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Moderating Role of Government Effectiveness on the Link between Economic Policy Uncertainty and Entrepreneurship Development in Nigeria

Nnamdi Chinwendu Nwaeze[1], Joseph Chukwudi Odionye[1,*], Agu Godswill Agu[2]

[1]Department of Economics, Abia State University, Uturu, Nigeria
[2]Department of Marketing, Abia State University, Uturu, Nigeria
*Corresponding author: joseph.odionye@abiastateuniversity.edu.ng

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Abstract This study investigates the moderating influence of government effectiveness on the link between economic policy uncertainty (EPU) and entrepreneurship development in Nigeria. The research used the novel quantile-based nonlinear autoregressive distributed lag (QNARDL) paradigm to evaluate the heterogeneous effects of government effectiveness in shaping how EPU affect entrepreneurship. The findings reveal several critical insights: First, EPU significantly affects entrepreneurial activities negatively both in the short-run and in the long-run across various quantiles, with stronger negative effects observed in the upper quantiles. Second, government effectiveness was found to have a significant and positive influence on entrepreneurial development, particularly at mid and upper quantiles. This suggests that effective governance mechanisms promote entrepreneurial confidence and activities. Third, the interaction analysis shows that government effectiveness mitigates the adverse effects of EPU on entrepreneurship. Notably, at the higher quantiles, improvements in governance more than offset the negative impact of rising policy uncertainty. Lastly, the findings support the presence of asymmetry in the EPU–entrepreneurship relationship and underscore the heterogeneous nature of policy impacts across different entrepreneurial quantiles. The study recommends that policymakers should prioritize clarity, consistency, and transparency in economic policies to reduce uncertainty and ensure timely communication and well-structured policy reforms that can help build investor and entrepreneurial confidence.

Keywords: *Entrepreneurship, economic policy uncertainty, government effectiveness, nonlinear ARDL, heterogeneous*

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1. Introduction

Entrepreneurship is the capacity to start up one's business and rely on this self-created employment prospects for self-sufficiency and revenue streams. This contrasts with depending solely on pay employment options offered by corporations or the government. While there is some ambiguity surrounding the definition of entrepreneurship [1,2], in developing nations, especially in Africa, entrepreneurship is viewed as a necessary or alternative source of income for those who are willing but unable to find more desirable wage employment. In many developing economies, entrepreneurship is crucial in driving economic progress. The number of physically fit jobless men and women has significantly decreased as a result of these self-efforts. Likewise, the national revenue is greatly increased by these kinds of personal activities. Furthermore, they directly or indirectly engage in profitable, productive, as opposed to unproductive, economic activity with their abilities and capacities [3].

It is undeniable the fact that developing nations such as Nigeria are plagued by rising unemployment rates in the face of rapidly increasing populations [4]. Nigeria is a reflection of an economic paradigm that grows gradually and has a lower capacity for absorption. As a result, some of these unemployed youths turned to vices, while others moved to North America and Europe in quest of better possibilities. But after years of fruitless looking for paid work, some of these unemployed people who are strong and need legal sources of income to survive naturally turn to self-employment. In light of this, a critical analysis of the dynamics and prevailing trends in population and unemployment rates in Nigeria, along with some government policy issues such as petroleum subsidy removal, exchange rate crisis, high cost of living, etc, mostly in recent years, largely supports the urgent need for in-depth empirical narratives that elucidate how government effectiveness could mitigate the effects of

policy uncertainty on entrepreneurship development in the country as well as offers pertinent policy options to support and reinvigorate this crucial sector for optimal performance.

1.2. Problem Statement

Entrepreneurial sector, which includes small and startup companies, is regarded as key component of economic growth in both developed and developing nations is the. However, small and newly established firms are particularly vulnerable to the prevailing economic conditions and policy uncertainties such as monetary because of their inexperience and modest liabilities. However, research has shown that macroeconomic policy uncertainty shocks have a significant detrimental impact on a country's employment, capital market, productivity, and outputs see, for example [5,6,7]. Amongst the most well-known macroeconomic policies in this context is monetary policy, which is managed by the central banks and serves to control the amount of money in circulation and levels of short-term interest rates, and tax policy. The relationship with entrepreneurship in this situation could be anticipated to be as follows: Unfavorable economic results lower company possibilities and market demands, which in turn lowers the level of entrepreneurial activity. Furthermore, uncertainty will compel entrepreneurs to adopt a wait-and-see strategy because investment is irreversible and primarily consists of fixed expenses [8]. For businesses that have a higher percentage of investment irreversibility, this will have a significant negative impact on investment and entrepreneurship development. When academics condemn the detrimental effects of shocks on the establishment and performance of new businesses, they either directly or implicitly take for granted the negative correlation that exists between economic uncertainty and entrepreneurship [9]. The decline in the state of the economy, the contraction of the consumer markets and the failure of the financial system are usually cited as the mechanisms explaining the adverse impacts on entrepreneurships [10,11].

Nigeria is bedeviled with rising unemployment rate, low growth rate, high cost of living, etc in recent years following the recent removal of fuel subsidy and the floating of exchange rate by the Federal government [4]. Based on a new computational approached adopted by NBS, in first quarter of 2023, the unemployment rate in the country with over 200 million people, dropped from 5.3 percent in the fourth quarter of 2022 to 4.1 percent. According to the data, however, the unemployment rate rose sharply to 5.0% in the third quarter of 2023. This represents a 0.8% increase from Q2 2023. Nigeria's labor force participation rate was 79.5% in third quarter of 2023 after reaching 80.4% in second quarter of 2023. Men's involvement rates were 80.9% while women's were 78.2%. Compared to those who live in cities, people who live in rural areas are more likely to engage in labor activities. There was a 1.5% decline in the employment-to-population ratio from the Q2 ratio to 75.6% in Q3. According to the report, the combined rate of time-related underemployment and unemployment as a percentage of the labor force population rose to 17.3% in Q3 from 15.5% in Q2.

The objective of Nigeria's Medium-Term National Development Plan (MTNDP) 2021–2025 is that "Nigeria improves economic competitiveness with a GDP growth of 3.8% that drives job creation, generates inclusive national growth, and lifts at least 25 million Nigerians out of poverty" [12]. Realising the economic growth rate of 3.8 per cent on average may become a mirage with the magnitude of unemployment rate in Nigeria. It is imperative to understand what policy option and policy direction that would enhance entrepreneurship development in the country as well as how improvement in government effective can mitigate policy uncertainty and thereby impedes the ugly trend. All things considered, concise policy narratives aimed at enhancing or augmenting the prevailing dynamics of entrepreneurship and its crucial causes, especially in Nigeria, will surface.

