Relationship between unemployment and policy uncertainty in Nigeria: ARDL evidence from 1990 to 2020

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Research Article

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Abstract

Nigeria has been facing policy uncertainty due to unemployment, poor infrastructure development, and weak foreign direct investment inflows. The government seeks policies that can effectively drive its macroeconomic activities as intervention. As such, this study assessed the determinants of policy uncertainty from 1990 to 2020. The dynamic autoregressive distributed lag approach was employed to analyse the positive and negative changes in policy uncertainty, as well as the reliability in macroeconomic activities such as unemployment, infrastructure development, and foreign direct investment inflows. The empirical evidence revealed short- and long-run relationship involving policy uncertainty with unemployment, infrastructure development, and foreign direct investment inflows. In particular, policy uncertainty positively affected macroeconomic activities that led to unemployment, infrastructural development and pessimistic foreign investors. Dynamic relationship seems to exists between policy uncertainty and macroeconomic activities in Nigeria. Risk-taking decisions had resulted in high unemployment rate, poor infrastructural development, and low foreign direct investment inflows.

**JEL classification:** E24, D81, C22

Introduction

Policy uncertainty (PU) denotes the belief that uncertainties revolving around energy sector, as well as fiscal, monetary, and other regulatory policies, contribute to unemployment (Kocaarslan et al., 2020b). In fact, a substantial number of studies have investigated the stock market, green economic efficiency, export earnings, interest rate, unemployment, and foreign institutional investment. Notably, high unemployment rate, weak foreign direct investment inflows, and ineffective economic policy exert adverse impact on infrastructural development. To worsen matters, escalating unemployment rate, income inequality, internal migration, and oil price fluctuations have further complicated the financial stability in numerous countries. Policy uncertainties have a critical role in shaping economic outcomes, as evidenced by the recent economic growth in many countries that are currently experiencing policy uncertainties (Al-Thaiq & Algharabali, 2019). Policy uncertainty (PU) has turned into a critical issue ever before advancement of technology and globalisation have taken place. Progress has created political division, increased polarisation comparatist, and the heightened role of government spending in the overall economy; thus causing a spike in uncertainty (Idris & Bakar, 2017). Even Jia et al. (2021) asserted that PU is a critical determinant of the economy due to its impact on macroeconomic fundamentals and economic growth of many countries. Besides, PU has been widely associated with policy-related risk.

This study highlights the relationship between policy uncertainty index and microeconomic variables (i.e., unemployment, infrastructure development, and foreign direct investment inflows). In specific, this study assessed the reaction of macroeconomic indices in times of uncertainty and the actions taken to mitigate such uncertainty. This study offers insights to all market participants. It is among of the few studies that provide suggestions to lawmakers and the government in devising effective strategies to deal with high-level uncertainty in macroeconomic factors. It is necessary to understand how uncertainty affects government decisions and how this is changing the scene. Infrastructure development and foreign direct investment inflows are related to transportation, financial, telecommunication, and energy sectors (F. U. Rehman et al., 2020).

The aim of this study is to amplify the need to address the challenges of unemployment, improve infrastructure development, and attract foreign direct investment due to threats of policy uncertainty. Overall, the results of past studies on unemployment signified that a country like Nigeria with abundant significant resources and greater percentage of educated citizens face unemployment (Amaechi, 2018). The millennium development goal for reducing unemployment, which is aimed at eradicating poverty by 2022, demands more internal and external economic policy intervention to attain its national economic development. Several studies revealed that the central role of PU is to influence economic activities, such as unemployment, investments, transportation, and the energy sector, in a positive manner (Doğrul & Soytaş, 2010; Elder & Serletis, 2009; F. U. Rehman et al., 2020). According to Kocaarslan et al., (2020), negative macroeconomic and social factors can affect unemployment and investment rates. Besides, the series of global investment crises of the 21st century have intensified the interest of regulatory bodies in the steep economic decline and slow recovery or PU (M. U. Rehman et al., 2019).

The rising uncertainty in Nigeria may greatly affect the youths’ education resulting in unemployment, investment in infrastructure and foreign direct investment inflows in an adverse manner. Empirical studies in Nigeria have scarcely focused on the impact of policy uncertainty on unemployment, infrastructure investment stability, and inflows of foreign investment. To see what the policy uncertainty holds, Fig. 1 illustrates the indices of unemployment, infrastructure development, and foreign direct investment inflows from 1990 to 2020.

