Population Dynamics, Labour Force Participation and Economic Misery in Nigeria: An Empirical Investigation

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Abstract
Nigeria in recent years has been confronted with several development challenges, in addition to unstable macroeconomic environment. About 133 million of her population lives in multidimensional poverty, with high rates of unemployment (33.3%) and inflation (27.33%), coupled with increased public debt profile. All these have culminated into a deteriorating misery index (MI), which has risen from about to 61.15 in 2022 to around 73.05 in 2023, using the Steve Hanks misery index methodology. This study examined the effects of population dynamics and labour force participation on economic misery in Nigeria over the period, 1990-2022. It employed the Autoregressive Distributed Lag (ARDL) Bounds testing and Dynamic Ordinary Least Squares (DOLS) techniques for analysis. Having checked the time series properties of the variables employed in the study and establishing the existence of long-run cointegration among the variables, the ARDL and DOLS findings showed that population dynamics significantly aggravated economic misery while labour force participation rate, economic growth and capital formation reduced misery level significantly in Nigeria. Therefore, governments at all levels should invest in physical capital, encourage more labour force participation, and continue to grow the economy. Moreover, the high rate of fertility should be put in check through encouragement of the girl-child education policy while inflation and unemployment rates, which are the 'bads' that raise the MI should be checked using appropriate fiscal and monetary policies.

Keywords: misery index, population dynamics, labour force participation, Nigeria

JEL classification codes: I3, J1, J21, J24.

1. **Introduction**

Nigeria in recent years has been confronted with several development challenges in addition to unstable macroeconomic environment. About 133 million (63.0%) of her population lives in multidimensional poverty, with high rates of unemployment (33.3%) and inflation (27.33%), coupled with increased public debt profile, which has resulted in soaring debt-to revenue and debt-to GDP ratios (Dauda, 2022; World Bank, 2022 and 2023; DMO-Debt Management Office, 2023; National Bureau of Statistics-NBS, 2023; and Central Bank of Nigeria-CBN, 2023). All these have culminated into a deteriorating misery index (MI) of the country. Nigeria's MI, which was about 43.0 in 2018 rose to 55.0 in 2019, and thereafter escalated to 61.15 in 2022, making her people more miserable than in previous years (Adi, 2019; Ikpoto, 2023).

Currently, Nigeria's MI stands at about 73.05, using the Hanke's model (Ikpoto, 2023). In the misery report released by Steve Hanke, a John Hopkins University professor of applied economics, which covered 156 countries, Nigeria, was the 15th most miserable country worldwide in 2020; however, in 2021 she rose to the 11th position in 2021; thereby making her the "fourth most miserable country in Africa, only behind Sudan, Zimbabwe and Angola" (Ikpoto, 2023).

The worsening MI of the nation is not unconnected with the abysmal performances of some of the components of the index and other development indicators. For instance, Nigeria's rates of unemployment, inflation, and bank lending currently stand at 33.3%, 27.33%, and 18.75%, respectively (National Bureau of Statistics-NBS, 2023; Central Bank of Nigeria-CBN, 2023) while per capita gross domestic product (GDP) growth remains 1.18% (World Bank, 2023).

Studies on MI in Nigeria are scanty. The few that are available focus on: computation of MI (Tule, Egbuna, Dada and Ebuh, 2017), how fiscal policy affects MI (Anaele and Nyenke, 2021; Ubah *et al*., 2021; George-Anokwuru, 2022), Corruption and MI (Akinlo, 2022), and economic growth and MI relationship (Ubah *et al*., 2021), which neglect how MI and other important variables relate in the economy. Moreover, previous works in the literature generally fail to interrogate how demographic dynamics and labour force participation affect MI, which is the gap the present study tries to fill. In fact, literature search generally could not produce substantial studies on the importance of population dynamics and labour force participation rate in tackling misery in the economy, globally and particularly in Nigeria. Only Audi and Ali (2023), which compare how public policy can be employed to address economic misery in developed and developing economies included population variable. Addressing dynamics of population such as high rate of fertility and mortality can help to reduce misery while increasing labour force participation will raise income level, thereby offsetting the 'bads' in the Hanke's MI.

