into the dynamics of labour force participation in Nigeria, underscoring the need for comprehensive policies that address the diverse array of challenges and promote inclusive and sustainable economic development. The study underscores the complexity of labour force participation determinants in Nigeria, emphasising socio-economic and contextual factors. These recommendations aim to foster inclusive economic growth and enhance labour force participation rate in the country.

Keywords: Economic Dynamics; Labor Force Participation; Multi-variable Approach; Robust Regression; Socioeconomic Analysis

Introduction

Labour force participation is a crucial indicator of a nation's economic vitality and social progress. It can be used to predict the level of a nation's level of economic development (Thaddeus et al., 2022). In the context of Nigeria, a nation marked by a diverse socio-economic landscape, understanding the drivers that shape labour force participation patterns is paramount.

Nigeria's labour market is characterised by a myriad of challenges and opportunities stemming from its vast population and rich natural resources (Ogwumike et al., 2006; Uduji & Okolo-Obasi, 2022) studies shows that poor households depend heavily on labour income; while the size of labour income depends on age-structure, sex, prospects of employment and wage rate. However, a nuanced understanding of the determinants of labour force participation in this complex

environment remains limited. Despite the existing body of literature on labour markets, employment, and economic growth, the intricate interplay of factors influencing labour force participation in Nigeria requires closer examination. The existing literature offers valuable insights into individual drivers of labour force participation. For instance, studies by Faridi, Malik, and Basit (2009) and Agwu et al. (2014) depicts that educational qualification raises the job opportunities of the entire individuals especially for females which underscored the significance of educational attainment in influencing employment prospects. Similarly, Sajid, Abdullah and Chik (2020) highlighted the role of infrastructure development, such as access to electricity, in promoting economic activities and labour force engagement. Meanwhile, Maurer and Potlogea (2021) shed light on the potential economic stimulus generated by oil revenue, emphasising its potential effects on job creation and labour force participation. While these studies offer key insights, they often focus on isolated factors and fail to provide a comprehensive understanding of the interdependencies among various determinants of labour force participation. This gap in the literature underscores the need for a multi-variable analysis that takes into account the complex interactions among variables such as access to electricity, oil revenue, educational enrollment, and unemployment rates.

Furthermore, the existing research landscape has primarily examined labour force participation through linear regression models, assuming normality and homoskedasticity in the data. However, the realities of complex economies like Nigeria's often challenge these assumptions. Non-linear relationships, serial correlation, and heteroskedasticity may distort findings and limit the accuracy of conclusions drawn from traditional regression methods. In light of these challenges, the study was designed mainly to comprehensively examine the drivers of Total Labour Force Participation Rate (TLFPR) in Nigeria using robust statistical techniques and a multi-variable analysis approach. However, specific objectives were to: assess the impact of access to electricity (AE) on TLFPR; analyse the relationship between Oil Revenue (OR) and TLFPR; examine the effect of Total Secondary School Enrollment (TSSE) on TLFPR; evaluate the relationship between Total Unemployment (TU) and TLFPR. By addressing this gap, this study provided a more nuanced and accurate understanding of the drivers shaping labour force participation dynamics in the country, contributing to informed policy-making and fostering inclusive economic growth. Hence, this study addressed the multifaceted question of what factors influence labour force participation in Nigeria through a rigorous quantitative multi-variable analysis.

Labour Force Participation Rate

The relationship between electricity access (AE), oil revenue (OR), total secondary school enrollment (TSSE), total unemployment (TU), and the total labour force participation rate (TLFPR) is a complex and nuanced one, shaped by various economic, social, and policy factors. Firstly, electricity access (AE) plays a pivotal role in influencing labour force participation. Improved access to electricity enhances productivity by facilitating the operation of businesses and industries, which can create job opportunities. It also encourages entrepreneurship, as reliable electricity enables the establishment of small-scale enterprises. Consequently, greater electricity access tends to correlate positively with labour force participation through economic growth and job creation. Secondly, oil revenue (OR) can have both positive and negative effects on labour market dynamics. On one hand, a substantial influx of oil revenue can boost government spending on social programmes and infrastructure, including education. This potentially leads to higher enrollment rates in secondary schools (TSSE), which can, in turn, influence labour force participation. However, the over-dependence on oil revenue can also result in economic instability and volatility, affecting employment opportunities. Additionally, excessive reliance on oil can hinder the development of other sectors, potentially leading to unemployment (TU) and under-employment issues that may negatively impact participation in labour force.

Thirdly, education through total secondary school enrollment (TSSE) is a critical determinant of labour force participation. Higher enrollment rates can lead to a more educated workforce, which tends to have better employment prospects and higher labour force participation rates. Education equips individuals with the skills and knowledge needed to access a wider range of job opportunities. However, the impact of school enrollment on TLFPR can be delayed, as it takes time for the educated population to enter the labour force. In essence, total unemployment (TU) may have a direct and immediate effect on TLFPR. When unemployment rates are high, individuals who are unable to find jobs are discouraged from participating in the formal labour force, resulting in a lower TLFPR. Conversely, lower unemployment rates tend to encourage more people to actively seek employment, thereby increasing TLFPR. The relationship between electricity access (AE), oil revenue (OR), total secondary school enrollment (TSSE), total unemployment (TU), and the total labour force participation rate (TLFPR) is multifaceted. It depends on various contextual factors, including government policies, economic stability, and the extent of development in each of these areas. The subsequent reviews border on the influence of each variable on total labour force participation.