Growing attention is being paid to which policy instrument might be used to encourage a certain entrepreneurship effect, as well as how policies might more effectively target particular aims [13]. Regulation is increasingly being viewed by academics and decision-makers as a tool to target entrepreneurial activity, as well as, in some situations, corporate expansion, innovation, and exporting. It is a complex subject how the regulatory environment impacts entrepreneurs. For instance, if the intention of regulators is to promote entrepreneurship generally, should they reduce tax or provide tax holiday to small and newly established firms? How can government effectiveness in terms of commitment to business-friendly environment promote entrepreneurship in Nigeria? How can policy uncertainty shocks be reduced in order to encourage entrepreneurial activities? These and many more are what this study seeks to provide solution to. While many studies exist on the impact of financial inclusion, information communication and technology, and tax rate on entrepreneurship in Nigeria [14,15], no known studies, to best of our knowledge, particularly in Nigeria considered policy uncertainty and government effectiveness. Thus, this study aims to examine how government effectiveness can mitigate the adverse effect of policy uncertainty on entrepreneurship in Nigeria.

1.3. Research Objectives

The main objective of the study is to evaluate the moderating role of government effectiveness on the link between economic policy uncertainty and entrepreneurship in Nigeria. The specific objectives are to:

1. Examine the effect of economic policy uncertainty on entrepreneurship in Nigeria
2. Analyse the impact of government effectiveness on entrepreneurship in Nigeria
3. Estimate the moderating effects of government effectiveness on the link between economic policy uncertainty and entrepreneurship in Nigeria

1.4. Research Questions

In view of the study’s objectives, the research questions are as follows:

1. What is the effect of economic policy uncertainty on entrepreneurship in Nigeria?
2. To what extend does government effectiveness impact on entrepreneurship in Nigeria?

3. How does government effectiveness mitigate or buffer the link between economic policy uncertainty and entrepreneurship in Nigeria?

1.5. Research Hypotheses

The research hypotheses stated in their null form are as follows:

1. Economic policy uncertainty has no statistically significant effect on entrepreneurship in Nigeria?
2. There is no statistically significant effect of government effectiveness on entrepreneurship in Nigeria?
3. Government effectiveness does not significantly mitigate the potentially adverse link between economic policy uncertainty and entrepreneurship in Nigeria?

1.6. Significance of the Study

This study contributes to the entrepreneurship literature by integrating good governance into the analysis of macroeconomic policy uncertainty. It provides policymakers with insights into how improving government effectiveness can shield entrepreneurial ecosystems from the adverse impacts of policy unpredictability. Furthermore, the research offers national evidence to help craft targeted strategies for entrepreneurship promotion in different institutional contexts.

2. Relevant Theories

2.1. Entrepreneurship and Economic Policy Uncertainty (EPU)

There are several ways that policy uncertainty might impact the establishment of a firm. First off, uncertainty has a big impact on how families, firms, and financial markets make decisions, which is consistent with real option theory. This influence arises from the goal of maximizing the difference between the current and future values of physical assets, which frequently causes important decisions with large, mostly irreversible costs to be postponed [8,9,16]. Second, as uncertainty heightens the information asymmetry between lenders and borrowers and increases the likelihood of bankruptcy, it may lead to fewer lending possibilities. As a result, banks might become wary and limit the amount they give to businesses, which would impede their ability to grow. However, other research suggests that there is a positive correlation between economic uncertainty and entrepreneurship. First of all, as entrepreneurial activity involves identifying and seizing market opportunities that emerge from uncertainty, economic uncertainty is critical in providing opportunities for entrepreneurs [17]. Policy uncertainty creates chances for profit; if everything could be predicted, then company profits would vanish [18].

Numerous empirical studies in the literature highlight the negative effects of EPU on the macroeconomy1. There has not been much research done on how EPU affects entrepreneurship, though. In a conceptual model, McMullen and Shepherd [19] show how an entrepreneur's comprehension of uncertainty and capacity for tolerating it set them apart from those who are passive in the face of entrepreneurial opportunity. According to Fan et al. [18], there is a positive correlation between increasing macroeconomic uncertainty and a rise in entrepreneurial activity in a sample of 36 nations where the culture places a strong emphasis on minimizing uncertainty avoidance. Higher macroeconomic uncertainty is associated with fewer entrepreneurial ventures, a negative association that is typically observed in nations with a high degree of uncertainty avoidance culture. According to Nguyen, et al. [10], EPU might not necessarily be bad for entrepreneurship. According to their findings, EPU has a positive correlation with the total amount of early-stage entrepreneurial activity (TEA) but a negative correlation with the number of newly registered enterprises. According to Tajaddini & Gholipour [20], higher levels of economic uncertainty have a long-term detrimental effect on the establishment of new businesses. Using the economic policy uncertainty index created by Baker, et al. [21] in a sample of 26 nations, [22] show that higher levels of EPU are linked to a rise in necessary entrepreneurship. Their results, however, show that opportunity entrepreneurship and EPU do not significantly correlate. Zhao, et al. [23] analyzed Chinese provincial data from 2005–2018 and found that higher levels of EPU reduced new firm entries. The effect was stronger in capital-intensive and high-tech industries. Gulen and Ion [24] studied a panel of U.S. firms and found that policy uncertainty causes firms to delay investment and expansion decisions—a spillover effect that reduces venture capital activity and entrepreneurial launches. Kim and Kung [25] examined the impact of uncertainty on innovation and entrepreneurship in the U.S. technology sector. They found that policy uncertainty reduced R&D spending and slowed the entry of startups. In the context of emerging economies**,** Nwosa and Adeleke [11] used Nigerian time series data and observed that EPU negatively impacted SME formation and expansion. The study recommended institutional reforms to mitigate policy unpredictability. Yoshino and Taghizadeh-Hesary [26] found that macroeconomic policy instability in Southeast Asia reduces access to entrepreneurial finance, affecting particularly small and informal businesses.

