Impact of Corruption on Public Investment Outcomes inNigeria

Abstract

Corruption remains a significant barrier to public investment in Nigeria, particularly for large-scale projects. This study aims to examine the impact of corruption on public investment outcomes across varying levels of investment. Using simultaneous quantile regression, the analysis captures both the direct effect of corruption and its interactions with macroeconomic variables, including GDP per capita, inflation, government effectiveness, political instability, and foreign direct investment (FDI). The results demonstrate that corruption consistently reduces public investment, with the negative impact intensifying at higher quantiles. Interaction terms reveal that government effectiveness mitigates the harmful effects of corruption, while political instability exacerbates them for smaller projects but plays a more complex role in larger ones. Inflation and FDI further amplify corruption's negative effects, particularly in medium and large-scale projects.The study concludes that larger public investments are especially vulnerable to corruption, which emphasises the need for stronger institutional frameworks and governance reforms to enhance transparency and accountability in public sector investment. Lastly, macroeconomic stability and improved political conditions are crucial to enhancing public investment outcomes, particularly in large-scale projects.

Keywords: Corruption, Public investment, Quantile regression, Nigeria

1.1 Introduction

Corruption remains one of the most widespread challenges to economic development, particularly in developing nations where weak institutions and governance frameworks often allow it to persist. It distorts resource allocation, impairs economic efficiency, and undermines public trust in government institutions (Mauro, 1995; Tanzi & Davoodi, 1997). In the context of public investment, corruption significantly affects the allocation and utilisation of resources, which results in inefficient outcomes in infrastructure development, social services, and other critical areas of public expenditure (Shleifer & Vishny, 1993). In Nigeria, Africa's largest economy, corruption has been deeply entrenched and has severely undermined the implementation of public investment projects. Despite extensive public expenditure aimed at improving infrastructure and social services, the country remains burdened by widespread inefficiencies, largely driven by the destructive influence of corrupt practices (Ugur & Dasgupta, 2011). Therefore, addressinghow corruption specifically affects public investment outcomes becomes crucial for developing policies that can significantly enhance the efficiency and effectiveness of public spending.

The empirical literature on the relationship between corruption and economic growth presents mixed findings, often referred to as the twin roles of corruption. On one hand, corruption is widely recognised for its detrimental impact on growth by distorting public resources,

discouraging foreign investment, and fostering inefficiency (Tanzi & Davoodi, 1997; Mauro, 1995). On the other hand, a smaller body of literature highlights a potential "grease-the-wheels" effect, where corruption can, in some cases, facilitate economic activity by bypassing inefficient bureaucratic processes, particularly in weak institutional environments (Méon & Weill, 2010; Kato & Sato, 2015). This dual perspective suggests that corruption's effect on economic performance is not uniformly negative and may vary depending on institutional quality, economic conditions, and governance structures. These conflicting findings underline the need for more comprehensive analysis, particularly in the context of public investment, where corruption can have varied effects depending on the size and scale of projects involved (Olken, 2007; Søreide, 2014).

Despite the extensive literature examining the relationship between corruption and economic growth, few studies have focused specifically on how corruption impacts public investment outcomes, particularly across different quantiles of economic performance. Much of the existing research has focused on broader macroeconomic indicators rather than sector-specific outcomes, which leaves a gap in understanding the distribution and effectiveness of public investment in the presence of corruption. This gap is particularly evident in Nigeria, where public investment is vital for infrastructure development and long-term economic growth, yet its effectiveness is often compromised by corrupt practices. Larger projects, in particular, may be more susceptible to mismanagement due to the greater financial stakes and complexity involved (Treisman, 2000).