The Impact of Access to Electricity on Total Labour Force Participation

Hwang and Yoon (2021) conducted a study with a focus on rural China in order to examine the effects of rural electrification on women's labour force participation. The findings added a layer of complexity to the relationship between electricity access and labour force engagement. Despite the widespread availability of electricity, it did not appear to correlate with an increase in non-agricultural waged labour for women. However, rural electrification did have a discernible influence on women's involvement in unpaid, non-agricultural family endavours. This suggested that electricity access may shape women's economic activities within their households and families, rather than directly impacting their participation in the formal labour market.

Additionally, Sajid, Abdullah, and Chik (2020) emphasised the critical role of electricity access in empowering women and enhancing their participation in the labour force, particularly in rural areas. The authors highlighted how electricity access facilitated educational initiatives and skill development among women. It was noted that the introduction of electric appliances, made possible by electricity access, alleviated household burdens, which, in turn, created opportunities for paid employment. The study underscored that electricity access fosters a harmonious balance between women's domestic and professional roles. In a similar vein, some scholars conducted a study in Nigeria, revealing that electricity access significantly influenced labour market outcomes. Specifically, their findings demonstrated a 7% decrease in agricultural employment and a simultaneous 15% increase in non-agricultural employment when accounting for electricity access (Tagliapietra et al., 2020). This suggests that expanding access to electricity to previously unconnected households could play a crucial role in boosting overall labour market engagement and reducing the country's reliance on agriculture. In sum, while these studies made important contributions to our understanding of the impact of access to electricity on female labour force participation, there is a clear need to broaden the scope of research to encompass total labour force participation, transcending gender-specific analyses. Such comprehensive research can provide a deeper and more nuanced perspective on the complex relationship between electricity access and labour force engagement, benefiting both men, women and even youths in society.

Petroleum-based Economy and Labour Force Participation

The relationship between a petroleum-based economy and total labour force participation is a subject of interest in various studies, particularly in regions like the Middle East and North Africa (MENA), where oil income often plays a significant role in economic development. Several studies

have sought to understand the complex dynamics between oil revenue and labour force participation. Solati and Solati (2017)'s study in the Middle East and North African (MENA) region challenged the conventional expectation of a direct association between oil income and Labour Force Participation (LFP). Contrary to this assumption, the findings suggested that oil income did not serve as the primary driver for the low rates of female labour force participation in these countries. Instead, factors such as basic education and fertility rates were identified as more influential determinants. The study further emphasised the role of societal norms and patriarchal cultures in shaping female labour force participation rates, indicating that these cultural factors hold more sway than the presence of oil income.

In another examination of labour participation in the MENA region, Majbouri (2017) considered the influence of Islamic family law on labour force participation. The study found that in nations governed by Islamic family law, the impact of per capita oil and gas rents on reducing female labour force participation rates was more pronounced compared to countries without such legal frameworks. This observation highlights the interplay between legal and economic factors in shaping labour force outcome and suggests that the legal framework can magnify the effects of oil wealth on labour force participation. Additionally, Maurer and Potlogea (2021) contribute to this discourse by exploring the broader relationship between oil wealth and labour force participation. Their findings indicated an overall positive impact of oil wealth on labour force participation, particularly among single women. This suggests that the presence of oil wealth can create employment opportunities and economic conditions that encourage women to enter the labour force.

Collectively put, the studies above highlighted the intricate relationship between oil revenue and labour force participation, particularly in the context of the MENA region. While the economic benefits of oil income are evident, its direct impact on labour force participation, especially for women, is influenced by various factors including cultural norms, legal frameworks, and individual circumstances. Understanding these dynamics is essential for crafting policies and strategies that promote inclusive labour force participation in petroleum-based economies.

Education and Labour Force Participation

The nexus between education, specifically school enrollment, and labour force participation is a crucial determinant of an individual's economic prospects and a nation's workforce productivity. Education serves as a foundational pillar for human capital development, shaping individuals' skills, knowledge, and abilities. School enrollment rates, which reflect the percentage of children and young adults attending formal education institutions, have a profound impact on labour force participation. Firstly, higher school enrollment rates are associated with a more educated and skilled workforce. As individuals receive formal education, they acquire the necessary skills and qualifications to secure better job opportunities. This, in turn, leads to higher labour force participation rates as more people are motivated and equipped to seek employment. Secondly, education often extends an individual's potential career span. With better education, individuals are more likely to pursue higher levels of education, leading to specialised skills and qualifications that can increase their employability. Consequently, they are more likely to participate in the labor force over a more extended period, delaying retirement and contributing to economic growth.

Furthermore, education can foster a culture of lifelong learning and adaptability, which is essential in today's rapidly changing job market. Educated individuals are more likely to engage in continuous skill development and stay relevant in their careers, resulting in sustained labour force participation. Additionally, education plays a vital role in reducing inequalities in labour force participation. It provides opportunities for marginalised groups, including women and minorities, to access the labour market, thereby increasing overall workforce diversity and inclusivity. Fundamentally, the

relationship between education, particularly school enrollment, and labour force participation is undeniable. Education empowers individuals with the skills and knowledge needed to access employment opportunities, extend their careers, and adapt to changing economic conditions. Moreover, it contributes to a more equitable and diverse workforce, ultimately driving economic growth and development. Thus, investments in education and efforts to improve school enrollment rates are essential for building a robust and sustainable labour force.