The identified gap is bridged in this study by assessing the relationships between policy uncertainty and several selected macroeconomic activities such as unemployment, infrastructure development and foreign direct investment. Therefore, development of infrastructure can lead to an influx of foreign direct investment and overcome unemployment in Nigeria, partly through the application of the Keynesian theory. Notably, uncertainty has a sizable effect on the real economy.

Literature Review
Policy uncertainty and multiplier effect theory

The Keynesian multiplier effect model by Oscar Lange (2015) on the marginal effect of a change of one economic variable upon another. The first was a marginal component effect of a difference, for instance, unemployment, infrastructure development, foreign investment inflows and policy uncertainty. Simple multipliers are those that involve marginal relationships. Therefore, in Eq. (2), let $\Delta PU$ be the change in policy uncertainty and $\Delta UNEM$ be the change in unemployment per unit of time. Write $\Delta PU=\Delta PU(Y)$ for policy uncertainty and $\Delta INFD=\Delta INFD(Y)$ for infrastructure development function. The marginal propensity to policy uncertainty is $\Delta PU=Y$, and the marginal propensity to decrease unemployment is $\Delta UNEM=\Delta UNEM(Y)$. from the relation $Y=\Delta PU=\Delta UNEM$, thus,

$$dUNEM/\Delta PU = dPU/\Delta UNEM = 1, (1)$$

Whence, if $PU$ is a free variable and $PU = UNEM(UNEM)$,

$$dPU/\Delta UNEM = 1 / \left[ 1 - UNEM \right]' (2)$$

And, if $UNEM$ is a free variable and $UNEM = UNEM(PU)$,

$$\frac{dUNEM}{dPU} = \frac{1}{1 - PU} (3)$$

Equation (1) is the policy uncertainty multiplier and equals the reciprocal of the marginal propensity to unemployment. Eq. (2) presented the unemployment multiplier and was equal to the marginal reluctance of policy uncertainty. These two and followed by other multipliers infrastructure development (INFD) and foreign investment (FDIN), can also be obtained, by the Kahn-Clark method, as the sum of infinite geometric progressions as follows:

$$\frac{dPU}{dINFD} = 1 + INFD' + (INFD')^2 + ... (4)$$

And,

$$\frac{dPU}{dFDIN} = 1 + FDIN' + (FDIN')^2 + ... (5)$$

Therefore, if $|INFD'| < 1$ or $|FDIN'| < 1$, these sums are equal to the expressions equations (4 and 5), respectively. The first condition implies the well-established empirical fact $0 < INFD' < 1$. Secondly, the theory holds that when the system is in stable condition, it means that $\Delta UNEM + \Delta INFD < 1$, which is given $0 < \Delta UNEM' + \Delta INFD' + \Delta FDIN' < 1$, more so, it implies that $0 < UNEM' + INFD' + FDIN' < 1$. The interpretation of the policy uncertainty multipliers is similar to that of the government spending multiplier effect. The poverty reduction multiplier indicates the marginal effect upon any annual change or increase in the rate of other factors. In the same way as the unemployment, infrastructure development and foreign direct investment inflows multiplier indicate the marginal effect upon and increase or decrease in the rate of policy uncertainty.

Empirical Issues

The literature on policy uncertainty and macroeconomic causes seems insufficient in empirical studies particularly in the context of Nigeria. As such, this study adds to the body of knowledge for the context of Nigeria if the policy uncertainty affects macroeconomic activities (Ben S. Bernanke, 2014). Most studies have investigated the impact of economic policy uncertainty on macroeconomic fundamentals, while only a handful of studies have looked into macroeconomic performance (Brogaard & Detzel, 2015; Christou et al., 2017). The interaction between policy uncertainty and macroeconomic indicators is a significant research area to date, especially in developing economies. The assumption is that policy uncertainty causes sequential reduction of employment and actual macroeconomic activities to slump (Carrière et al. 2013). Keynes (1936) asserted that economic policy uncertainty generates unemployment in terms of war and insurrections. Wen et al., (2019) studied the energy market in ARDL and discovered an asymmetric short-run long-run relationship. The findings have significant implications for investors and policymakers, especially those who face uncertainty in making accurate decisions. Unemployment is a critical macroeconomic issue within the economies spectrum due to the development of policies based on social and economic consequences. Doğrul et al. (2010) assessed the interrelationships among oil prices changes, economic activities, and employment. A Toda-Yamamoto technique revealed that economic activities improved the forecast of unemployment in the long run. This finding supports the hypothesis that labour or employment is relatively a substitute production factor.