2.2. Entrepreneurship and Institutions

This section looks at the relationship between institutions and entrepreneurship, which has been the topic of many research, even if fewer studies have concentrated on the important connection between entrepreneurship and uncertainty. Institutional economics can shed light on the elements that encourage opportunity entrepreneurship in this setting and eventually boost economic growth rates. Therefore, institutional considerations have a big influence on how people make entrepreneurial and productive decisions. This idea has been used in the field of entrepreneurship research to highlight the understanding that formal and informal institutions are important in determining whether or not to start a new business, especially when it comes to perceptions of opportunities and knowledge [27,28,29,30] [31,32] [33,34,35]. Autio and Rannikko [36] in a study of Finnish

regions, showed that local governments with more effective policy delivery systems had significantly higher startup success rates**.** Acs, et al. [37] confirmed through regional analysis in the U.S. that counties with better governance foster more high-growth entrepreneurial activity. Estrin, et al. [38] demonstrated that countries with high-quality institutions (including government effectiveness) see more opportunity-driven entrepreneurship, as opposed to necessity-driven entrepreneurship. Chowdhury, et al. [39] found that government support through stable institutions and efficient bureaucracies enhances entrepreneurial ecosystem quality, especially in emerging markets.

2.3. Institutions, Entrepreneurship, and Policy Uncertainty

There is a dearth of research that provides strategies to mitigate the negative consequences of EPU on entrepreneurship, despite the fact that the impact of this phenomenon has been extensively discussed in the literature. Acs, et al. [37] contend, however, that improved institutional quality—a sign of improved governance—can strengthen a nation's investor protection measures and, as a result, boost the investing behavior of business managers. Expanding on these claims, it can be argued that a stronger governance framework may be able to mitigate the negative effects of EPU on business investment choices. Wang, et al. [40] used panel data from 22 Asian countries (2004–2019) and showed that the negative effect of EPU on entrepreneurship was significantly weaker in countries with high government effectiveness scores (measured by World Bank Governance Indicators). The moderation was particularly strong in countries with active SME support programs. Sinha and Srivastava [41] applied a moderation model using Indian state-level data and found that states with better regulatory frameworks and public service delivery systems experienced smaller declines in business registrations during policy shocks (like demonetization or GST reforms). Alvarez and Urbano [30] examined data from Latin America and found that while EPU negatively impacts early-stage entrepreneurship, this relationship becomes statistically insignificant in countries with higher scores of government effectiveness and rule of law. Fuentelsaz, et al. [42] investigated institutional quality across European countries and found that uncertainty reduced entrepreneurial entry only in countries with weak regulatory environments. Strong governance counteracts risk aversion. Desai, et al. [43] in their study of financial and legal institutions, emphasized that in countries with better governmental institutions, policy volatility had a diminished deterrent effect on venture capital-backed entrepreneurship.

3. Estimation Framework

3.1. Data Description

This analysis adopts quarterly series from 1996 to 2022 to exemplify the distributional influence of economic policy uncertainty (EPU) on entrepreneurship, alongside the moderating effect of government effectiveness on the distributional link between these variables. The study's data was obtained from the World Bank data repository, World Uncertainty Index by Ahir, et al. [44] at www.policyuncertainty.com, and the Central Bank of Nigeria Statistical Bulletin in alignment with the study's objectives. Table 1 offers a comprehensive elucidation of the series.

Table 1. Data descriptions

Variables	Representation	Unit of dimension	Source
Entrepreneurship	ENP	Self-employed, total (% of total employment)	WDI
Nation's EPU	EPU	Indigenous Policy Uncertainty Index	WUI Index
Government Effectiveness	GFF	Perception of the quality of public services, and its independence from political pressure and its commitments to good policy (Unit Score)	WDI
Financial Sector Development	FID	Credit to private sector (% GDP)	CBN
Exchange rate	EXR	Nigerian exchange rate vis-à-vis US dollar	CBN
Interest rate	INT	Prime lending rate (percentage)	CBN
Inflation	INF	Inflation, GDP deflator (annual %)	CBN

Note: CBN represents Central Bank of Nigeria, WDI epitomizes world development indicator at world bank repository.

3.2. Method of Data Analysis

This study analysed the distributional influence of economic policy uncertainty (EPU) on entrepreneurship and how this connection is modulated by government effectiveness in Nigeria utilising the cutting-edge Quantile Nonlinear Autoregressive Distributed Lag (QNARDL) model introduced by Cho et al. [45,46]. The QNARDL, formulated by Cho et al. [45], represents an enhancement of the QARDL created by Cho et al. [47]. The selection of this estimation procedure is based on its numerous advantages compared to QARDL and nonlinear ARDL, as it allows for the estimation of both sign-based and magnitude-based asymmetric distributional quantile effects of regressors on the response [45,46]. This has led to its application in contemporary scientific research [48,49]. It is also utilised within fractionally integrated series. This approach indicates both the magnitude and direction of severe positive and negative changes in EPU and its modulation influence on entrepreneurship in the country. This understanding is essential, as not all shocks in EPU (whether negative or positive) will self-employment investment decision; however, specific alterations in policy uncertainty will affect investment decision and, thus, entrepreneurship. However, the QNARDL estimate process fails when used within higher-order stationary series, which is its principal restriction [45,46,50,51,52].

3.3. Model Specifications

In line with the theoretical views and relevant past studies [8,9,53,19,18], the study considers the functional

forms:

$LENP_t = b_0 + b_1LEPU_t + b_2LGFF_t + b_3LEXR_t + b_4LFID_t + b_5INT_t + b_6INF_t + \varepsilon_{it}$ (1)

$LENT_t = b_0 + b_1[LEPU_t * LGFF_t] + b_2LEPU_t + b_3LGFFt_t + b_4LEXR_t + b_5LFID_t + b_6INT_t + b_6INF_t \ \varepsilon_{it}$ (2)

In Eqs. 1 and 2, L signifies the natural log of the series. In Eq. 1, entrepreneurship (ENT) is expressed as a function of economic policy uncertainty (EPU), government effectiveness (GFF), exchange rate (EXR), financial sector development (FID), interest rate (INT), and inflation (INF) respectively. Eq. 2, on the other hand, expresses ENT as a function of the interaction between EPU and government effectiveness, as well as other covariates. The Eq. (2) estimate the moderating role of government effectiveness (GFF) on the link between EPU and entrepreneurship in Nigeria. Additionally, the subscript t denotes the time period while ε indicates the stochastic error term. The choice of the control variables was guided by economic theory and the prior studies. The first step is to compute the QARDL in line with Cho et al [50] which specifies the model following Pesaran and Shin [54] as

$$Z_t[X(\tau)] = \psi_0(\tau) + \psi(\tau)Z_t + \sum_{j=1}^{p}\delta_i(\tau)Z_{t-i} + \sum_{j=0}^{q}\varphi_i(\tau)X_{t-i} + \mu_t$$

$$\text{where } \psi_i(\tau) = \sum_{i=0}^{p}\psi_i \text{ and } \varphi(\tau) = -\sum_{i=1}^{q}\varphi_i(\tau) \quad (3)$$