The research conducted by Agwu, Nwankwo, and Anyanwu (2014) centered on agricultural labour participation in Abia State, Nigeria, with a primary aim to investigate the factors influencing youth engagement in agricultural labour. Their findings revealed several noteworthy trends, including negative relationships between participation and factors such as education, income from non-agricultural sources, parental occupation, paternal education, and mechanisation. In contrast, a study by Faridi, Malik, and Basit (2009) uncovered a positive correlation between overall educational attainment and female labour force participation. Moving beyond Nigeria, Lim, Abdul Rahman, and Arsad (2021) delved into the impact of labour force factors on Labour Force Participation Rates (LFPR) from a gender perspective across states in Malaysia for the years 2011 to 2016. The authors found that factors such as being outside the labour force, non-marital status, and higher education levels were associated with a decrease in male LFPR. For the determinants of female LFPR, it was revealed in another study that factors such as unemployment, widowhood, being outside the labour force, and among others were linked to a decreased female LFPR. Essentially, the above studies underscored the role of education in influencing labour force participation, with distinct relationships emerging between different education levels and LFPR for both males and females in these contexts.

In a study, a group of researchers (Sorsa et al., 2015) explored the intricacies of female labour force participation in India and uncovered a perplexing trend. Contrary to conventional expectations, they found that as education and income levels increased among women, female labour force participation actually decreased. This unexpected finding raised questions about the factors beyond education and income that might be influencing women's participation in the labour force. Notably, while the study identified this trend, it did not delve deeply into the specific impact of electricity access on this phenomenon.

Unemployment and Labour Force Participation

Unemployment can have a significant influence on labour force participation, as it directly affects individuals' decisions to either participate in the labour market or withdraw from it altogether. Unemployment has the potential to affect the level of labour force participation, which measures the proportion of the working-age population either working or actively looking for work, through various channels. These different pathways illustrate how unemployment can shape labour force participation rates. Firstly, the fear of unemployment can discourage individuals from actively seeking work and, consequently, lead to a decline in labour force participation. When job prospects are bleak, people may become discouraged and stop looking for work altogether, causing them to be classified as "discouraged workers." These individuals are no longer counted in the labour force, artificially lowering the labour force participation rate. Secondly, long-term unemployment can erode an individual's skills and work readiness. Prolonged periods of unemployment may lead to skills deterioration or obsolescence, making it increasingly difficult for individuals to re-enter the workforce. This skill atrophy can be a significant deterrent for people considering returning to work, further reducing labour force participation.

Furthermore, unemployment can have a cascading effect on labour force participation within households. If one member of a household loses their job, it can put financial strain on the entire

family. In response, other members may choose to leave or postpone their entry into the labour force to take on caregiving responsibilities or support the unemployed member. This phenomenon can particularly impact women, who often bear a disproportionate burden of caregiving responsibilities, leading to gender disparities in labour force participation rates. Additionally, the overall economic climate plays a crucial role in labour force participation. During economic downturns, when unemployment rates are high, individuals may be more inclined to stay in school, retire early, or rely on other sources of income, such as social assistance programmes. These choices can affect labour force participation rates, as people may temporarily exit the labour market until conditions improve. In brief, unemployment can significantly influence labour force participation rates in multiple ways. It can discourage job seekers, lead to skill erosion, affect household decisions, and be impacted by broader economic conditions. Policies aimed at addressing unemployment and providing support to those affected can play a vital role in maintaining healthy labor force participation rates and promoting economic stability.

Several studies have explored the relationship between unemployment and labour force participation, each offering unique insights and potential policy implications. Österholm's study in 2010 focused on Sweden and found a significant and long-term relationship between unemployment and labour force participation. This discovery challenged the Unemployment Invariance Hypothesis (UIH), suggesting that changes in labour force participation can impact unemployment rates in the country (Österholm, 2010). The study highlighted implications for economic policy and the need for further research in labor economics. The study conducted by Altuzarra et al. in 2019 delved into the intricate relationship between the unemployment rates (UR) and the labour force participation rate (LFPR) in Spain, with a specific focus on gender differences. Their findings offered valuable insights and policy implications. Notably, the research reveals that, for the aggregate population and male individuals in Spain, there is no discernible long-term relationship between UR and LFPR. In simpler terms, changes in labor force participation among these groups do not seem to significantly influence their unemployment rates over time, aligning with the Unemployment Invariance Hypothesis (UIH).

Tansel et al. (2016)'s study examined Turkey and indicated that there was no long-run relationship between labour force participation and unemployment rates in the Turkish context. This suggests that the dynamics between these two variables in Turkey differed from those observed in other countries, such as Sweden and Spain. Lastly, Emerson (2011)' s study centred on the United States of America and presented compelling evidence demonstrating the presence of a long-term equilibrium relationship between labour force participation rates and unemployment in the country. This finding suggested that changes in labour force participation could indeed have a long-term impact on unemployment rates. In conclusion, the reviewed studies collectively provide varying insights into the relationship between unemployment and labour force participation across different countries, emphasising the importance of considering country-specific and gender-specific dynamics when analysing this relationship.