Colombo (2013) investigated economic policy uncertainty shock in the United States by involving some macroeconomic aggregates via structural vector autoregression (SVAR) with price indices and business cycle. The findings showed that one standard deviation shock to US PU led to a
Economic policy uncertainty (EPU) is attributable to multiple factors, including uncertainty in monetary, fiscal, economic, social, political, and regulatory policies. However, uncertainty can elicit a strong reaction from macroeconomic factors mainly contributed by government policymakers due to electoral outcomes or uncertain regime (Baker et al., 2016; M. U. Rehman et al., 2019). AZIZ et al. (2020) assessed the macroeconomic Islamic indices volatility in the Exponential Generalized Autoregressive Conditional Heteroscedastic model (EGARCH), in which the results delivered that Islamic stock markets of the selected countries did not exert much influence on the global economic policies market conditions. The Islamic markets are specific and can define the behaviour of firm investments. Similarly, the results reiterated that the shock in macroeconomic factors had negligible influence on the Islamic indices volatility returns, while the Indonesian and Turkish Islamic stock indices returns fluctuations did not affect the macroeconomic factors at all. Hence, economic policies and markets condition are the primary price factors and can facilitate investors to formulate policies. In China, Huang et al. (2020) developed a monthly PU index for 2000–2018 to foreshadow a decline in equity price, employment, and output. Using SVAR with macroeconomic variables and dynamic relationship resulted in positive innovation for EPU index that foreshadowed weak macroeconomic activity; indicating that uncertainty led to a statistically significant economy slump. By applying both ARDL and Granger causality. Faheem et al. (2020) measured linear, nonlinear, and causal relationships between sectors level foreign direct investment and infrastructure in Pakistan between 1990 and 2017. The outcome suggested the presence of asymmetric connection in both long- and short-run with bidirectional causality between infrastructure development and foreign direct investment. The policy implication holds that improving infrastructure is vital to attract foreign investors.

Economic policy uncertainty has many critical roles in shaping the economic outcomes for both developed and developing countries. Evidently, many empirical studies have reported on the correlations among stock market, green economic efficiency, export earnings, interest rate, unemployment, and foreign institutional investment. This study identified a gap in light of infrastructure development indices. For instance, Jia et al. (2021) deployed linear and nonlinear ARDL models in Brazil, Russia, India, China countries (BRICs) to evaluate the relationship on financial innovation from 2004 to 2018. The results revealed that long- and short-run cointegration existed between EPU and financial innovation. Similarly, Onuigbo et al. (2021) Onuigbo et al., (2021) examined the effect of PU on the Nigerian stock market based on quarterly data retrieved from 1997 to 2019. Referring to ARDL, the results showed that the long-run relationship was stable between EPU and the Nigerian Stock Exchange. The EPU displayed a significantly negative impact on the Nigerian stock market. In China, based on green economic efficiency. Ma et al. (2021) Ma et al., (2021) measured economic, social, and environmental development using stack-based measurement and Luenberger productivity indicator to estimate the static Green Economic Efficiency (GEE) dynamic green total factor productivity with the factor for PU between 2003 and 2020. The results showed a positive correlation between PU on green economic efficiency and the total green element of PU. The policy implication suggested that the government should exert a macro-control role in the market mechanism to improve green economic efficiency and green total factor productivity as a target to minimise economic uncertainty.

Meanwhile, Raulatu et al. (2019) examined the effect of Nigerian contemporaneous export earnings on EPU from 1997 to 2016. By using the external vulnerability theory that posited macroeconomic shocks and financial market to achieve the study objective, both Autoregressive Distributed Lag (ARDL) and General Autoregressive Conditional Heteroscedasticity (GARCH) estimations were employed. The results revealed an adverse effect on the global EPU for Nigerian export earnings, which was vulnerable to external shock through diversification of the economy. The policy implication suggested that Nigeria should diversify its export strategy to protect the contemporaneous effect of global EPU. Next, non-linear ARDL approach was deploy by Kocaarslan et al. (2020a) to investigate the presence of asymmetric interactions among oil prices, uncertainty interest rate, and unemployment. The results indicated a long term relationship between increment in oil price and higher unemployment rate, but no significant impact was noted for oil prices reduction. The policy implied that diversifying away from oil may reduce the responsiveness of unemployment and economic uncertainty. He et al. (2021) examined the impact of economic policy uncertainty on foreign institutional investment in China using longitudinal and multilevel data retrieved from 2004 to 2017. The results showed that foreign institutional investment decreased with increasing economic policy uncertainty. The policy implication recommended that economic policy uncertainty had more effect on institutional foreign investment when the host institution employed open policy.
This study realized that, in Nigeria, the number of studies conducted on the relationship between economic policy uncertainty were insufficient in number, which this study requires to extend the search. Therefore, this study advances further in filling the gap in policy uncertainty as an unemployment policy. The expected outcome of this study could also help improve more studies on policy uncertainty in Nigeria. The general objective of this study is to find the relationship between unemployment and policy uncertainty in Nigeria from 1990 to 2020 using autoregressive distributed lag for long and short run.