A cursory examination of Nigeria's demography shows the nation's population as at 2022 being 218.54 million, with a growth rate of 2.38% per annum while the country is projected to become the third largest globally by 2050 (Dauda, 2020; World Bank, 2023). Moreover, Nigeria's total fertility, adolescent fertility, birth, and labour force participation rates currently stand at 5.24, 102.22, 37.12 and 58.46, in that order (World Bank, 2023). A high population and its dynamics

as well as low labour force participation rate can aggravate misery. This further justifies the present work.

Thus, the current paper examines the impact of population dynamics and labour force participation on Nigeria's MI within the period 1990-2022, using the Autoregressive Distributed Lag (ARDL) and the Dynamic Ordinary Least Squares (DOLS) modelling approaches. It diverges significantly from the above works cited on the grounds of methodology and empirics in addition to the issues raised above.

1. Stylized Facts
2.1 Overview of Misery Index, Labour Force Participation Rate and Total Population for Nigeria, 1990-2022

Table 1: Five Years Average Values of Misery Index, Labour Force Participation Rate and Total Population of Nigeria, 1990-2022

Variable	**MI**	LFPR	TPP (Million)
1990-1994	102.07	60.44	100.26
1995-1999	87.21	60.13	113.86
2000-2004	71.76	60.07	129.69
2005-2009	66.35	60.26	148.42
2010-2014	68.37	57.95	170.12
2015-2019	76.01	57.76	193.57
2020-2022	74.50	58.45	213.42

Note: MI = Misery Index, LFPR = Labour Force Participation Rate, TPP = Total Population

Source: Computed by Author from World Bank (2023).

As evident in the Table, the average misery index for Nigeria has been fluctuating. It was highest in 1990-1994 period, with the value of 102.07 before a decline to 87.21 in 1995-1999. The decline was sustained till the period 2005-2009 at 66.35 before it rose to 68.37 in 2010-2014 and further to 76.01 in 2015-2019 before a slight reduction to 74.50 in 2020-2022. Labour force participation rate has fallen consistently since 1990 to 2019 before it rose marginally in 2020-2022 period. However, the nation's rising population persisted from an average of 100.26 million in 1990-1994 to 213.42 million within the year 2020-2022.

2. Brief Literature Review
The MI was introduced originally by Arthur Okun in the 1970's (Nessen, 2008), which was computed as the sum of current, seasonally adjusted unemployment and the current inflation rate. This was however extended by Barro (1999), which he referred to as the "Barro Misery Index" (BMI). His index was calculated as the addition of the rates of unemployment, inflation and interest with the difference between the actual and trend rate of GDP growth (GDP shortfall).

Barro's misery index was modified by Hanke (2011) in which he computed the index as addition of unemployment, inflation and bank lending rate minus real GDP per capita growth. According to Hanke, the first three elements are "bads" and make people miserable; whereas, the 'good' element (per capita GDP growth), helps to offset the 'bads'. With this, nations can be ranked based on their performance, with a higher MI indicating a higher level of misery.

Misery index is an important metric to determine the state of economic performance and wellbeing of individuals in the economy. Extant empirical literature does not contain much work on how population dynamics and labour force participation affect economic misery. A good number of available empirical studies revolve around misery index and economic growth relationship (Wang *et al.*, 2019; Akay and Oskonbaeva, 2020; Ubah *et al.*, 2021), fiscal policy and misery index (Anaele & Nyenke, 2021), life expectancy and misery index nexus (Ali, Audi & Roussel, 2021), corruption and misery index (Akinlo, 2022) among others, most of, which conclude that high level of MI is detrimental to economic and development outcomes.

With respect to economic growth and misery index nexus, Dadgar & Nazari (2018) examine how economic growth and governance affect misery index in Iran in a time series data, covering the period 1974–2011 and using vector autoregressive modeling approach. The authors discovered that economic growth reduced misery index significantly in the country. Consistent with this study is the work of Ubah *et al.* (2021) on Nigeria, which employed the ARDL approach. It was reported that economic growth has negative and statistically significant impact on misery index.

Moreover, two papers, Wang *et al.* (2019) and Akay and Oskonbaeva (2020) studied how misery index affects economic growth. On their part, Wang *et al.* (2019) focused on the economy of Pakistan within the period 1989-2017 to investigate the influences of financial structure and misery index on economic growth. However, Akay & Oskonbaeva (2020) in their panel study analysed the nature of interaction that exists between economic growth and misery index in 16 transition countries, using a Panel ARDL approach from 1996 to 2017. Both papers concluded that misery index deteriorated economic growth.