The quantile connectivity representing the long-run operational function is expressed in Eq. 4

$$Z_t = \alpha(\tau) + \gamma(\tau)X_t + \mu_t$$

$$\text{where } \alpha = \psi\left(1 - \sum_{i=1}^{p}\delta_i(\tau)\right)^{-1} \text{ and } \gamma = \psi_1\left(1 - \sum_{i=1}^{q}\varphi_i(\tau)\right)^{-1};$$

μ_t is a stationary process expressed as $(\Delta X_t, \mu_t(\tau), \Delta X_{t-1}, \mu_{t-1}(\tau),...)$ (4)

Following Cho et al., (2020), the QNARDL generalized function is specified in Eq. 5

$$\Delta Z_t[X(\tau)] = \psi(\tau) + \psi(\tau)Z_{t-1} + \sum_{i=1}^{p}\delta_i(\tau)\Delta Z_{t-i} + \sum_{i=0}^{q}(\varphi_i^{pos}(\tau)\Delta X_{t-i}^{pos} + \varphi_i^{neg}(\tau)\Delta X_{t-i}^{neg}) + \theta(\tau)ect + \alpha_1^{pos}(\tau)X_t^{pos} + \alpha_1^{neg}(\tau)X_t^{neg} + \mu_t \quad (5)$$

$\theta(\tau)$ signifies the level of convergence across different of quantiles, τ is the τ^{th} percentile as it drives movements in response factor. $\alpha_1^{pos}(\tau)X_t^{pos}, \alpha_1^{neg}(\tau)X_t^{neg}$ represents the long-term positive (pos) and negative (neg) parameters respectively,

$$ect_{t-1} = Z_{t-1} - \alpha_1^{pos}(\tau)X_t^{pos} - \alpha_1^{neg}(\tau)X_t^{neg}$$

is the quantile error correction term.

where $\alpha_1^{pos}(\tau) = -\varphi_1^{pos}(\tau)/\psi(\tau)$ and $\alpha_1^{pos} = -\varphi_1^{pos}(\tau)/\psi(\tau)$.

Cho et al [45] proposed that the QNARDL should first re-parametized before the estimation in order to avoid the singularity issue.

In line with the operational designs in Eqs. 1 and 2, the QNARDL model is presented in Eqs. 6 and 7 respectively.

$$\begin{aligned}\Delta LENP_t(\tau) &= \psi_0(\tau) + \psi_1(\tau)LENP_{t-1} + \sum_{i=0}^{p}\delta(\tau)\Delta LENP_{t-1} \\ &+ \sum_{i=0}^{q1}\varphi_1(\tau)\Delta LEPU[{}^{pos}_{neg}]_{t-i} + \sum_{i=0}^{q2}\varphi_2(\tau)\Delta LGFF_{t-i} + \\ &\sum_{i=0}^{q3}\varphi_3(\tau)\Delta LEXR_{t-i} + \sum_{i=0}^{q4}\varphi_4(\tau)\Delta LFID_{t-i} + \sum_{i=0}^{q5}\varphi_5(\tau)\Delta INT_{t-i} \\ &+ \sum_{i=0}^{q6}\varphi_6(\tau)\Delta INF_{t-i} + \ \theta(\tau)LEPU_{neg}^{pos} + \alpha_1(\tau)LGFF \\ &+ \alpha_2(\tau)LEXR + \alpha_3(\tau)LFID + \alpha_4(\tau)INT + \ \alpha_5(\tau)INF + \theta(\tau)ECT + \mu_{it}\end{aligned} \quad (6)$$

$$\begin{aligned}\Delta LENP_t(\tau) &= \psi_0(\tau) + \psi_1(\tau)LENP_{t-1} + \sum_{i=0}^{p}\delta(\tau)\Delta LENP_{t-1} \\ &+ \sum_{i=0}^{q1}\varphi_1(\tau)\Delta[LEPU * LGFF][{}^{pos}_{neg}]_{t-i} + \sum_{i=0}^{q2}\varphi_2(\tau)\Delta LEPU_{t-i} + \\ &\sum_{i=0}^{q3}\varphi_3(\tau)\Delta LGFF_{t-i} + \sum_{i=0}^{q4}\varphi_4(\tau)\Delta EXR_{t-i} + \sum_{i=0}^{q5}\varphi_5(\tau)\Delta LFID_{t-i} \\ &+ \sum_{i=0}^{q6}\varphi_6(\tau)\Delta INT_{t-i} + \ \sum_{i=0}^{q7}\varphi_7(\tau)\Delta INF_{t-i} + \theta(\tau)[LEPU * LGFF]_{neg}^{pos} \\ &+ \alpha_1(\tau)LEPU + \alpha_2(\tau)LGFF + \alpha_3(\tau)LEXR + \alpha_4(\tau)LFID + \ \alpha_5(\tau)INT \\ &+ \alpha_6(\tau)IN + \theta(\tau)ECT + \mu_{it}\end{aligned} \quad (7)$$

Where the variables in Eqs. 6 and 7 are as defined in Eqs. 1 and 2, ECT is the error correction term, Δ = difference operator; p, q1, q2, q3, q4, q5, and q6 signify the ideal lag values of respective variables which is designated by means of lag length information principles, μ = stochastic component. Eqs 6 and 7 are the QNARDL-ECM models, pos and neg stand for increase and decrease in the respective threshold series, the threshold (asymmetric) series EPU and the interaction between EPU and government effectiveness. Following Shin, et al. [37], the study split the asymmetric series (LEPU and LEPU*LGFF) into positive and negative as expressed in Eqns. 8a, 8b, 8c, and 8d:

$$\begin{aligned}LEPU_t^{pos} &= \sum_{i=1}^{m}\Delta LEPU_{t-i}^{pos} \\ &= \sum_{i=1}^{n}\max(\Delta LEPU_i, 0)\end{aligned} \quad (8a)$$

$$LEPU_t^{neg} = \sum_{i=1}^{m} \Delta LEPU_{t-i}^{neg} = \sum_{i=1}^{n} \max(\Delta LEPU_i, 0) \quad (8b)$$

$$LIRM * LFSE_t^{pos} = \sum_{i=1}^{m} \Delta LEPU * LGFF_{t-i}^{pos} = \sum_{i=1}^{n} \max(\Delta LEPU * LGFF_i, 0) \quad (8c)$$

$$LIRM * LFSE_t^{neg} = \sum_{i=1}^{m} \Delta LEPU * LGFF_{t-i}^{neg} = \sum_{i=1}^{n} \max(\Delta LEPU * LGFF_i, 0) \quad (8d)$$