Data And Methodology

The model developed in this study had been based on PU indices from Nigeria by specifying restrictive criteria for articles that contained economic, policy, and uncertainty aspects. For instance, Ahir et al. (2018), Al-Thaqeb et al. (2019) and Davis (2016) measured economic policy uncertainty by using articles that discussed about economy, policy, and uncertainty in the contexts of health insurance, war, terrorism, unemployment investment, etc. Therefore, in this study, the approach taken to measure policy uncertainty had been based on correlation matrix, ARDL and diagnostic tests to find the relationship between unemployment, increasing infrastructure development, and enhancing the flow of foreign direct investment into the country. The methodological framework for this study incorporated the ARDL model to quantify the relationships between policy uncertainty and macroeconomic variables of unemployment, infrastructure development, and foreign direct investment inflows in Nigeria. Additionally, the error term test was to identify the convergence rate from short and long run. This study employed the macroeconomic variables highlighted in the annual Nigerian Economic Policy Uncertainty (EPU, 2021) indicators listed in Table 1, which comprised of unemployment, infrastructure, and foreign direct investment inflows data in time series retrieved from the World Development Indicator (WDI, 2021).

### Table 1

<table>
<thead>
<tr>
<th>Variables</th>
<th>Indicators</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Economic policy uncertainty</td>
<td>Policy uncertainty proxy as economic policy uncertainty % decline in investment, economic stability, etc. (World Uncertainty Index for Nigeria)</td>
<td>WUINGA</td>
</tr>
<tr>
<td>Unemployment</td>
<td>Share of youth not in education or employment (% of youth population) international labour organization (ILO)</td>
<td>WDI</td>
</tr>
<tr>
<td>Infrastructure development</td>
<td>Gross fix capital formation (Annual % growth)</td>
<td>WDI</td>
</tr>
<tr>
<td>Foreign direct investment inflows</td>
<td>Foreign direct investment inflow (%GDP)</td>
<td>WDI</td>
</tr>
<tr>
<td>Source: Compiled by author</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The methodological framework aligns with Keynesian theory for multiplier effect that policy uncertainty has a sizable effect on the absolute economic stability. Supposing an economy that concentrated on decreasing unemployment, increasing infrastructure development and to boost the inflows of foreign investors has function of:

\[
\frac{dPU}{dUNEM} + \cdots + \cdots = 1 (6)
\]

it implies that \( 0 < UNEM' + INFD' + FDIN' < 1 \). The interpretation of the policy uncertainty multipliers is similar to that of the government spending multiplier effect.

Model specification

The macroeconomic variables employed in this study are unemployment (UNEM) as the share of youth not in education or employment, infrastructure development (INFED) to mean the growth of fix capital annual formation, and foreign direct investment inflow (FDIN).

The ARDL specification in a model is expressed in Eq. (8):

\[
\alpha_t = \phi_0 + \beta \sum_{i=1}^{n} Y_{t-i} + \alpha \sum_{i=1}^{n} e_{t-i} (7)
\]

Where \( \alpha \) represents the exogenous variables, \( \phi < 0 \) to warrant that \( \alpha \) is a positive variance. The general form of autoregressive distributed lag model adopted for the study is specifying as in Eq. (8)
\[ \Delta Y_t = \beta_0 + \sum_{i=1}^{n} \beta_1 \Delta X_{t-1} + \sum_{i=1}^{n} \beta_2 \Delta X_{t-1} + \sum_{i=1}^{n} \beta_3 \Delta X_{t-1} + \Delta \phi_{t-1} + \Delta \phi_{t-1} + \Delta \phi_{t-1} + \mu_t(8) \]

Where \( \Delta \) the first difference operator is \( Y_t \) is the dependent variable that is a function of its lagged values as well as the lagged values of the independent variables \( \phi \) denotes the coefficients of the short-run dynamics and \( \mu \) refers to error term.

Sunde (2017) had deployed ARDL and causality analysis; while Pesaran and Shin (1999), in their empirical and theoretical study in economics after all variables were integrated of level, first difference, and cointegrated, deployed the approach of Granger causality from one direction. Engle et al. (1987) pointed out that the existence of cointegration between variables indicates information for both long and short terms. Turning to this present study, ARDL was deployed to examine the variables cointegration and convergence direction from PU to unemployment, infrastructure development, and foreign direct investment inflows in the context of Nigeria.