Regarding fiscal policy and misery index relationship, three studies; Anaele & Nyenke (2021), George-Anokwuru (2022) and Audi & Ali (2023) were found; out of which the first two are time series conducted on Nigeria while the third, a panel study compares how public policy can affect economic misery in both developed and developing economies. The findings of the papers converge; indicating that fiscal policy is important for reducing misery index. However, some fiscal policy measures (total tax revenue and domestic debt) reported by George-Anokwuru (2022) raised misery index in Nigeria.

Another area of empirical focus is how life expectancy and misery index relate. Literature search produced only one result, Ali, Audi & Roussel (2021). In this work, which studied the effect of urbanization and economic misery on average life expectancy in selected Middle East and North Africa (MENA) economies within the period 2001-2016, it was discovered that economic misery significantly reduced average life expectancy in MENA nations.

Furthermore, a study was found on the impact of the misery index on corruption in Nigeria (Akinlo, 2022), which reported a long-run relationship between misery index and corruption

within 1980–2018 in which misery index contributed to a surge in the level of corruption in both the short run and long run.

With respect to foreign direct investment and misery index connection, literature search produced three results, which overwhelmingly found an inverse relationship between both issues. For instance, Ditta and Hassan (2017) investigated the effect of economic misery among other variables on foreign direct investment (FDI) in Pakistan over the period of 1972- 2013. The study, which employed the ARDL approach, reported a negative but insignificant effect of misery index on FDI in the country. However, Abraham and Matthew (2019) found negative and statistically significant effect of misery index on FDI in Nigeria between 1981 and 2017. This finding is in consonant with that of Khan, Majeed and Asghar (2022) in Pakistan.

Aside from the above studies, economic misery and crime rate relationship has also been examined in empirical literature. For example, Ajide (2019) in his work on the effect of institutional quality and misery index on crime rate in Nigeria between 1986 and 2016, it was discovered that economic misery significantly increased the level of crime in Nigeria. Consistent with this finding is the result of a panel study conducted by Açcı and Çuhadar (2021) on a group of countries referred to as the Fragile Five (Brazil, Indonesia, India, South Africa and Turkey) from 2004 to 2017, using dynamic panel analysis. In this work, the authors found that misery index and its components (unemployment and inflation) contributed to rising crime rates in these countries.

Misery index and international tourism nexus has also been investigated. In a study produced by literature search, López (2022) in a Vector Autoregressive (VAR) model showed that misery index negatively impacted the number of outbound tourists in Mexico. However, no significant statistical effect of tourist departures was found on misery index.

Findings have also shown that misery index aggravated the level of poverty and income inequality in some economies. One panel study in Sub-Saharan Africa (SSA) (Nwani and Osuji, 2020) and a time series work in Iran (Korrani and Zia, 2023) confirmed this stance. Nwani and Osuji (2020) found that misery index significantly amplified poverty rate in 20 economies of SSA between 1990 and 2018. Korrani and Zia (2023) have also reported among other variables that between 1971 and 2019, misery index worsened income inequality in Iran.

Misery index and happiness relationship has also been studied. Blanchflower, Bell, Montagnoli and Moro (2014) and Arge (2022) examined this relationship in Europe within the periods 1975-2013 and 2004-2018, respectively. Both studies concluded that misery index significantly reduced the level of happiness in the continent within the study periods. Flèche and Layard (2017) also showed that mental illness has contributed to high misery index in USA, Australia, Britain and Germany.

Similarly, misery index has been reported to have increased human capital outflow in Pakistan (Ali *et al.*, 2015), bad governance raised economic misery in Iran (Dadgar and Nazari, 2018) while misery index has reduced remittances in Jamaica (Das, Brown and Mcfarlane, 2023), a country noted for high remittance inflows.