It is crucial to determine the series order of integration considering that QNARDL is only reliable when the series integration order is no greater than 2. This study employs the Canova-Hansen test, which incorporates the seasonal element in unit root analysis, Zivot-Andrews (ZA_URT) with structural breaks, and the conventional augmented Dickey-Fuller (ADF). This is to ensure that the use of the stationary processes is limited to I (1) and I (0). Additionally, the Wald test of symmetry was employed to evaluate the symmetric relationship among the examined series across different quantiles. In each threshold series of Eqs. 6 and 7, the null hypothesis is denoted by $\eta(\tau)^{po} = \eta(\tau)^{ne}$ as against the alternative that $\eta(\tau)^{po} \neq \eta(\tau)^{ne}$ and $\gamma(\tau)^{po} = \gamma(\tau)^{ne}$ as against the alternative that $\gamma(\tau)^{po} \neq \gamma(\tau)^{ne}$ The rejection of the null hypothesis suggests an asymmetric relationship between the threshold series.

4. Empirical Results

4.1. Descriptive Statistics

Typically, each scientific discourse commences with descriptive statistics that establish a basis for more robust computations. Consequently, summary statistics were utilised for the relevant series in this study. This test essentially elucidates the distribution's shape and the series' behavioural pattern, among other variables. The information from the descriptive statistics indicates the regularity of the distribution of the series. Consequently, Table 2 provides a summary of the test results.

According to the Jarque-Bera statistics presented in Table 2, the series only except government effectiveness (GFF), exhibit deviation from normal distribution. The results provide strong estimates despite the presence of anomalous distribution, thereby supporting the choice of the quantile-based nonlinear ARDL estimation approach [55,45,46,47] [56,57,58,59,60,61]. The Kurtosis indicates a normal peak for economic policy uncertainty (EPU), exchange rate (EXR), and financial development (FID), while the other series exhibit abnormal peaks. Furthermore, it indicates that while other variables exhibit a positive skew, GFF displays an inverse skew.

Table 2. Descriptive Statistics

	ENP	EPU	EXR	FID	GFF	INT	INF
Average	82.91	0.297	174.73	11.19	10.81	13.10	82.91
Max.	86.04	0.762	416.43	20.37	22.13	39.72	86.04
Min.	81.09	0.022	10.82	5.79	1.52	4.63	81.09
Sks.	0.97	0.723	0.759	0.784	-0.059	1.39	0.97
Kts.	2.57	2.929	2.715	3.301	2.13	7.09	2.57
J-B	17.62**	9.43**	10.72**	11.47**	3.51	110.1**	9.65**

*Note: Skt., Kts, and J-B represent skewness, kurtosis, and Jarque-Bera tests respectively; **(*) signifies 1%(5%) level of significance, respectively*

4.2. Unit Root Test (URT)

To ascertain the model series integration order, the study employed a number of robust stationarity estimation techniques, such as the Canova-Hansen seasonality unit root test (CH_ URT) to account for seasonality, Zivot-Andrews (ZA_URT) to account for structural breaks inherent in a long series, and the conventional augmented Dickey-Fuller (ADF). The choice of these arrays of unit root procedures is to ensure that level- and difference-stationary series are used, ensuring robust and reliable estimates [47,57,62,63].

The procedures hypothesize unit root (non-stationary) at the designated seasons and structural breaks for CH_URT and ZA_URT [64] respectively. The outcomes of the URTs, in brevity, are presented in Table 3.

Panel A of Table 3 reveals level-stationary in LEPU, LGFF and LEXR at the joint and diverse seasons, while the other series indicate difference-stationary across diverse seasons. The outcomes from the ZA_URT and ADF further confirmed the fractionally integrated series. Specifically, ADF indicates that, except LGFF, all the series are difference-stationary series while in the case of the ZA_URT, LENP, LFID, INT and INF are difference-stationary series. However, the other series are level-stationary series. The tests support the application of QNARDL, as the series exhibit fractional integration across various breaks and seasonal periods [45,47,62,63,65]. The research, consistent with Cho et al. [45,46], employed a two-step cointegration approach to produce the projected residual following re-parametrized estimation, thereby addressing the singularity issue. Table 4 summarises the results of the cointegration analysis.

Table 3. Unit Root Tests Result

Panel A: Canova-Hansen Seasonal Unit Root Test												
Variables	J_LM	1%	5%	10%	S1	Crit	S2	Crit	S3	Crit	S4	Crit
LENP	1.33	1.35	1.01	0.85	1.32	0.47	1.32	0.47	1.35	0.47	-	-
LEPU	1.8**	1.35	1.01	0.85	0.5**	0.75	0.5**	0.75	0.4**	0.75	-	-
LGFF	1.5**	1.35	1.01	0.85	1.1**	0.75	0.6**	0.75	0.4**	0.75	-	-
LEXR	1.41**	1.35	1.01	0.85	1.4	0.75	1.09*	0.75	1.16	0.75	-	-
LFID	1.32	1.35	1.01	0.85	1.28	0.75	1.56	0.75	1.45	0.75	-	-
INT	1.37	1.35	1.01	0.85	2.08	0.75	2.09	0.75	2.11	0.75	-	-
INF	1.07	1.35	1.01	0.85	1.98	0.75	1.45	0.75	1.16	0.75	-	-

Panel B: Conventional and Structural Breaks URTs												
	ADF_URT					Zivot-Andres unit root test (ZA_URT)						
Variables	Level	1st diff	2nd diff	I (d)	Lag	Level	B-P	Lag	1st diff	B-P	Lag	I(d)
LENP	-1.27	-4.2**		1	8	-2.8	12Q1	2	-6.87**	13Q4	2	1
LEPU	-2.50	-7.8**		1	9	-5.7**	15Q3	4				0
LGFF	-5.5**			0	5	-6.1**	08Q9	5				0
LEXR	-1.94	-4.1**		1	4	-5.1**	15Q4	3				0
LFID	-1.44	-3.5**		1	8	-1.98	19Q3	2	-6.87**	20Q1	4	1
INT	-1.23	-5.3**		1	4	-0.98	11Q4	6	5.26**	17Q4	5	1
INF	-2.07	-7.9**		1	8	-2.67	21Q3	7	-6.83**	18Q1	6	1

*** indicates LM test (both joint and individual seasons) signifying the rejection of null hypothesis of unit root at the specified seasons/with breaks at 5% level of significance. J_LM represents joint LM statistic; S represents seasons and Crit connotes the critical vale for individual seasons; BP represents break period; I(d)signifies the order of integration*

4.3. Cointegration Test

Considering that the pre-requisite for cointegration in QNARDL model is satisfied, the study estimated both the bound cointegration within the framework of. QNARDL and the two-step cointegration and the summary of results are presented in Table 4.