The estimation for short term relationship based on error correction model (ECM) is given as follows:

\[ PU = f(UNEM, INFD, FDIN) \]

9

Whereas the econometrical model specified as Eq. (11)

\[ PU = \beta_0 + \beta_1 UNEM_t + \beta_2 INF_D_t + \beta_3 FDIN_t + \mu_t(10) \]

In this study, \( PU \) refers to the dependent variable for policy reliability, accuracy, and consistency. Next, the independent variables are unemployment reduction (UNEM), infrastructure development (INF), and foreign direct investment inflows (FDIN). The intercept \( X_1 \) to \( X_3 \) indicates the coefficients of the independent variables. No variable for estimation in this study based on Eq. (10). Meanwhile, \( \mu \) is one period lagged and error correction term.

The ARDL model uses sufficient number of lags to enable the study to capture the relationships among the variables. Besides, it is possible for different variables to have different optimal lags that capture the data generating process. More importantly, the ARDL model can be used with limited observations or samples despite the presence of missing data to provide robust results in light of cointegration analysis (Pesaran, 2008). The ARDL model \([q, r, s]\) below was used to determine the presence of long term relationships among the variables, as well as to test the presence of cointegration of PU with unemployment, infrastructure development, and foreign direct investment inflows:

\[ \Delta PU_t = \beta_0 + \sum_{j=1}^{q} \beta_1 \Delta UNEM_t + \sum_{k=1}^{r} \beta_2 \Delta INF_D_t + \sum_{l=1}^{s} \beta_3 \Delta FDIN_t + \mu_1 EPU_{t-1} + \mu_2 UNEM_{t-1} + \mu_3 INF_D_{t-1} + \mu_4 FDIN_{t-1} + \mu_t(11) \]

Where \( \Delta \) represents change, \( \beta_1 \) is the short-run coefficient, \( \phi \) denotes the long-run coefficient along with long-run corresponding multiplier, and \( \mu \) is the white noise. The null hypothesis of no cointegration for Eq. (11) is \( H_0: \phi_1 = \phi_2 = \phi_3 = \phi_4 = 0 \), when compared to the alternative hypothesis of cointegration, \( H_1: \phi_1 \neq \phi_2 \neq \phi_3 \neq \phi_4 \neq 0 \). The null hypothesis test used F-statistics, in which the results were later compared with critical values Pesaran et al. (1999) and Pesaran (2008). The test depends on variables \( l(0) \) and \( l(1) \) that involve asymptotic critical values. The critical values for \( l(0) \) series are referred to as lower-bound critical values; whereas the critical values for \( l(1) \) series are known as upper-bound critical values. The series initiated by Phillips & Perron (1988) provide the answers for unit root test and augmented with Dickey Fuller test (Dickey & Fuller, 1979). If the computed F-statistics is above the upper bound, the null hypothesis is rejected; indicating a long-run equilibrium relationship between the variables. If F-statistics fall below the lower bound, the null hypothesis of cointegration signifies the absence of a long-run equilibrium relationship.

The estimation for short term relationship based on error correction model (ECM) is given as follows:

\[ \Delta PU_t = \beta_0 + \sum_{j=1}^{p} \beta_1 \Delta UNEM_{t-1} + \sum_{k=1}^{r} \beta_2 \Delta INF_D_{t-1} + \sum_{l=1}^{s} \beta_3 \Delta FDIN_{t-1} + \lambda EC_{t-1}(12) \]

As ARDL and ECM are sensitive to lag length, Akaike information criteria (AIC) and Bayesian information criterion (BIC) were used to select the optimum lag length. Similarly, \( \lambda \) denoted sign for measuring the speed of adjustment (coefficient) and \( EC_{t-1} \) will reveal the disequilibrium from short-run to long-run convergence within the years. Next, diagnostic tests were carried out to examine serial correlation, normality, heteroscedasticity, stability cumulative sum, and cumulative sum of squares. All the test results stayed within the critical bound; the null hypothesis for all coefficients in the given regression cannot be rejected.
Priori Expectation

Based on the priori expectation, this study expected the value of to be positive, positive, negative and greater than zero.

Results And Discussion

Test for Stationarity

To execute the stationarity test, the Augmented Dickey Fuller (ADF) unit root test was deployed to ascertain the order of integration, as tabulated in Table 2.