Methods and Source of Data

This section delineates the methodology underpinning the research endeavour. It sought to scrutinise the forces steering labour force participation in the country through a comprehensive analysis using robust statistical techniques. The dataset, sourced from the World Bank report on Human Development Indicators (HDI), spans from 2000 to 2020, capturing a significant temporal scope. The author adopted a well-grounded *ex post facto* research design framework. This design is suitable for investigating relationships between variables in a retrospective manner, aligning with the study's objectives to explore the drivers of labour force participation over a specified timeframe. Meanwhile, the filter criteria for the data inclusion encompassed the years 2000 to 2020, reflecting

a judicious choice made to ensure consistent data availability and relevance. As shown in Table 3, the research sample comprised 21 observations years after these adjustments except one variable, maintaining statistical robustness and integrity. The study utilised multiple linear regression techniques to carry out the statistical analysis.

Variable Measurement

The proxies for "drivers of labour force" were: Access to Electricity (AE), Oil Revenue (OR), Total Secondary School Enrollment (TSSE), and Total Unemployment (TU). Meanwhile, labour force participation was denoted by Total Labour Force Participation Rate (TLFPR).

Model Specification

The model for "exploring the drivers of labour force participation in Nigeria: a multi-variable analysis" is functionally stated thus:

$$TLFPR = f(AE + OR + TSSE + TU) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{ 1 (Model)}$$

$$TLFPR = \beta_0 + \beta_1 \times AE + \beta_2 \times OR + \beta_3 \times TSSE + \beta_4 \times TU + \mu_t \ldots\ldots\ldots\ldots\ldots\ldots \text{ 2 (Model)}$$

Where:

TLFPR=Total Labour Force Participation Rate (outcome variable)

β_o = a constant

β_1- β_4 = Coefficients of the predictor variables

AE= Access to Electricity (independent variable)

OR= Oil Revenue (independent variable)

TSSE= Total Secondary School Enrollment (independent variable)

TU= Total Unemployment (independent variable)

To assess the underlying assumptions of a linear regression, the study employed diagnostic tests to validate the model's reliability and accuracy. The Jarque-Bera test for normality was used to scrutinise the distributional properties of the residuals. Additionally, Multicollinearity using Variance Inflation Factor (VIF) was assessed, ensuring the independence of predictors for unbiased coefficient estimation. The evaluation of serial correlation was pivotal. Consequently, Breusch-Godfrey Serial Correlation LM Test was administered to detect the presence of serial correlation in the residuals. The identified serial correlation substantiated the adoption of Robust Least Squares regression. This approach, equipped with robust standard errors, effectively mitigated the potential issue of serial correlation, ensuring the reliability of the coefficient estimates.

As a part of model specification, the study leveraged the Ramsey RESET test to ascertain whether additional variables should be included to enhance the model's explanatory power. Also, addressing heteroskedasticity concerns, the heteroskedasticity test using Breusch-Pagan-Godfrey was conducted, underpinning the robustness of the results and inferences. In summation, this methodology encapsulated a comprehensive approach that aligns with the research's objectives and the characteristics of time series data. In essence, the adopted *ex post facto* research design

harmonised with the study's retrospective nature, and the rigorous diagnostic tests and techniques, including robust regression, fortify the integrity of the analysis.

Results

The provided correlation matrix in Table 1 below revealed valuable insights into the relationships among the variables: Total Labour Force Participation Rate (TLFPR), Access to Electricity (AE), Oil Revenue (OR), Total Secondary School Enrollment (TSSE), and Total Unemployment (TU). When analysing the matrix and applying a correlation coefficient threshold of 0.80, as recommended by Hair, Tatham and Anderson (2005), Garson (2012) and Owumi and Eboh (2022), numerous variable pairs exhibit correlations that either meet or surpass this established threshold. For instance, the correlation coefficient of 0.79 between Access to Electricity (AE) and Total Secondary School Enrollment (TSSE) indicates a robust positive linear relationship between these variables. Similarly, the correlation coefficient of 0.55 between AE and Total Unemployment (TU) highlights a moderate positive linear relationship. Perhaps most notably, the correlation coefficient of -0.85 between Total Labour Force Participation Rate (TLFPRF) and Access to Electricity (AE) signifies a strong negative linear relationship between these two variables.

The presence of correlation coefficients surpassing the 0.80 threshold raises concerns regarding multicollinearity. Multicollinearity arises when independent variables are highly correlated, which can lead to challenges in discerning the individual impacts of these variables within a regression model. Given these findings, it is advisable to conduct further investigations into multicollinearity using methods like Variance Inflation Factors (VIF). Should multicollinearity be confirmed, appropriate actions, such as variable transformation or removal, may be warranted to mitigate potential repercussions on the reliability and interpretability of regression models. Addressing multicollinearity is crucial for ensuring the robustness of the statistical analyses and the credibility of the derived insights.

Table1: Test for Multicollinearity Using Pairwise Correlation Matrix

	TLFPRF	AE	OR	TSSE	TU
TLFPRF	1				
AE	-0.85	1			
OR	-0.19	0.58	1		
TSSE	-0.76	0.79	0.69	1	
TU	-0.65	0.55	-0.06	0.17	1

Source: Author's Computation Using EViews 10

Variance Inflation Factor (VIF) Test for Multicollinearity

The Variance Inflation Factor (VIF) quantifies the extent to which multicollinearity affects the variance of the estimated regression coefficients. It computes the ratio of the variance of a coefficient when multiple predictors are included in the model to the variance of that coefficient when it's the only predictor. A VIF value above 10 is generally considered indicative of a potential issue with multicollinearity. Given that VIF values above 10 typically raise concerns about multicollinearity, the observed VIF values in this case may not be alarming and shown in Table 2.