This empirical research addresses this gap by employing simultaneous quantile regression to analyse the differentiated effects of corruption on public investment across various quantiles of economic performance in Nigeria. In doing this, it contributes to the body of knowledge in several important ways. First, by using simultaneous quantile regression, it moves beyond the limitations of average-effect models to offer a more comprehensive examination of the varying impacts of corruption across different levels of public investment. This approach allows for the analysis of whether corruption exerts a stronger influence on larger public investment projects, which often involve higher financial stakes and greater opportunities for rent-seeking (Treisman, 2000). Second, the study incorporates interaction terms between corruption and key macroeconomic variables, including GDP per capita, inflation, government effectiveness, political instability, and foreign direct investment (FDI). These interactions provide insights into how broader economic and institutional conditions mediate the relationship between corruption and public investment outcomes, particularly in a

developing economy context (Kaufmann, Kraay, & Zoido-Lobatón, 1999). Lastly, the findings of this research have significant policy implications for Nigeria, where public investment is critical for infrastructure development.It emphasises the key areas where governance reforms, robust anti-corruption measures, and institutional strengthening are urgently required to enhance the efficiency of public investment, particularly in large-scale projects that are most vulnerable to mismanagement and inefficiency.

2.1 Conceptual review

Corruption and public investments are two essential concepts in this review. Corruption is broadly defined as the abuse of entrusted power for private gain, and it manifests in various forms such as petty, grand, and systemic corruption. Transparency International (2018) further elaborates on this by describing corruption as "the misuse of entrusted power for private gain" which practically stresses its occurrence in both public and private sectors. Similarly, Rose-Ackerman (1978) presents corruption as a consequence of distorted markets where public officials engage in rent-seeking behaviour to maximise their utility by accepting bribes or inducements. The United Nations Development Programme (1999) broadens the definition of corruption to include not just financial gain, but also non-financial rewards such as political influence. This means corruption can involve the misuse of public office to secure political power, loyalty, or influence, rather than just monetary bribes. Examples include nepotism, patronage, and manipulating policies for political advantage, which undermine governance and public trust without direct financial exchanges.

Several scholars have provided additional insightful definitions of corruption. Johnston (1996) defines corruption as "the abuse of public roles or resources for private benefit." Klitgaard (1988) offers a more formulaic approach, describing corruption as: $C = M + D – A$, where corruption (C) equals monopoly power (M) plus discretion (D) minus accountability (A). This definition is particularly useful in understanding how structural weaknesses within institutions create fertile grounds for corrupt practices to emerge. Heidenheimer (1970) adds a socio-cultural dimension by categorising corruption into "black," "grey," and "white" forms, based on public perception. Black corruption involves acts broadly condemned by society, grey refers to practices that might be accepted in some circles but not others, and white corruption includes practices tolerated in certain communities or contexts, though still technically corrupt. Bardhan (1997) defines corruption as "the use of public office for private gain in a way that contradicts the rules of the game."

Corruption is commonly categorised into three distinct forms, including petty corruption, grand corruption, and systemic corruption, with each varying in scope, scale, and impact. Petty corruption refers to low-level, everyday corrupt practices that typically involve small amounts of money or minor favours. It often occurs in routine interactions between citizens and public officials, such as bribing a clerk to speed up the processing of a document, paying off a traffic officer to avoid a fine, or tipping a healthcare worker for preferential treatment (Klitgaard, 1988; Rose-Ackerman, 1999). While the individual amounts involved in petty corruption are relatively small, the cumulative impact can be significant, especially in countries where these practices are widespread (Olken & Pande, 2012). Petty corruption undermines public trust in institutions and disproportionately affects poorer members of society, who may be coerced into paying bribes to access essential services or avoid harassment (Tanzi, 1998). For example, in many developing countries, citizens may be forced to pay bribes for basic services like education, healthcare, or utilities. This assist in deepening inequality and perpetuating cycles of poverty (Transparency International, 2021).

Grand corruption, by contrast, involves large-scale corruption, typically carried out by high-ranking officials or political elites. This type of corruption is characterised by the misappropriation of substantial public resources, manipulation of state contracts, or embezzlement of funds intended for major public projects (World Bank, 1997; Rose-Ackerman, 1999). Grand corruption can devastate a country's economy, diverting resources away from critical sectors such as infrastructure, education, and healthcare, which are vital for development (Tanzi & Davoodi, 1997). For example, in Nigeria, large-scale corruption scandals involving government contracts in the oil sector have diverted billions of dollars that could have been used for public investments (Amundsen, 2010; Akinola, 2020). Grand corruption also undermines the rule of law, fosters impunity, and weakens democratic institutions, as those in power use their positions to enrich themselves at the expense of the public (Søreide, 2006; Mauro, 1995).