From the above empirical works, it is apparent that the focus of the present paper is not captured. In fact, none of the studies on misery index conducted in Nigeria (Abraham and Matthew, 2019; Ajide, 2019; Anaele and Nyenke, 2021; Ubah *et al*., 2021; Akinlo, 2022; George-Anokwuru, 2022), centre on the effects of population dynamics and labour force participation on misery index. In addition, a critical examination of the studies revealed that majority of them computed misery index using the Okun's methodology (Blanchflower, Bell, Montagnoli and Moro, 2014; Wang *et al.*, 2019; Akay and Oskonbaeva, 2020; Ali, Audi and Roussel, 2021; Açcı and Çuhadar, 2021; Ubah *et al*., 2021; Arge, 2022; Audi and Ali, 2023; Das, Brown and Mcfarlane, 2023), as against the Hanke's computation used in the current study. Okun's methodology for the computation of MI is justifiable for studies regressing MI on economic growth because other MI computation methodologies (e.g's Barro and Hanke's contained. Similarly, apart from the ARDL approach common to a good number of them, none of the works employed DOLS, which the current study combined with ARDL approach for robustness check. These arguments justify the present paper and make it unique.

3. **Methodology**

This study, which examines how population dynamics and labour force participation can operate to reduce MI in Nigeria, hinges on Hanke's MI equation. It however adopts and augments the model employed by Dadgar and Nazari (2018) in which economic growth and globalization variables were regressed on MI in Iran as well as the work of Audi and Ali (2023), which dwells on how public policy can influence economic misery. The current paper augments both models with population dynamics and labour force participation variables.

In view of the above, the empirical model specified for the current study is based on the function

$$MI = f(PPD, LFP, FCF, GDP, FDI) \qquad (1)$$

where PPD = population dynamics variables, LFP = labour force participation, FCF = fixed capital, GDP = economic growth, and FDI = foreign direct investment.

The justification for the inclusion of the control variables stems from their importance in enhancing the level of productivity, employment generation and income in the economy.

4.1 Empirical Model Specification and Estimation Technique

The semi-logged empirical model specified for the study derives from equation (1), and it is given as:

$$\ln MI = \beta_0 + \beta_1 \ln AFR_t + \beta_2 PP65 + \beta_3 \ln LPR_t + \beta_4 FCF_t + \beta_5 \ln FDI_t + \beta_6 GDP_t + \varepsilon_t \qquad (2)$$

where: MI stands for misery index, AFR is adolescent fertility rate while PP65 is population of persons within the age bracket of 65 and above as a percentage of total population (both variables captures population dynamics), LPR implies labour force participation rate, FCF means gross fixed capital formation growth, FDI signifies foreign direct investment as percentage of GDP, GDP stands for GDP growth, the symbol β_0 is the intercept parameter of the model, $\beta_1...\beta_6$ are the slope parameters, ε is the stochastic disturbance term while *t* stands for time.

4.2 Estimating Technique

The study used the Autoregressive Distributed Lag Model (ARDL) technique of estimation proposed by Pesaran, Shin and Smith (2001). One of the advantages of the ARDL approach is that it is applicable irrespective of the order of integration of the variables employed provided none of the variables is integrated of order two, i.e. I (2). In addition, the ARDL technique is free from the issue of endogeneity and serial correlation, and provides consistent estimation even with small observation sizes. Moreover, the technique captures the estimation of short-run and long-run dynamics in a single framework.

Therefore, equation (2) is formulated into an ARDL model as:

$$\Delta \ln MI_t = \beta_0 + \sum_{i=1}^{j} \beta_1 \Delta \ln MI_{t-i} + \sum_{i=1}^{j} \beta_2 \Delta \ln AFR_{t-i} + \sum_{i=1}^{j} \beta_3 \Delta PP65_{t-i} + \sum_{i=1}^{J} \beta_4 \Delta \ln LFP_{t-i} +$$

$$\sum_{i=1}^{j} \beta_5 \Delta FCF_{t-i} + \sum_{i=1}^{j} \beta_6 \Delta \ln FDI_{t-i} + \sum_{i=1}^{tj} \beta_7 \Delta GDP_{t-i} + \alpha_1 \ln MI_{t-i} + \alpha_2 \ln AFR_{t-i} + \alpha_3 PP65_{t-i} +$$

$$\alpha_4 \ln LFP_{t-i} + \alpha_5 FCF_{t-i} + \alpha_6 \ln FDI_{t-i} + \alpha_6 GDP_{t-i} + \varepsilon_t$$