Table 4. Bound Cointegration Test

Model	F-Statistics	t-Statistics	5% level	I(0)	1(1)	Remark
Panel A: Bound Cointegration						
Base Model	6.11**			2.56	3.49	Cointegrated
Moderating	5.76**	4.96**	7.1***	2.56	3.49	Cointegrated
Panel B: Two-Step Cointegration						
Residual_1		-6.32***	-2.89			Cointegrated
Residual_2		-5.17**	-2.88			Cointegrated

*Note: ***(**) denotes 1% (5%) level of significance*

Table 4 revealed a robust long-run interaction between economic policy uncertainty and entrepreneurial advancement, government effectiveness, and other relevant covariates given that the reparametized residual is level-stationary. Thus, the study estimated the QNARDL-ECM result.

4.4. Lag Length Selection

The ideal lag value for the series was determined using the lag length information principles, and the findings are shown in Table 5.

Table 5 divulges lag 2 as the ideal lag value based on the information condition, Consequently, the QNARDL is estimated based on lag 2.

Table 5. Lag length Choice based on Information Criteria

Lag	Logl	LR	FPR	AIC	SC	HQ
0	409.3126	NA	6.03e-11	-6.505042	-6.368576	-6.449606
1	1870.670	2757723	6.25e-21	-29.49468	-28.53942	-29.10663
2	2529.012	3.431754*	3.12e-24*	-37.20988*	-32.16066*	-35.15877*
3	2142.182	46.06922	2.54e-22	-32.71262	-30.11978	-31.65934
4	2157.715	24.80199	3.60e-22	-32.38250	-28.97087	-30.99661
5	2284.451	190.1037	8.59e-23	-33.84598	-29.61556	-32.12748
6	2529.012	437.3926	2.18e-22	-32.85451	-31.08046	-32.13385

* denotes lag order chosen by the condition

4.5. Quantile Nonlinear Autoregressive Distributed Lag (QNARDL) Result

The QNARDL technique was employed, as mentioned earlier, to ascertain the heterogeneous impact of economic policy uncertainty on entrepreneurial development as well as the moderating influence of government effectiveness on the enlisted connectivity in Nigeria. Table 6 provides a succinct summary of the most relevant empirical results.

Table 6. Summary of Quantile Nonlinear ARDL Outcomes

	Quantiles								
	Panel A1: Short-Term Outcomes								
Variables	q_10th	q_20th	q_30tt	q_40th	q_50th	q_60th	q_70th	q_80th	q_90th
d(LENP(-1))	0.34**	0.36**	0.36**	0.38**	0.37**	0.39**	0.42**	0.44**	0.46**
d(LEPU_P)	-0.08**	-0.09*	-0.09**	-0.18**	-0.19**	-0.21**	-0.26**	-0.27**	-0.34**
d(LEPU_P(-1))	-0.12	-0.23	-0.12	-0.15*	-0.15*	-0.17*	-0.19	-0.17	-0.18**
d(LEPU_N)	-0.011	-0.025	-0.028	-0.034	-0.040	-0.044	-0.052	-0.059	-0.057
d(LGFF-1))	0.003	0.006	0.007	0.008	0.016*	0.019**	0.021**	0.023*	0.025**
d(LEXR(-1))	0.121	0.116	0.181*	0.019	0.122	0.124*	0.132**	0.143*	0.158**
d(LFID)	0.052**	0.059*	0.062	0.068*	0.074**	0.077**	0.085**	0.092*	0.12**
d(INT)	-0.05**	-0.09**	-0.097	-0.181	-0.178	-0.212	-0.295	-0.379	-0.46*
d(INF)	-0.053	-0.061	-0.066	-0.079	0.084	-0.058	-0.040	-0.032	-0.028
ECT_1(-1)	-0.055	-0.065	-0.072**	-0.082**	-0.084**	-0.088**	-0.087*	-0.097*	-0.099**
SR_A1_Validity Test: RRT [2.78] SQT [36.56]** QSET [41.06]** WT [44.12]**									
	Panel A2: Long-Term Outcomes								
LEPU_P	-0.041	-0.047	-0.041	-0.054	-0.087	-0.089	-0.084*	-0.092*	-0.093**
LEPU_N	-0.01	-0.017	0.021	0.024	0.027	0.031	0.036	0.042	0.053
LGFF	0.046	0.055	0.076	0.073	0.082*	0.088**	0.087**	0.094*	0.098*
LEXR	0.010	0.014	0.013	0.021	0.025**	0.023**	0.033**	0.043*	0.045**
LFID	0.11**	0.10**	0.18**	0.26**	0.28**	0.37**	0.41**	0.43*	0.58**
INT	0.030	0.103	0.108	0.108	0.012	0.211	0.231	0.317	0.187
INF	0.035	-0.109	-0.201	-0.202	-0.303	-0.117	-0.143	-0.135	-0.130
LR_A2_Validity Test: RRT [1.72] SQT [25.81]* QSET [30.28]** WT [39.32]**									

*Note: ** p<0.01, * p<0.05;.RRT denotes Ramsey RESET test model specification, SQT epitomizes Slope Quantile test, QSE represents Quantile Slope Equality test for quantile symmetry, WT represents Wald test of threshold variables. LEPU_P(LEPU_N) signifies positive (negative) changes in EPU.*

Table 6 summarises the results from the QNARDL. One interesting finding is that entrepreneurial development (d(LENP(-1)) is self-reinforcing across all quantiles, among other intriguing findings. The positive and strong association between the past and present values of LENP obviously illustrates this consequence.