Table 2: Assessment of Multicollinearity Using Variance Inflation Factor (VIF)

Date: 08/11/23. Time: 14:02			
Sample: 2000-2020			
Included observations: 17			
	Coefficient	**Uncentered**	**Centered**
Variable	**Variance**	**VIF**	**VIF**
C	3.47E-25	256.7011	NA
AE	3.83E-28	728.7147	6.216584
OR	6.78E-34	13.55228	2.415081
TSSE	8.18E-29	96.15958	3.997536
TU	2.09E-27	31.94608	2.525262

Source: Author's Computation Using E-Views 10

Assessment of Normal Distribution in the Context of Labor Force Participation and Socioeconomic Indicators in Nigeria

To determine whether the data approximately follows a normal distribution, the researcher analysed the skewness, kurtosis, and performed a Jarque-Bera test. These statistics helped to assess the departure of the data from a normal distribution. In the context of Ordinary Least Squares (OLS) regression, the assumption of normally distributed residuals is important for valid statistical inference. In this study, the normal distribution characteristics of variables associated with labor force participation and key socioeconomic indicators in Nigeria was examined. These variables included the Total Labour Force Participation Rate (TLFPR), Access to Electricity (AE), Oil Revenue (OR), Total Secondary School Enrollment (TSSE), and Total Unemployment (TU). To evaluate the normality distribution of the variables and to ascertain whether the prerequisite of a normal distribution, essential for OLS regression, was upheld, the researcher scrutinised key statistical measures including skewness, kurtosis, and the Jarque-Bera test. Skewness values serve as indicators of distribution symmetry, with a value of 0 denoting perfect symmetry. A positive skewness signifies a distribution skewed to the right (tail on the right), while negative skewness indicates a distribution skewed to the left (tail on the left). In contrast, kurtosis values of 3 are characteristic of a normal distribution. Values surpassing 3 denote heavier tails and a more peaked distribution (leptokurtic), whereas values below 3 indicate lighter tails and a flatter distribution (platykurtic).

The Jarque-Bera test, which investigates both skewness and kurtosis, was employed to gauge the conformity of a variable to a normal distribution. This test calculates a statistic and contrasts it against a critical value, with a significant divergence from zero in the test statistic suggesting a departure from normality. Upon analysis, the results indicated important insights into the normality assumptions of the studied variables. The Total Labour Force Participation Rate (TLFPR) in Table 3 revealed a p-value of 0.437763, suggesting that its distribution is not significantly different from a normal distribution. Similarly, the variables Access to Electricity (AE) and Oil Revenue (OR) exhibit p-values of 0.571562 and 0.764437, respectively, implying that their distributions closely aligned with normality. Total Secondary School Enrollment (TSSE) further supported this trend with a p-value of 0.860685, indicating a reasonable adherence to a normal distribution. However, it is important to note that the Total Unemployment (TU) variable presents a contrasting pattern. With a p-value of 0.042092, its distribution significantly deviated from the normal distribution assumption. This departure underscored the need for caution when making assumptions about the normality of the Total Unemployment variable. So, it can be deduced that the normality assumption required of engaging OLS has been challenged here. This necessitated the adoption of the Robust Least Squares regression technique.

In the nutshell, the findings from this analysis shed light on the normal distribution characteristics of the studied variables. While TLFPR, AE, OR, and TSSE appear to reasonably adhere to a normal distribution, the distribution of Total Unemployment (TU) notably stands out. Acknowledging these distinctions is crucial for accurate statistical interpretation and modeling, reinforcing the reliability of insights drawn from the dataset.

Table 3: Descriptive Statistics and Normality Test

	TLFPR	AE	OR	TSSE	TU
Mean	58.29588	51.19642	4597.496	39.01387	4.987381
Median	58.40606	52.20000	4732.501	39.23280	3.882000
Maximum	60.99928	59.30000	8878.970	56.20540	9.714000
Minimum	53.85224	43.12146	1230.851	24.60941	3.700000
Std. Dev.	2.123492	4.627795	2116.065	8.375362	2.025359
Skewness	-0.682901	-0.209753	0.174475	0.081595	1.345167
Kurtosis	2.316598	1.949951	2.298421	2.369942	3.055132
Jarque-Bera	1.652153	1.118766	0.537232	0.300053	6.335818
Probability	0.437763	0.571562	0.764437	0.860685	0.042092
Sum	991.0300	1075.125	96547.43	663.2358	104.7350
Sum Sq. Dev.	72.14748	428.3297	89554650	1122.347	82.04160
Observations	17	21	21	17	21

Source: Author's Computation Using E-Views 10

The Ramsey RESET test is used to check the adequacy of a regression model by examining whether adding non-linear terms of the predicted values (fitted values) of the dependent variable improves the model's fit. It helps to identify potential misspecification of the model. The Ramsey RESET Test results suggested that there was evidence to consider including additional powers of the fitted values (such as squared fitted values) in the model. Specifically, the Likelihood ratio test p-value of 0.2235 indicates that there was no significant indication that including squared fitted values would enhance the model's ability to capture potential non-linearity in the relationship between the independent variables (AE, OR, TSSE, TU) and the dependent variable (TLFPR) in the specified context of this study. However, it is important to note that the F-test p-value of 0.3384 did not support the inclusion of squared fitted values at a conventional significance level of 0.05. This suggests that the evidence for improvement from including squared fitted values is weak. In essence, while the Ramsey RESET Test results did not provide strong evidence for the inclusion of squared fitted values to enhance the model's fitness, it is crucial to recognise that model adequacy relies not only on statistical tests but also on theoretical understanding and practical considerations related to the specific variables and research context.