(3)

Where Δ is first difference operator, j is the lag length, $\beta_1 - \beta_7$ represent the short-run coefficients while $\alpha_1 - \alpha_7$ are the long-run coefficients. The variables were tested for unit root to determine the stationarity status and order of integration while the ARDL Bounds' test was carried out to establish the existence of a long-run cointegration relationship among the variables. In order to account for the short-run deviation from the long run equilibrium, the Error Correction (EC) version of equation (3) is re-specified as

$$\Delta \ln MI_t = \beta_0 + \sum_{i=1}^{j} \beta_1 \Delta \ln MI_{t-i} + \sum_{i=1}^{j} \beta_2 \Delta \ln AFR_{t-i} + \sum_{i=1}^{j} \beta_3 \Delta PP65_{t-i} + \sum_{i=1}^{J} \beta_4 \Delta \ln LFP_{t-i} +$$

(4)

$$\sum_{i=1}^{j} \beta_5 \Delta FCF_{t-i} + \sum_{i=1}^{j} \beta_6 \Delta \ln FDI_{t-i} + \sum_{i=1}^{tj} \beta_7 \Delta GDP_{t-i} + \xi ECT_{t-1} + \varepsilon_t$$

Where ξ captures the speed of adjustment of short run to long run equilibrium and ECM_{t-1} is the EC term.

In addition to the ARDL technique, the study used Dynamic Ordinary Least Squares (DOLS) for a robustness and sensitivity checks. The DOLS approach has been adjudged as consistent estimator that takes into account the potential endogeneity and serial correlation issues.

4.3 Variable Measurement Data Source

The variables for the model were measured as follows:
Misery was measured using Misery Index (MI), which was computed with the Hanke's methodology. This is given as

$MI = UEM + INF + BLR - GDPPg$ (5).

Where: MI = Misery Index, UEM = Unemployment Rate, INF = Inflation Rate, BLR = Bank Lending Rate, and GDPPg = Real GDP Per Capita Growth. Other variables remain as earlier defined. The data for the study were sourced from World Bank (2023) world development indicators database.

4. Empirical Results

The empirical results, which cover descriptive statistics, correlation analysis outcomes, unit root test findings, ARDL Bounds cointegration test results, the short run and long run ARDL findings, and DOLS, diagnostic or post estimating test results are presented in Tables 2-7 as well as Figures 1 and 2:

5.1   Descriptive Statistics

Table 2: Descriptive Statistics

Statistic	MI	AFR	LPR	FCF	FDI	GDP	PP65
Mean	78.36	125.41	59.38	2.19	1.63	1.64	3.09
Median	71.46	128.17	60.12	2.61	1.49	1.81	3.09
Maximum	137.60	140.87	60.54	40.39	5.79	12.28	3.21
Minimum	60.55	101.68	55.24	-23.75	0.18	-4.51	2.98
Standard Deviation	19.77	12.16	1.48	12.45	1.20	3.85	0.06
Skewness	2.07	-0.83	-1.46	0.31	1.87	0.45	0.16
Kurtosis	6.14	2.57	3.97	4.79	6.88	3.38	2.23
Observations	32	32	32	32	32	32	32

Source: Computed by Author

From the descriptive statistics presented above, Nigeria's misery index averaged 78.36 within the study period. This however, ranges between the minimum and maximum values of 71.46 to 137.60, respectively. Adolescence fertility in the country remains very high over the years as apparent in its average value of 125.41. The labour force participation rate appears not encouraging given the mean estimate of 59.38, with both minimum (60.12) and maximum (60.54) values being very close to each other. The growth rate of fixed capital is low while foreign direct investment as a percentage of GDP is equally low. Population ages 65 and above as percentage total population averaged 3.09.

5.2 Correlation Analysis

Table 3: Correlation Results

Variables	MI	AFR	LPR	FCF	FDI	GDP	PP65
MI	1.00						
AFR	0.34	1.00					
LPR	0.19	0.52	1.00				
FCF	-0.14	0.10	-0.04	1.00			
FDI	0.45	0.53	0.43	0.03	1.00		
GDP	-0.54	0.26	0.17	0.21	-0.06	1.00	
PP65	0.48	0.91	0.63	0.05	0.46	0.04	1.00

Source: Computed by Author

It is apparent from the correlation results that there was no evidence of high multicollinearity among the variables, given the low values of their correlation coefficients.