Across multiple quantiles, the short-term outcome (Panel A1) regarding the mentioned regressors shows that increasing economic policy uncertainty (d(LEPU_P)) substantially worsens the country's entrepreneurial advancement. There is a heterogeneous influence of EPU on entrepreneurial development (ENP), since the size of the coefficient shows that its negative impact on ENP increases as EPU moves up the quantiles. The quantiles of the country's entrepreneurial development (q_10th, q_20th, q_30th, q_40th, q_50th, q_60th, q_70th, q_80th, and q_90th) are reduced by 0.08%, 0.09%, 0.09%, 0.18%, 0.21%, 0.26%, 0.27% and 0.34%, respectively, due to a 1% elevated EPU. The findings provide credence to the theoretical argument that, in response to high levels of economic policy-induced uncertainty, investors adopt pause-and-wait investing strategy to reduce risk and, as a result, a decrease in self-employed activities. However, the reduction in EPU (d(LEPU_N)) has no significant effect on entrepreneurial development across diverse quantiles. On the other hand, the long-term results show that for every 1% increase in EPU at the top quantiles (q_70th, q_80th, and q_90th), the country's entrepreneurial activities fall by 0.084%, 0.092%, and 0.093%, respectively. This result aligns with those of Nguyen et al. [10], Zhao et al. [23] for China, Nwosa and Adeleke [11] for Nigeria, Yoshino and Taghizadeh-Hesary [26] for Southeast Asia but contradicts the study of Khurana et al. [22] which showed that higher levels of EPU are linked to a rise in necessary entrepreneurship.

In relation to the government effectiveness (d(LGFF)), Panel A1 shows that, in the short-run, government effectiveness significantly boosts the country's entrepreneurship, particularly in the range of q_50th to q_90th percentile change. In specific terms, it demonstrates that in the short run, the middle and higher quantiles (q_50th, q_60th, q_70th, q_80th, and q_90th) of Nigeria's entrepreneurship grow by 0.016%, 0.019%, 0.021%, 0.023%, and 0.025%, respectively, as a percentage improvement in the country's government effectiveness (LGFF). Negligible impact on entrepreneurship is observed in the lowest quantile (between the tenth and fourth) though. Similarly, across mid and upper quantiles, government effectiveness substantially increases entrepreneurship in the country, according to the long-run outcomes. To be more specific, there is an increasing long-run positive effect of GFF on ENP, as shown by the following: an improvement in the country's effective governance enhances entrepreneurship at the 50th to 90th percentiles by 0.082%, 0.088%, 0.087%, 0.094%, and 0.098, respectively. This indicates that the country's entrepreneurship is enhanced by increased self-employed investment, which is a direct result of good governance. This result is in agreement with prior research on the following: Acs et al. [37] for United States, Autio and Rannikko [36] for Finland, and Estrin et al. [38] and Chowdhury et al. [39] for emerging nations.

For the covariates, Panels A and B show that, across different quantiles, financial sector development (LFID) significantly enhances the country's investment in entrepreneurship in the short and long run. This lends credence to the idea that an efficient financial system in a country enhances the availability, accessibility, and affordability of financial resources, which are essential for entrepreneurs to start and grow their businesses and hence boosts entrepreneurship. Similarly, exchange rate, both in the short-run and long-run substantially improves

entrepreneurship especially at the upper quantiles. Furthermore, as predicted, interest rate substantially reduces entrepreneurship. What this means is that a high interest rate increases the cost of loans, making it more expensive for entrepreneurs to finance startups or expansion and hence decreases entrepreneurial activities.

Furthermore, the outcome indicates that the speed of adjustment (ECT_1(-1)) is appropriately signed and significant in all the quantiles, indicating a long run convergence of the variables. Since the null hypothesis of symmetric is rejected, the estimation describing the validity test indicates that the series is asymmetric over varied quantiles. Similarly, well-specified models are indicated by the Ramsy RESET test, and considerable slope equality suggests that there is asymmetry in the slope coefficients across quantiles. According to the Wald test, there is heterogeneous relationship between the EPU and entrepreneurship.

4.6. Does Government Effectiveness Moderate the Devastating Effects of EPU on Entrepreneurship?

This section aims to explore the extent to which government effectiveness (GFF) moderates the negative relationship between EPU and entrepreneurship. It specifically analyses the interaction effects of EPU and government effectiveness on entrepreneurship, as outlined in Eq. 2. The results are succinctly presented in Table 7.

Table 7 apparently reveals that improvements in government effectiveness mitigates the adverse effect of EPU on entrepreneurship in Nigeria. This obvious reason is based on the outcomes as reveals in Panel B1 (short-run outcomes) and Panel B2 (long-run outcomes), where the coefficients of interaction terms ((d(LEPULGFF_P)) significantly enhances entrepreneurship in several quantiles, particularly the upper quantiles. In particular, at the upper quantiles (q_70th, q_80th, and q_90th), the interaction between economic policy uncertainty (EPU) and government effectiveness (GFF) substantially increases the country' entrepreneurship in the short-run (Panel B1) by 0.134%, 0.132%, and 0.141% respectively following 1 percent increase, whereas in the long-run (Panel B2), it significantly increases the country's GDP only at the 80th and 90th quantiles (q_80th and q_90th) by 0.071%, and 0.121% respectively. What this means is that, the positive influence of government effectiveness on entrepreneurship outweighs the negative effect of EPU on entrepreneurship. The implication of this upshot is that, when there is a quality governance, the fear, cost, and uncertainty associated with entrepreneurial activity are greatly diminished. This outcome aligns with the findings of Desai, et al. [43], Fuentelsaz, et al. [42] for the European countries, Alvarez, et al. [30] for Latin America, [31] for India, and Wang, et al. [40] for Asian countries.

Pertaining to the covariates, the upshot as displayed in Table 8 (Panels B1 and B2) demonstrates that financial development (LFID) substantially affects the country's entrepreneurship development positively across different quantiles in both the short-run and the long-run upholding the hypothetical view that efficient financial sector enhances the availability, accessibility, and affordability of financial resources, which are essential for entrepreneurs to start and grow their businesses and hence boosts entrepreneurship.