Moreover, the Breusch-Pagan-Godfrey test involves testing whether there is a relationship between the squared residuals and the explanatory variables in the model. If the p-value associated with any of these statistics is below 0.05 significance level, then it might be concluded that there is heteroskedasticity in the model. In this study, the p-values for all the statistics are significantly above 0.05 (e.g., 0.7786, 0.7049, 0.8742), indicating that there was no enough evidence to reject the null hypothesis of homoskedasticity. This suggested that there was no significant problem of heteroskedasticity in the model based on the results of the Breusch-Pagan-Godfrey test. Similarly, the Breusch-Godfrey Serial Correlation LM Test was conducted. It is a statistical test used to detect the presence of autocorrelation (serial correlation) in the residuals of a regression model. Autocorrelation refers to the correlation between the current value of a variable and its past values at different lags. In the context of regression analysis, it means that the error terms (residuals) of the model are correlated with each other over time.

In this study, the F-statistic in Table 4 was 5.551177, which indicated that there might be serial correlation present. The associated probability value (Prob. F) was 0.0239, which was below 0.05 level of significance. The p-value was compared to a chosen significance level of 0.05 to determine whether to reject the null hypothesis. If the p-values associated with the F-statistic and Chi-Square tests are both below the chosen significance level of 0.05, there would be evidence to reject the null hypothesis. This suggests that there is autocorrelation in the residuals, meaning that the error terms are correlated over time. If the p-values are above the significance level, there would not be sufficient evidence to reject the null hypothesis, suggesting that there might not be significant autocorrelation present in the residuals. On this note, the Ordinary Least Square regression assumption of no autocorrelation has been violated hence the adoption of Robust Least Squares (RLS) regression technique to correct the pitfall.

The adoption of Robust Least Squares regression can be a reasonable approach to mitigate the effects of autocorrelation indicated by the Breusch-Godfrey Serial Correlation LM Test. However, it's also important to consider the severity of the autocorrelation, the nature of your data, and the goals of your analysis. If autocorrelation is a major concern and the data is time series data, it might be worth exploring specialized time series techniques for a more comprehensive treatment of the autocorrelation issue.

Table 4: Model Specification, Heteroskedasticity and Autocorrelation Tests

S/N	Types of Diagnostic test	F-Test	P-Value
1	Ramsey RESET Test for Model Specification	1.001720	0.3384
2	Heteroskedasticity Test: Breusch-Pagan-Godfrey	2.167697	0.7786
4	Breusch-Godfrey Serial Correlation LM Test:	Prob.F(2,10): 5.551177	Prob.Chi- Square(2): 0.0239

Source: Author's Computation Using E-Views 10

Interpretation of Descriptive Statistics for Labor Force Participation and Socioeconomic Indicators in Nigeria

Table 5 provides a comprehensive set of descriptive statistics that offer insights into variables related to labour force participation and socioeconomic indicators in Nigeria. Key statistics include the mean, maximum, and minimum values, each of which contributes to a deeper understanding of the data's central tendencies, ranges, and implications. The mean, or average, is a fundamental statistic that indicates the arithmetic average of a dataset. In this context, it provided an insight into the typical value around which the data points tend to centre. For example, the mean Total Labour Force Participation Rate (TLFPRF) of approximately 58.30 signifies the average participation rate across the examined cases. This value serves as a central reference point and can be considered a representative measure of the dataset's central tendency.

The maximum and minimum values denote the upper and lower limits of the data distribution, respectively. They illustrate the range within which the data points vary. The maximum Total Unemployment (TU) value of 9.714 represents the highest unemployment rate observed in the dataset, indicating the upper boundary of unemployment levels. Conversely, the minimum Oil Revenue (OR) value of 1230.851 signifies the lowest recorded revenue during the reviewed period (2000-2020), highlighting the lowest point within the range. These values provide insights into the variability and extremities present in the dataset.

The implications of the foregoing are that, the mean encapsulates the typical value for each variable, aiding in understanding the average scenario for each indicator. The maximum and minimum values

offer insights into the upper and lower limits of the observed data points, providing a sense of the dataset's overall spread. These statistics collectively contribute to characterising the distribution and behaviour of the variables. Such insights are pivotal for making informed decisions in policy-making, research, and strategic planning, allowing stakeholders to grasp the central tendencies and extremities of the variables under examination. The implications of these statistics guide subsequent analyses, help identify potential outliers, and inform strategies aimed at managing the variables for socioeconomic progress.

Regression Results

The regression analysis examined the relationship between the Total Labour Force Participation Rate (TLFPR) in Nigeria and several independent variables, including Access to Electricity (AE), Oil Revenue (OR), Total Secondary School Enrollment (TSSE), and Total Unemployment (TU). Robust Least Squares with M-estimation, incorporating specific weighting and scaling methods, was employed for this analysis. The results indicated that the intercept term was significantly different from zero, with a coefficient of 75.00434 and a high z-statistic of 12.92471. This implies that, while considering all other factors constant, a one-unit increase in the baseline level of the Total Labour Force Participation Rate leads to an increase of 75.00434 units in TLFPR.