4.3   Unit Root Test

To determine the stationarity status for the purpose of establishing the order of integration of the variables employed for analysis in the study, the Augmented Dickey-Fuller (ADF) and Phillips-Perron unit root tests were carried out. The results are presented in Table 4.

Table 4: Unit Root Test

Variables	ADF				PP				
	Level	P-value	1st- Diff.	P-value	Level	P-value	1st- Diff.	P-value	Remarks
MI	-2.08	0.253	-4.80	0.001***	-2.37	0.158	-4.78	0.001***	I(1)
AFR	-0.62	0.851	-3.08	0.039**	-0.10	0.942	-3.13	0.035**	I(1)
LPR	-2.27	0.189	-4.11	0.004***	-1.66	0.443	-3.13	0.035**	I(1)
FCF	-10.32	0.000***	-7.08	0.000***	-10.56	0.000***	-14.73	0.000***	I(0)
FDIP	-2.83	0.066*	-6.06	0.000***	-2.90	0.056*	-9.54	0.000***	I(1)
GDP	-3.77	0.008***	-9.38	0.000***	-3.89	0.006***	-20.11	0.000***	I(0)
PP65	-1.10	0.698	-3.70	0.011**	-0.31	0.913	-2.97	0.049**	I(1)

Source: Computed by Author

The unit root tests as presented in Table 4 shows the outcomes for two variables (GDP and fixed capital growths) failing to reject the null hypothesis of no unit root at level while the remaining variables became stationary at first difference. However, all variables therefore were stationary at first difference. These suggest a mixed integrating order of *I (0)* and *I (1)*. The outcome thus, confirms the appropriateness of the use of ARDL estimating techniques.

4.4   ARDL Bounds Cointegration Test

Table 5: ARDL Bound Test Results

Significance level			LCB I (0)	UCB I (1)
F-statistic	5.53	10%	1.99	2.94
		5%	2.27	3.28
		1%	2.88	3.99

Source: Computed by Author

The Bounds test cointegration results reported in Table 5 shows the existence of long run cointegration among the variables employed in the model estimated. This is evident in the F-statistic value (5.53), which is above the Upper Bounds critical value (3.28) at 5% level of significant.

4.5   Long-Run and Short-Run Results showing the Impacts of Population Dynamics and Labour Force Participation on Misery Level in Nigeria

Dependent variable is misery index

Table 6 ARDL Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Long Run				
Constant	24.43**	8.77	2.79	0.014
lnAFR	0.47	1.25	0.38	0.713
lnLPR	-8.47***	2.77	-3.06	0.008
FCF	-0.02**	0.01	-2.17	0.047
lnFDI	0.05	0.07	0.69	0.503
GDP	-0.03**	0.01	-2.50	0.025
PP65	4.03**	1.76	2.30	0.037
Short Run				
Δ(LNLPR)	1.19	1.29	0.92	0.373
Δ (LNLPR (-1))	6.50***	1.77	3.68	0.002
D(GFCG)	-0.005***	0.001	-5.25	0.000
Δ (GFCG (-1))	0.003***	0.001	3.09	0.008
Δ(LNFDIP)	-0.007	0.02	-0.30	0.766
Δ(P65P)	-8.52	4.65	-1.83	0.087
Δ (P65P (-1))	25.60***	5.53	4.63	0.000
ECT	-0.73***	0.09	-8.06	0.000
Diagnostic Test Results				
R-squared	0.78			
X^2_{SC}	2.8519			0.2403
X^2_{H}	10.2617			0.7428
X^2_{FF}	2.2899			0.1428
X^2_{N}	0.1763			0.9156

*Note: *, ** and *** indicate significance levels for 1%,5% and 10% respectively. The values in parenthesis are p-values respectively. X^2_{SC}, X^2_{H}, X^2_{FF} and X^2_{N} represent LM test for serial correlation, heteroskedacticity, RAMSEY RESET test, and normality test, respectively.*