• Table 2

Stationarity ADF and PP Test Results

<table>
<thead>
<tr>
<th>variables</th>
<th>Level and Intercept</th>
<th>1st Diff and Intercept</th>
<th>lag</th>
<th>Level and Intercept</th>
<th>1st Diff and Intercept</th>
<th>Bandwidth</th>
</tr>
</thead>
<tbody>
<tr>
<td>PU</td>
<td>-3.7362*</td>
<td>-6.4091***</td>
<td>1</td>
<td>-3.6332*</td>
<td>-9.3777***</td>
<td>4</td>
</tr>
<tr>
<td>UNEM</td>
<td>-1.2720***</td>
<td>-0.3920***</td>
<td>1</td>
<td>-1.3990***</td>
<td>-3.0089***</td>
<td>2</td>
</tr>
<tr>
<td>INFD</td>
<td>-0.2431***</td>
<td>-0.5107***</td>
<td>1</td>
<td>-2.3909***</td>
<td>-0.7328***</td>
<td>1</td>
</tr>
<tr>
<td>FDIN</td>
<td>-4.2526*</td>
<td>-1.3156***</td>
<td>1</td>
<td>-4.2526*</td>
<td>-3.2577***</td>
<td>3</td>
</tr>
<tr>
<td>1% critical value</td>
<td>-3.6701</td>
<td>-3.6701</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5% critical value</td>
<td>-2.9810</td>
<td>-2.9639</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10% critical value</td>
<td>-2.6299</td>
<td>-2.6299</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*, ** and *** indicate significance level at 1%, 5% and 10%

Source: Computed by author

The stationarity test revealed that all variables are integrated, because they do not have trend. Therefore, based on the results obtained from the stationarity test, the ARDL estimation method was deployed due to the presence of unit root or stationarity at first difference.

Correlation matrix test

In determining the reliability of policy uncertainty and macroeconomic activities, the correlation matrix dependency in ARDL model displayed that all the variables were large diagonally and this showcased the positive relationship of the variables or model. According to Konishi (1978), and in the study of Cadima et al. (2009) and Pham-gia et al. (2014), pre-processing data through covariance or correlation matrix is perform to test the variables interdependence and relationship. The results are tabulated in Table 3.

• Table 3

Correlation Matrix
Based on the test of covariance matrix analysis using ordinary (uncentered) Pearson correlation, the correlation coefficients of PU with macroeconomic performance had been positive and statistically significant at 1% level. This showed that PU with unemployment, infrastructure development, and foreign direct investment inflows were indeed correlated or reliable.

### Co-integration Test

To determine the existence of a long term relationship among the study variables, the ARDL bound for cointegration test was performed and the results are presented in Table 4.

#### Table 4

<table>
<thead>
<tr>
<th>F-statistic for cointegration</th>
<th>Model</th>
<th>F-statistics</th>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>PU= UNEM,INFD,FDIN</td>
<td>6.343***</td>
<td>cointegration</td>
<td></td>
</tr>
<tr>
<td>UNEM= PU,INFD,FDIN</td>
<td>7.169***</td>
<td>cointegration</td>
<td></td>
</tr>
<tr>
<td>INFD, PU,UNEM,FDIN</td>
<td>9.252***</td>
<td>cointegration</td>
<td></td>
</tr>
<tr>
<td>FDIN= PU,UNEM,INFD</td>
<td>6.201***</td>
<td>cointegration</td>
<td></td>
</tr>
</tbody>
</table>

Critical bound value

<table>
<thead>
<tr>
<th>Significance</th>
<th>I(0)</th>
<th>I(1)</th>
<th>K</th>
</tr>
</thead>
<tbody>
<tr>
<td>10%</td>
<td>2.37</td>
<td>3.2</td>
<td>3</td>
</tr>
<tr>
<td>5%</td>
<td>2.79</td>
<td>3.67</td>
<td>3</td>
</tr>
<tr>
<td>1%</td>
<td>3.65</td>
<td>4.66</td>
<td>3</td>
</tr>
</tbody>
</table>

Computed by author

Note: *** is significance at 1%, ** is significance at 5% level, * is significance at 10% level. K is lag length selected based on Akaike criterion (automatically)

Table 4, the F-statistics bound test is 6.343 indicated relationship among the variables, which exceeded the critical values of both upper and lower bounds at 1% significance level. Thus, the null hypothesis of no cointegration shall be rejected based on the empirical findings recorded in this present study; a long run relationship seemed to exist between policy uncertainty and unemployment, infrastructure development and foreign direct inflows in Nigeria from 1990 to 2020. Similarly, the observed coefficient of determination was 0.71; signifying that 71% of the variation in policy uncertainty was explained by macroeconomic factors (unemployment, infrastructure development, & foreign direct investment inflows). The result retrieved from Durbin Watson revealed the absence of serial correlation (2.606768). This means; the policy uncertainty in Nigeria had an impact on macroeconomic activities (unemployment, infrastructure development and foreign direct investment).