Systemic corruption occurs when corrupt practices are not isolated incidents but are deeply embedded within the political, economic, and social systems of a country. In such environments, corruption is so widespread that it becomes a norm rather than an exception, with public officials, businesses, and even citizens participating in or tolerating corrupt behaviour (Johnston, 2005; Klitgaard, 1988). Systemic corruption creates an environment where bribery, kickbacks, and fraud are expected in almost every transaction, which makes it difficult for honest actors to operate effectively (Rose-Ackerman, 1999). In these situations,

corruption infiltrates every level of governance, from local authorities to national institutions, and addressing it requires comprehensive reforms (Rothstein & Torsello, 2014). Countries like Somalia and Venezuela have been described as having systemic corruption, where the lines between public and private interests are blurred, and the lack of accountability mechanisms allows corruption to thrive unchecked (Transparency International, 2021; Ploch, 2010).

Public investment is conceptually defined as government spending aimed at creating or enhancing public goods and services that support long-term economic growth and social welfare. The International Monetary Fund (2014) defines public investment as "government expenditure on capital projects such as infrastructure, education, and health that are expected to yield long-term economic and social benefits." The World Bank (2017) expands on this by emphasising that public investment "directly contributes to the economy's productive capacity." From a productivity standpoint, Aschauer (1989) emphasises the importance of public investment, particularly in infrastructure, as a key driver of economic performance. His work argues that public capital investments, such as roads, bridges, and communication networks, are essential for enhancing the efficiency of private-sector activities, ultimately leading to significant gains in overall economic productivity. Musgrave (1959) considers public investment part of fiscal policy aimed at correcting market failures by providing public goods that the private sector cannot efficiently supply.

Public investment is often classified into several key categories, including physical infrastructure, human capital development, and social infrastructure. Physical infrastructure investments, such as roads, bridges, and energy systems, are essential for reducing the cost of doing business and improving connectivity within and between regions (World Bank, 2012). These investments are critical not only for facilitating trade and economic activities but also for attracting private sector investment. Human capital investments, particularly in education and healthcare, are equally important, as they enhance labour productivity and improve the overall quality of the workforce (Becker, 1993). Social infrastructure, on the other hand, refers to investments in facilities and services that promote social welfare and quality of life, such as public housing, recreational amenities, and social services (Barr, 1998). These investments foster social cohesion and ensure that basic human needs are met, particularly for vulnerable populations. The development of robust social infrastructure is critical to sustaining inclusive growth and improving societal well-being, as it creates an environment

where all individuals can access essential services, regardless of their socio-economic background.

For this research, a public investments index has been constructed to capture key dimensions of public spending. Access to electricity serves as a proxy for infrastructure development, school enrolment rates represent investment in education, and life expectancy stands in as a measure of health investment. In addition, capital spending on economic and social services provides a comprehensive view of the government's role in fostering long-term development. In examining the impact of corruption on public investments, corruption is defined as the misuse of public office for private gain, as measured by the Corruption Perceptions Index (CPI) from Transparency International. The CPI provides a perception-based assessment of corruption levels within the public sector, aggregating expert opinions and surveys to rank countries by their perceived levels of corruption.

2.2 Empirical Literature Review

This review critically examines empirical studies on the relationship between corruption and economic growth, while also acknowledging the growing body of literature that explores the impact of corruption on public investment. Although substantial research has been conducted on the dual role of corruption in economic growth, whether as an obstacle or a facilitator, less attention has been paid to how corruption affects public investment, particularly in developing countries. However, research of this nature is particularly important, as public investment plays a key role in economic development, and corruption often distorts the allocation of resources in this sector. As a result, this review aims to shed light on both the broader economic implications of corruption and its specific impact on public investment outcomes, especially in contexts where such studies are limited, like Nigeria.