However, Access to Electricity (AE) did not appear to have a statistically significant relationship with TLFPR, as indicated by its coefficient of -0.216785 and a p-value of 0.2612. In practical terms, this means that a one-unit increase in Access to Electricity does not have a statistically significant impact on the Total Labour Force Participation Rate. In contrast, Oil Revenue (OR) showed a likely connection, with a coefficient of 0.000623 and a p-value of 0.0151. This suggests that a one-unit increase in Oil Revenue is associated with an increase of 0.000623 units in the Total Labour Force Participation Rate, and this relationship is statistically significant at the 0.05 significance level. Similarly, Total Secondary School Enrollment (TSSE) displayed a statistically significant relationship, with a coefficient of 0.194391 and a p-value of 0.0292. This implies that a one-unit increase in Total Secondary School Enrollment leads to an increase of 0.194391 units in the Total Labour Force Participation Rate, and this relationship is statistically significant at the 0.05 significance level. Nonetheless, Total Unemployment (TU) appeared to lack a significant relationship, as its coefficient was -0.256802, and the p-value was 0.5683. In practical terms, this means that a one-unit increase in Total Unemployment does not have a statistically significant impact on the Total Labour Force Participation Rate.

The analysis yielded an R-squared of 0.460504, implying that the model explained around 46.05% of TLFPR variability, while Adjusted R-squared is 0.280671. These results underscore the potential significance of Oil Revenue and Secondary School Enrollment but suggest a non-significant role for Access to Electricity and Total Unemployment in explaining TLFPR in Nigeria.

Table 5: Robust Least Squares Regression Analysis Results for Exploring the Drivers of Labour Force Participation in Nigeria

Method: M-estimation				
M settings: weight=Bisquare, tuning=4.685, scale=MAD (median centered)				
Huber Type I Standard Errors & Covariance				
Variable	**Coefficient**	**Std. Error**	**z-Statistic**	**Prob.**
C	75.00434	5.803171	12.92471	0.0000
AE	-0.216785	0.192962	-1.123464	0.2612
OR	0.000623	0.000257	2.429378	0.0151
TSSE	0.194391	0.089127	-2.181064	0.0292
TU	-0.256802	0.450103	-0.570541	0.5683
	Robust Statistics			
R-squared	0.460504	Adjusted R-squared		0.280671
Rw-squared	0.852189	Adjust Rw-squared		0.852189
Akaike info criterion	31.98587	Schwarz criterion		36.81886
Deviance	16.24087	Scale		0.846728
Rn-squared statistic	31.00254	Prob(Rn-squared stat.)		0.000003

Source: Author's Computation Using E-Views 10

$$TLFPR = 75.00434 - 0.216785 \times AE + 0.000623 \times OR + 0.194391 \times TSSE - 0.256802 \times TU$$

Discussion of Findings

Interestingly, the relationship between Access to Electricity (AE) and TLFPR was not found to be statistically significant. The presented finding aligns with a study conducted in rural China, which similarly failed to establish a clear association between increased access to electricity and women's participation in the formal labour market. Nonetheless, this result reaffirms the expectations set forth by studies emphasising the critical role of basic infrastructure, including electricity, in promoting economic activities and encouraging labour force engagement, as highlighted by Sajid et al. (2020) and Tagliapietra et al. (2020). Meanwhile, a positive relationship was noticed between Oil Revenue (OR) and TLFPR. This finding echoes a previous research that has pointed to the potential economic stimulus generated by oil revenue and its cascading effects on job creation and labour force participation (Maurer & Potlogea, 2021). The positive coefficient supports the notion that oil revenues can contribute to job growth, thereby bolstering labour force engagement. A study in the Middle East and North African (MENA) region did not link an increase in labour force participation to oil income. This contradicts the current finding, which suggests that there might be such a link (Solati & Solati, 2017). Likewise, in the context of the MENA region, Majbouri (2017) argued that the influence of per capita oil and gas rents on lowering female labour force participation rates was more noticeable when compared to countries without such resources.

Furthermore, Total Secondary School Enrollment (TSSE) exhibited a statistically significant positive relationship with Total Labour Force Participation Rate (TLFPR). This result diverges from conclusions drawn in a couple of prior studies that associated higher levels of educational attainment with decreased labour force participation (Agwu et al., 2014; Sorsa et al., 2015). It also contrasts with a study in Malaysia that linked higher education to a decrease in male labour force participation (Lim et al., 2021).

Nevertheless, the finding that Total Secondary School Enrollment (TSSE) exhibited a statistically significant relationship with the Total Labour Force Participation Rate (TLFPR) aligns with the expectations established by previous research. Several studies, including those conducted by Faridi

et al. (2009) and Solati & Solati (2017), have underscored the pivotal role of education in improving employability, thereby fostering higher levels of participation in the labor force. It is worth noting that while education holds the potential to enhance employability, certain cultural practices might impede the direct translation of education into a substantial increase in labour force participation, particularly among women. However, it is essential to recognise that this particular aspect falls outside the scope of the present study, which primarily focuses on the quantitative relationships between the specified variables. Further qualitative research or an exploration of cultural factors would be necessary to delve deeper into the nuanced dynamics of labour force participation in this context.