Source: Computed by Author

Table 7: DOLS results

Dependent variable is misery index

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant	27.61***	3.04	9.09	0.001
LNAFR	2.36***	0.58	4.057	0.015
LNLPR	-9.81***	0.91	-10.826	0.000
GFCG	-0.01***	0.01	-2.783	0.050
LNFDIP	0.10**	0.03	3.589	0.023
GDPG	-0.04**	0.01	-6.374	0.003
P65P	1.82	0.88	2.077	0.106
R-squared	0.99			

*Note: *, ** and *** indicate significance levels for 1%,5% and 10% respectively.*
Source: Computed by Author

The long-run estimates as shown in Table 6, revealed a positive but insignificant effect of adolescent fertility on misery index in Nigeria. Labour force participation rate, growth of fixed capital and economic growth reduced misery level significantly in Nigeria in the long-run while the population of persons age 65 and above significantly raises the level of misery in the country. Specifically, a percentage rise in labour force participation rate, growth of fixed capital and economic growth reduced misery level significantly by 8.47%, 2.0% and 0.3%, respectively while level of misery rose by 0.04% due to a percentage increase in the population of those within the age bracket 65 years and above.

The short-run results did not diverge importantly from the long-run outcomes. For instance, the growth of fixed capital formation significantly reduced economic misery level in the country while the impact of population ages 65 and above on misery in Nigeria was positive and statistically significant. However, the lagged values of labour force participation rate and fixed capital growth were counterintuitive. The error correction variable showed a negative and significant coefficient of 0.73, implying a speed of adjustment of 73%.

Results of Dynamic Least Squares (DOLS) are presented in Table 7. The findings of the estimation showed that adolescent fertility increased misery level by 2.36% in Nigeria while labour force participation rate, fixed capital and economic growth correspondingly decreased misery in the country significantly by 9.81%, 1.0% and 4.0%, which is consistent with the earlier reported findings from the long-run estimates of ARDL. The coefficient of population ages 65 and above was insignificant while that of foreign direct investment was significantly counterintuitive.

The diagnostic test results as shown in Table 6 and Figures 1 & 2 indicated that there was no problem of heteroskedasticity, model misspecification and the residuals were normally distributed, as the probabilities of the test results were not significance. Furthermore, the CUSUM and CUSUMsq tests showed that the models estimated were reliable and stable, as the graphs are within the 5% critical bounds.

The findings reported above consistent with conclusions of other studies elsewhere. For instance, studies such as Dadgar and Nazari (2018), Okonji and Igbanugo (2019) and Ubah *et al* (2021) found that economic growth significantly reduced misery index in Iran and Nigeria, respectively.

Similarly, Wang *et al* (2019) and Akay and Oskonbaeva (2020) in their studies, which examined how misery index among other variables affect economic growth reported that economic misery contributed to significant decline in economic growth.

Equally, the positive impact of adolescent fertility and population of the elderly on misery supports the stance of extant literature. Though empirical studies on how misery and fertility relate are scarce, related work reported positive and significant impact of fertility on poverty, particularly in developing economies (see Birdsall and Griffin, 1988; Eastwood and Lipton, 1999). Moreover, due to its positive impact on population growth, African Development Bank-AfDB (2012, 1) argued that "in countries with sparse resources and inadequate policies, population growth could lead to economic decline and social misery." Population ageing has also been reported as raising misery level by Kabir, Khan, Kabir and Rahman (2013) and Ravallion (2021).

Moreover, the result indicating negative and significant impact of capital formation on misery is consistent with the findings of Ugondah and Adindu (2021) and Audi and Ali (2023). Furthermore, the negative and insignificant relationship between foreign direct investment and misery is in agreement with the findings of Ditta and Hassan (2017), Ihensekhien and Akungu (2019) and Khan, Majeed and Asghar (2022), which regressed foreign direct investment on misery index and other variables. The result of the middle however, was significant.