### Long run and short-run results
The number of cointegration identified in Eq. (6) and applying the same ARDL estimation from Eq. (7) to assess the parameters of long-run and short run coefficient of the variables at level. The long-run and short run results are stated in Table 5. Moreover, all the estimated coefficients have correct statistical signs and significant in the model except for the coefficient of foreign direct investment inflows.

- **Table 5**

<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>Coefficients</th>
<th>Std. Error</th>
<th>T-[p-value]</th>
</tr>
</thead>
<tbody>
<tr>
<td>PU</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>UNEM</td>
<td>1.1771115</td>
<td>0.691926</td>
<td>2.559688[0.0227]</td>
</tr>
<tr>
<td>INFD</td>
<td>10.39960</td>
<td>3.247166</td>
<td>3.202668[0.0064]</td>
</tr>
<tr>
<td>FDIN</td>
<td>-7.437888</td>
<td>4.995927</td>
<td>-1.488790[0.1587]</td>
</tr>
<tr>
<td>C</td>
<td>685.2141</td>
<td>273.8144</td>
<td>2.502476[0.0253]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>Coefficients</th>
<th>Std. Error</th>
<th>T-[p-value]</th>
</tr>
</thead>
<tbody>
<tr>
<td>UNEM</td>
<td>1.221764***</td>
<td>0.463947</td>
<td>2.633415[0.0197]</td>
</tr>
<tr>
<td>INFD</td>
<td>1.293629**</td>
<td>3.304870</td>
<td>0.391431[0.7014]</td>
</tr>
<tr>
<td>FDIN</td>
<td>-6.349736*</td>
<td>4.092929</td>
<td>-1.551392[0.1431]</td>
</tr>
<tr>
<td>ECM(-1)*</td>
<td>-1.449637</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Note:** significant at *** 1%, **5% and *10%. ARDL maximum lag (2,0,3,3) selected based on Akaike Information Criterion and dependent variable PU. The DW confirms no autocorrelation and the F-statistic values overall model is significant. R-square is 0.85 that shows only 85% of predicted variable PU is elaborated by explanatory variables proving 78% variability in policy uncertainty for the study period.

Table 5 presents the cointegrating and short-run equilibrium relationship among the variables or the error correction term. The results revealed a long-run equilibrium relationship for policy uncertainty with unemployment, infrastructure development, and foreign direct investment in Nigeria. Apparently, there was sequential adjustment in the level of policy uncertainty when both unemployment and infrastructure development increased, except for foreign direct investors that decreased at a point in time. The results indicated a 1% increase in unemployment as long-run positive adding to the policy uncertainty by a 1.77%. The infrastructure development showcased increased by 10.39%, there was a counter long-run positive increased in policy uncertainty. Lastly, the foreign direct investment level decreased in the long run by -7.20%. The stable relationships of policy uncertainty with unemployment and infrastructure development were significantly positive with negative and insignificant foreign direct investors. On the contrary, instability was noted in the flows of foreign direct investors in Nigeria for the selected study period. The short run relationship between policy uncertainty, unemployment, infrastructure development and foreign direct investors indicated positive and significant unemployment, positive and insignificant infrastructure development and negative and insignificant foreign investors in Nigeria.

The short run and long run relationship between unemployment, infrastructure development, and foreign direct investment, had an estimated coefficient of -1.44% adjustment with the past and current year. However, the results are quick to explain that the model estimation showed that the PU in Nigeria exerted a significant positive impact on high-level macroeconomic activities in Nigeria. These findings corroborate the Keynesian approach, which establishes that policy uncertainty leads to unemployment. Hence, this study adds to the body of knowledge that a dynamic relationship exists between policy uncertainty, unemployment, infrastructure development and foreign direct investment in Nigeria. The effect of policy uncertainty has a high risk on unemployment, infrastructural development, and foreign direct investment. This empirical evidence
Conclusion And Policy Implication