Surprisingly, Total Unemployment (TU) did not exhibit a significant relationship with total labour force participation. The result is consistent with that of Altuzarra et al. (2019) that found no discernible long-term relationship between unemployment rate (UR) and labour force participation in Spain. It also confirmed a previous study conducted in Turkey, which found that there is a disconnect between unemployment and labor force participation (Tansel et al. 2016). However, it contradicts a study in Sweden that established a significant and long-term relationship between unemployment and labour force participation in the country (Österholm, 2010). Emerson's study in the United States compellingly demonstrated a lasting equilibrium connection between labour force participation rates and unemployment in the country. The current study supports this prior research in the existing literature (Emerson, 2011).

In essence, the findings offered both insights and challenges as contextualised within the existing literature. While the significance of the intercept, Oil Revenue, and Total Secondary School Enrollment align with some theoretical expectations, the non-significant relationships of Access to Electricity and Total Unemployment raised intriguing questions about the interplay of various socio-economic factors in Nigeria's labour force dynamics. These disparities emphasise the need for nuanced analyses that consider local contexts, institutional frameworks, and potential interactions between variables to provide a comprehensive understanding of the labor force participation dynamics

Conclusion

In examining the intricate web of factors influencing labour force participation in Nigeria, this study has unearthed intriguing insights and challenges that add nuance to the existing literature. Notably, the non-significant relationship between access to electricity and total labor force participation calls attention to the intricate interplay of socio-economic variables in Nigeria's labour dynamics. While expectations rooted in infrastructure development literature were not entirely supported, it underscores the importance of considering localised factors and the specific context of Nigeria. Conversely, the positive relationship observed between oil revenue and labour force participation resonates with previous research, highlighting the potential economic stimulus of oil revenue and its positive impact on job creation and labour force engagement. This finding provides empirical evidence for the notion that oil revenues can foster job growth, thereby bolstering labour force participation, albeit contrary to some regional studies.

The positive relationship between education proxied by total secondary school enrollment and labour force participation, while consistent with some prior studies, reinforces the conventional wisdom linking higher education to increased labour force participation. However, it raises questions about the influence of cultural practices and other contextual factors that may hinder the direct translation of education into greater labour force engagement, particularly among women. Surprisingly, total unemployment exhibited no significant relationship with labour force participation, echoing findings from international studies and underscoring the complexity of labour dynamics. This result reinforces the importance of nuanced analyses that consider local contexts,

institutional frameworks, and potential interactions between variables in comprehending labour force participation dynamics in Nigeria. In the nutshell, the study underscores the multifaceted nature of labour force participation in Nigeria and emphasises the need for a holistic understanding that transcends simplistic assumptions. These findings provide valuable insights for policy-makers and researchers alike, serving as a call to further investigate the intricate socio-economic factors shaping Nigeria's labour landscape.

Recommendations

In light of the study's findings, several practical recommendations emerged for the Nigerian government and concerned stakeholders. These recommendations span diverse areas, including infrastructure development, economic diversification, education reform, gender inclusion, targeted unemployment solutions, entrepreneurship promotion, data enhancement, and a nuanced approach. By prioritising these measures, Nigeria can foster a more inclusive and robust labour force, ultimately contributing to its socio-economic development. They are enumerated thus:

1. Invest in Rural Electrification: Although our study did not find a statistically significant relationship between access to electricity and labour force participation, it is crucial for the government to prioritise rural electrification. Reliable access to electricity remains a fundamental infrastructure component that can stimulate economic activities and create opportunities for job growth, particularly in rural areas. Initiatives aimed at expanding the electricity grid and promoting renewable energy sources should be pursued vigorously.
2. Diversify the Economy: Given the positive relationship between oil revenue and labour force participation, it is advisable for Nigeria to diversify its economy beyond oil. Over-dependence on oil can be precarious due to price volatility and environmental concerns. Diversification efforts can include promoting non-oil sectors such as agriculture, manufacturing, and technology, which have the potential to generate employment and broaden labour force engagement.
3. Reform Education Policies: The positive relationship between total secondary school enrollment and labour force participation implies the need for a re-intensification of education policies. While education is essential, it is crucial to ensure that educational attainment aligns with employability and labour market demands to yield maximum labour force engagement in Nigeria. Policy-makers should focus on vocational and skills-based training programmes that equip individuals with practical skills needed for the workforce.
4. Tailored Unemployment Solutions: Since total unemployment did not exhibit a significant relationship with labour force participation, it is imperative to develop tailored unemployment solutions. This may involve creating targeted job training and placement programmes, improving labour market information systems, and offering financial incentives for job creation by businesses.
5. Enhance Data Collection and Research: To gain a deeper understanding of labour force dynamics in Nigeria, government agencies and research institutions should collaborate to enhance data collection efforts. Comprehensive and up-to-date data on labour force participation, unemployment, and education can inform evidence-based policy decisions.
6. Promote Entrepreneurship: Encouraging entrepreneurship can be a viable strategy for job creation and labour force engagement. Government support for small and medium-sized enterprises (SMEs), including access to credit, business training, and regulatory simplification, can stimulate entrepreneurial activity and reduce unemployment.

Incorporating these recommendations into policy planning and implementation can help Nigeria navigate its complex labour force landscape, promoting increased participation, economic growth, and improved livelihoods for its citizens.

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