Although literature fails to produce any findings on labour force participation and economic misery relationship, one of the basic assumptions underlying the misery index hypothesis is that higher unemployment possesses the capacity to increase misery (Das, Brown and Mcfarlane, 2023). Thus, higher labour force participation rate can help to reduce economic misery as reported in the current study.
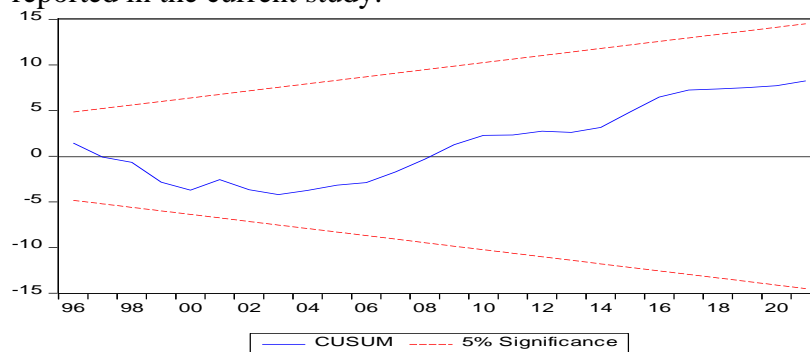

Figure 1: **CUSUM Test Result for Model Stability**
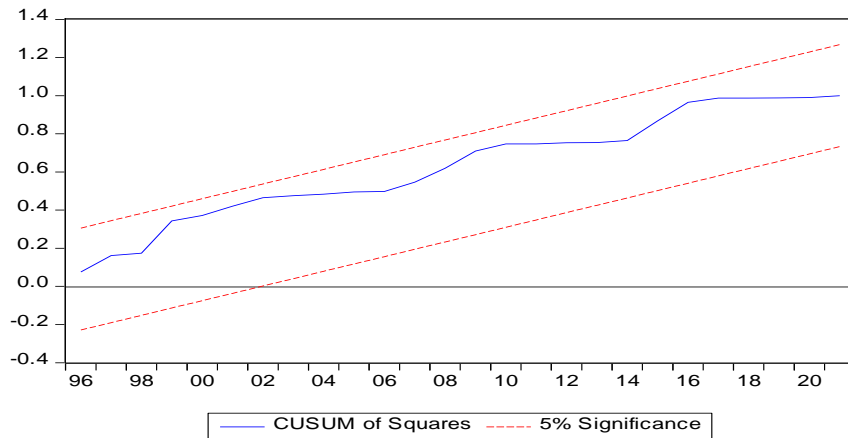**Source**: Generated by Author

Figure 2: **CUSUMsq Test Result for Model Stability**
Source: Generated by Author

5.6 Discussion of Results

The long-run results of both ARDL and DOLS revealed evidently that labour force participation rate is highly important for reducing misery level in Nigeria going by its negative and statistically significant impact on misery index in the findings of this study. This is not unexpected because one of the components of misère index is unemployment. Thus, the more those in the working population participate in the labour market, the better, because this will help to reduce unemployment, raise productivity and increase income level in the economy. Moreover, since per capita income growth is an important component of the misery index, referred to by Hanke as the 'good', due to its ability to offset the 'bads' (unemployment, inflation and bank lending rate), its negative and significant relationship reported in the study is consistent. The implication is that economic growth is important for reducing misery and raising the nation's growth will help to reduce economic misery in the country

With respect to population dynamics (captured using adolescent fertility and population ages 65 and above), findings from the ARDL analysis showed that adolescent fertility increased misery level but not significantly while the result returned by DOLS was positive and significant. For population ages 65 and above, outcome from ARDL was positive and significant; however, the result from the DOLS analysis although positive was insignificant. Combining these, it is apparent that population dynamics contribute to rising misery in the country. For instance, high fertility rate, particularly that of the adolescent as the case currently in Nigeria has the capacity to reduce household income, impact negatively on school attendance, increase school dropout rate, deepen poverty among households and further raise economic misery. In the same vein, rising population of the elderly will increase dependency ratio, impact negatively on income of the labour force, depress income and economic growth.

1. **Summary, Conclusion and Policy Implications**

The current study examined the effects of population dynamics and labour force participation rate on economic misery in Nigeria over the period, 1990-2022, using the ARDL and DOLS techniques of estimation. Having assessed the time series properties of the variables employed in the study, and establishing the existence of long-run cointegration among the variables, the ARDL and DOLS results suggested population dynamics are capable of raising economic misery in Nigeria while labour force participation rate, economic growth and capital formation contributed to reduction in economic misery in the country. The policy implications of the findings are that governments at all levels should invest in physical capital, encourage more participation of labour in labour market and continue to grow the economy. In addition, the high rate of fertility should be put in check through the girl-child education policy.

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