Several empirical studies have identified conditions under which corruption may have positive effects on economic growth. Trabelsi and Trabelsi (2021) argue that corruption, when maintained at moderate levels, can temporarily facilitate growth by helping to circumvent bureaucratic inefficiencies. Their research, which examines a range of countries, concludes that beyond a certain threshold, corruption becomes detrimental, eroding institutional quality and negatively impacting long-term economic development.Allan and Roland (2013) provide further evidence supporting this argument, using both linear and nonlinear panel methods to assess the relationship between corruption and growth across 42 developing countries. They found that moderate levels of corruption could spur growth by

alleviating regulatory burdens, especially in environments with weak institutions. However, their findings also highlight the transient nature of these benefits, noting that persistent corruption undermines governance and eventually stifles economic performance.

Similarly, Djouadi et al. (2024) present a dynamic threshold analysis that explores the non-linear relationship between corruption and economic growth in East Asian and MENA countries. Their findings suggest that corruption may initially facilitate growth by expediting bureaucratic processes, but beyond a certain threshold, it becomes detrimental to public sector investment and long-term development.Saha and Gounder (2013) offer similar insights into the non-linear effects of corruption on economic growth. Their panel least squares approach shows that while low levels of corruption might have a minor positive impact on growth by expediting administrative processes, beyond a critical threshold, corruption severely impairs economic growth and public sector efficiency.Huang (2016) also explores the possibility that corruption might coexist with growth in certain contexts. His study of 13 Asia-Pacific countries, including South Korea and China, shows that rapid economic growth can occur alongside high levels of corruption. The study suggests that factors such as institutional reform, industrialisation, and government intervention may moderate the adverse effects of corruption, thus, allowing growth to proceed despite its presence

In contrast, numerous studies emphasise the overwhelmingly negative impact of corruption on economic growth. Mauro's (1995) seminal work shows how corruption distorts public expenditure and reduces investment in productive sectors. Mo (2001) later confirmed these findings, showing that corruption significantly hampers human capital development and discourages foreign direct investment, leading to slower economic growth. Aidt et al. (2008) also stress that corruption erodes trust in institutions, leading to inefficiencies that are particularly harmful in developing countries.

Recent studies also support this view. Densumite (2023) provides additional evidence from a study on 12 countries, revealing that corruption negatively impacts economic growth by eroding public trust and reducing the efficiency of government expenditure. Makar et al. (2023) further support these findings in their study, which used Johansen cointegration and vector error correction techniques to analyse the long-run effects of corruption on Nigeria's economic growth from 1986 to 2019. They revealed that corruption has a significantly negative long-term effect on growth, particularly through its transmission channels such as household consumption, investment, and government spending

Ngakosso and Owonda (2021) investigated the relationship between corruption and economic growth in the Economic and Monetary Community of Central Africa (EMCCA), finding that corruption acts as a “grain of sand” in the economic machinery, negatively affecting growth. Miah et al. (2021) examined the impact of corruption on economic growth in Bangladesh, India, and Pakistan using an ARDL approach. The findings suggest that corruption significantly hampers growth by decreasing the efficiency of public sector investment and misallocating resources.

Gründler and Potrafke (2019) use System GMM models to show how corruption impedes growth, particularly in countries with weak institutional frameworks, reducing public sector efficiency and long-term growth prospects. Ajie and Gbenga (2015) and Shera et al. (2014) both find strong negative correlations between corruption and economic growth in Nigeria, with corruption distorting resource allocation and undermining public expenditure. Yusuf et al. (2014) show how corruption exacerbates poverty and impedes growth in Nigeria, further strengthening the argument that corruption's negative impact on economic performance is particularly severe in developing countries.