Table 7. Interaction Effects of EPU and Government Effectiveness on Entrepreneurship

	Quantiles								
Panel B1: Short-Term Outcomes									
Variables	q_10th	q_20th	q_30th	q_40th	q_50th	q_60th	q_70th	q_80th	q_90th
d(LENP(-1))	0.27**	0.26**	0.28**	0.28**	0.27**	0.29**	0.32**	0.34**	0.35**
d(LEPULEFF_P)	0.141	0.140	0.139	0.141	0.146	0.221	0.134**	0.132**	0.141*
d(LEPULGFF_P(-1))	0.107	-0.111	0.114	0.121	0.126	0.127	0.109	0.112**	0.121
d(LEPULGFF_N)	-0.014	-0.015	-0.042	-0.504	-0.522	0.092	-0.145	-0.143	-0.156
d(LEPU(-1))	-0.043	-0.064	-0.075	-0.069	-0.074	-0.063**	-0.077**	-0.078*	-0.091**
d(LGFF(-1))	0.013	0.012	0.014	0.065	0.085**	0.091**	0.094**	0.096*	0.097**
d(LEXR(-1))	0.039	-0.011	-0.019	0.004	0.031	0.052	0.053	0.054	0.081
d(LFID)	0.046*	0.059*	0.061**	0.076**	0.086*	0.078**	0.078*	0.083*	0.089**
d(INT)	-0.011	-0.034	-0.045	0.044	-0.037	-0.082	-0.088	-0.101	-0.098*
ECT_2(-1)	0.041**	-0.044*	-0.052**	-0.059**	-0.063*	-0.073**	-0.081*	-0.086*	-0.096**
SR_B1_Validity Test: RRT [1.03] SQT [27.56]** QSET [31.96]** WT [36.61]**									
Panel B2: Long-Term Outcomes									
LEPULGFF_P	-0.029	0.031	0.049	0.046	0.067	0.078	0.080	0.071**	0.121**
LEPULGFF_N	-0.013	-0.017	-0.033	-0.037	-0.039	-0.234	-0.237	-0.234	-0.146
LEPU	-0.031*	-0.059	-0.053	-0.067**	-0.069*	-0.073**	-0.081**	-0.093**	-0.095**
LGFF	0.044	0.053	0.058	0.063	0.069	0.079	0.084	0.105	0.141**
LEXR	0.077	0.079	0.081	0.084	0.091	0.098	0.161	0.474	0.556
LFID	0.011*	0.092**	0.101**	0.109**	0.109**	0.176**	0.221*	0.287**	0.286**
INT	1.121	1.124	1.123	1.147	1.151	1.273	2.279	3.243	4.301
INF	0.012	0.014	0.012	0.021	0.022	0.035	0.039	-0.078	-0.089
LR_B2_Validity Test: RRT [4.01] SQT* [23.11] QSET** [32.24] WT** 27.83									

*Standard errors are in parentheses ** p<0.01, * p<0.05;.RRT denotes Ramsey RESET test model specification, SQT epitomizes Slope Quantile test, QSE represents Quantile Slope Equality test for quantile symmetry, WT represents Wald test of threshold variables. LEPULGFF_P (LEPULGFF_N) signify increase(decrease) of the interaction between economic policy uncertainty and government effectiveness respectively.*

5. Conclusion and Strategic Suggestions

This research explored the heterogeneous effects of economic policy uncertainty (EPU) and its interplay with government effectiveness on entrepreneurial activities in Nigeria, employing the innovative QNARDL model. This research offers a distinctive addition to the current body of literature by elucidating the asymmetric and heterogeneous relationship between the series, characterised by both sign-based and magnitude-based dimensions. Furthermore, it elucidates the interplay between EPU and good governance in relation to entrepreneurship. The findings reveal several critical insights: First, EPU significantly affects entrepreneurial activities negatively both in the short-run and in the long-run across various quantiles, with stronger negative effects observed in the upper quantiles. This implies that periods of high uncertainty deter both marginal and high-level entrepreneurial efforts. Second, government effectiveness was found to have a significant and positive influence on entrepreneurial development, particularly at mid and upper quantiles. This suggests that effective governance mechanisms promote entrepreneurial confidence and activities. Third, the interaction analysis shows that government effectiveness mitigates the adverse effects of EPU on entrepreneurship. Notably, at the higher quantiles, improvements in governance more than offset the negative impact of rising policy uncertainty. Fourth, the study further demonstrates that, across diverse quantiles, financial sector development and exchange rate improvements significantly encourage entrepreneurship, while high interest rates consistently suppress it. Lastly, the findings support the presence of asymmetry in the EPU–entrepreneurship relationship and underscore the heterogeneous nature of policy impacts across different entrepreneurial quantiles.

5.1. Policy Recommendations

In light of these findings, the following policy measures are recommended to foster a more resilient and vibrant entrepreneurial ecosystem in Nigeria:

Enhance policy certainty and stability: Policymakers should prioritize clarity, consistency, and transparency in economic policies to reduce uncertainty. Timely communication and well-structured policy reforms can help build investor and entrepreneurial confidence.

Strengthen Government Effectiveness: Enhancing the quality of governance—through bureaucratic efficiency, anti-corruption measures, regulatory quality, and effective service delivery—will not only support entrepreneurial growth directly but also act as a buffer against the negative effects of policy uncertainty.

Promote financial sector development: Strengthening financial institutions to provide accessible and affordable financing options for entrepreneurs is crucial. Special credit schemes for startups, simplified loan processes, and support for alternative financing (e.g., venture capital, crowdfunding) should be encouraged.

Maintain exchange rate stability: Volatile exchange rates can distort input costs and market expectations. Policies that support exchange rate stability—through sound macroeconomic management and foreign exchange reserves—can create a more predictable environment for entrepreneurs.

Lower interest rates for SMEs and startups: Since high interest rates discourage entrepreneurial investment, targeted interventions such as interest rate subsidies, microfinance programs, and concessional loans for new businesses should be considered.

Design tailored interventions for different entrepreneurial segments: Given the heterogeneous effects observed across quantiles, policy measures should not be one-size-fits-all. Interventions must consider the specific needs of micro, small, and medium-scale entrepreneurs, especially those at lower quantiles who are more vulnerable to shocks.

By addressing both structural and policy-induced barriers, Nigeria can foster a more robust entrepreneurial landscape that remains resilient in the face of economic uncertainties. These recommendations align with global evidence and are crucial to realizing inclusive and sustainable economic growth through entrepreneurship.

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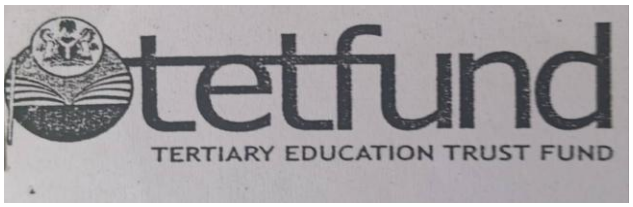

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