In an economic environment, i.e., Nigeria, with high unemployment, low infrastructure development, and fewer foreign direct investors; policymakers seem to face more challenges. The instability of foreign investors based on lack of good infrastructure and difficulties in lowering unemployment stems from economic uncertainty. The goal is to address the challenges of unemployment, to improve infrastructure development, and to attract foreign direct investment into the country; thus the need to achieve an apparent shortcut effect of policy uncertainty. In determining the reliability of the values tabulated in this study, the estimations had proven a correlation between policy uncertainty and the macroeconomic activities. Employing the correlation matrix, ARDL model to assess the specified relationships, it was found that long-run policy uncertainty had been stable in the long run and not in the short run. The empirical evidence from ARDL estimation indicated a positive long-run relationship of policy uncertainty with unemployment and infrastructure development, but a negative long-run relationship between flow of foreign investors and policy uncertainty in the context of Nigeria. The reaction of macroeconomic activities in times of uncertainty is consistent with both the

Diagnostic Tests

Heteroskedasticity Test Results

After autoregressive distributed lag estimation that revealed the long run and short run relationship of the variables, the next is diagnostic test. Heteroscedasticity was tested by using the ARDL Serial correlation and Heteroscedasticity test to correct the short run abnormality, in which the results are tabulated in Table 6:

Table 6

Results of White heteroskedasticity test.

<table>
<thead>
<tr>
<th>F-statistic</th>
<th>F-statistic</th>
<th>Obs*R-squared</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serial correlation</td>
<td>0.752464</td>
<td>3.270182</td>
<td>0.1949</td>
</tr>
<tr>
<td>Heteroskedasticity</td>
<td>0.371035</td>
<td>6.765603</td>
<td>0.8727</td>
</tr>
</tbody>
</table>

Normality test results

The normality test is one among the most important descriptive statistics that provide summary about measuring observations. The normality test was deployed to measure the central tendency and dispersion of the analysed data. The data exhibited normal distribution, as shown in Fig. 2, the mean is greater than the standard deviation; indicating the absence of outlier and a significant negative median with a greater percentage of data being equal or greater. The data distribution was sensitively normal and the mean was good to represent the data since the probability was high.

Results of Stability Test

To determine the stability of the model, both CUSUM and CUSUM of squares were employed and the estimated model indicated stability within the two critical bounds in Figures (3). Therefore, stability results validate the findings from ARDL cointegration, long and short run tests after residual diagnostic and normality test in Figure 2, serial correlation and heteroscedasticity test in Table 6. The tests revealed that the residuals were normally distributed, while the Jarque-Bera value was 1.141%, and the probability value was 0.565%. The Ramsey’s RESET Test for regression specification error indicated absence of model misspecification with 5% significance level.

Conclusion And Policy Implication

In an economic environment, i.e., Nigeria, with high unemployment, low infrastructure development, and fewer foreign direct investors; policymakers seem to face more challenges. The instability of foreign investors based on lack of good infrastructure and difficulties in lowering unemployment stems from economic uncertainty. The goal is to address the challenges of unemployment, to improve infrastructure development, and to attract foreign direct investment into the country; thus the need to achieve an apparent shortcut effect of policy uncertainty. In determining the reliability of the values tabulated in this study, the estimations had proven a correlation between policy uncertainty and the macroeconomic activities. Employing the correlation matrix, ARDL model to assess the specified relationships, it was found that long-run policy uncertainty had been stable in the long run and not in the short run. The empirical evidence from ARDL estimation indicated a positive long-run relationship of policy uncertainty with unemployment and infrastructure development, but a negative long-run relationship between flow of foreign investors and policy uncertainty in the context of Nigeria. The reaction of macroeconomic activities in times of uncertainty is consistent with both the
Keynesian approach and several work established in the literature for the relationship between unemployment, infrastructure development and the flow of foreign investors that increase policy uncertainty in Nigerian economy. A stable relationship among the variables is the central role of policy uncertainty for not influencing the economic activities in Nigeria in the short term. The policy uncertainty is indeed significant to address the impacts of policy uncertainty and government decisions on national economy. Essential aspects of the economic policy uncertainty contribute to policy decision, particularly on reshuffling the challenges for policy uncertainty and economic activities to thrive. By including specific measures on the reform, the policy can influence the economic activities, including investment in infrastructure (e.g., finance, energy, communication, & technology sectors) and potentially reduce unemployment. Therefore, reducing policy uncertainty can restore and flourish economic activities in the country. Another policy measure that is prescribed to policymakers is to maximise both domestic and foreign investments, thus creating job opportunities and dealing with high policy uncertainty if it remains the primary macroeconomic objective in the Nigerian economic success.

Declarations

Conflicts of interest

Authors mention that there is no conflict of interest in this study.

References


Figures
Figure 1

A plot of the policy uncertainty in Nigeria

Figure 2

results of Jacque-Bera

Figure 3

results of CUSUM and CUSUM of squares