Emerging research has focused on how corruption disrupts the allocation of resources and impairs public investment in areas such as infrastructure and social services. Kesar and Jena (2022) reveal that corruption distorts public investment in BRICS economies, significantly hampering economic growth. Nguyen and Duong (2021) further emphasise the role of corruption in the misallocation of public funds, particularly in developing nations, with corruption exacerbating the negative effects of the shadow economy.In West Africa, Iheanachor et al. (2023) highlight the negative effects of corruption on environmental sustainability and economic performance, while Ibrahim and Sheu (2015) demonstrate how corruption misallocates public resources in Nigeria, slowing growth in critical sectors like infrastructure and education.

2.3 Research Gap and Contribution

Despite the substantial body of literature on examining corruption and economic growth, few studies have focused specifically on how corruption impacts public investment outcomes, particularly across different quantiles. This lack of focus is evident not only across countries

but also in Nigeria, where most research has focused on broader economic indicators rather than sector-specific outcomes. This leaves a gap in understanding how corruption affects the distribution and effectiveness of public investment, especially given its critical role in supporting long-term development in emerging economies.

This empirical researchaddresses this gap by examining the differentiated effects of corruption on public investment across various quantiles of economic performance. Using simultaneous quantile regression, this research paper provides a clearer picture of how corruption impacts public investment at different points of the economic distribution. This offers more insights into whether the effects of corruption are more significant at specific levels of public investment. This approach allows for a deeper understanding of the non-uniform effects of corruption, informing targeted policy interventions to enhance public sector efficiency and mitigate damaging influence of corruption on public investment.

2.4 Theoretical Framework

In classical economic theory, public investment is viewed with caution, as it is believed that excessive government intervention could distort market forces (Smith, 1776; Ricardo, 1817). Classical economists assert that public investment should be limited to areas where the market fails to provide efficiently, such as in public goods and essential infrastructure, to avoid impeding private sector efficiency and growth (Pigou, 1932). Similarly, neoclassical economists, while also cautious, focuses more on the potential inefficiencies of public investment, particularly the risk of crowding out private investment (Barro, 1974). They argue that public investment should be carefully targeted to address specific externalities and public goods, as excessive public investment can lead to higher taxes, debt, and reduced private sector activity, ultimately restraining long-term economic growth (Samuelson, 1954; Friedman, 1962). The concern in neoclassical models is that public investment, when not properly managed, could divert resources away from more efficient private sector activities, resulting in suboptimal economic outcomes for the economy.

The Keynesian perspective introduced a significant shift, particularly in response to the economic crises of the 1930s. Keynesian theory, as articulated by John Maynard Keynes, posits that active government intervention, particularly through public investment, is essential for stabilising economies during recessions and periods of high unemployment (Keynes, 1936). Unlike classical and neoclassical views, which often regard public investment as a potential inefficiency that risks crowding out private investment, Keynesian theory highlights

its crucial stabilising role. This implies that governments can address private sector shortfalls and manage economic cycles by injecting capital into infrastructure, education, and healthcare. Public investment is thus seen not only as a tool to correct market failures but also as a means of fostering long-term economic growth and development (Blinder & Solow, 1974).

However, while Keynesian theory emphasises the benefits of public investment, distortions such as corruption can significantly undermine its effectiveness. Corruption inflates costs, reduces the quality of projects, delays completion, and ultimately weakens the economic stimulus expected from such investments. These distortions threaten to erode the multiplier effect that public investment is supposed to generate, emphasizing the importance of governance reforms to ensure that public investment achieves its intended outcomes. Beyond Keynes, modern growth theories, particularly endogenous growth models, have further expanded the understanding of public investment. Endogenous growth theory posits that public investment, especially in infrastructure, education, and research and development, can have long-term effects on economic growth by improving productivity and fostering innovation (Romer, 1990). These investments strengthen the economy's capacity to innovate and accumulate human capital, driving sustainable growth from within. Nevertheless, corruption can severely undermine the principles of endogenous growth theory by diverting resources toward inefficient or less productive projects. When funds intended for critical areas such as research, education, or infrastructure are misallocated due to corrupt practices, the ability to improve productivity and innovation is eroded. This diversion hampers the economy's long-term growth potential, as the key drivers of endogenous growth, such as human capital and technological progress, are weakened by inefficiencies and mismanagement.

The effect of corruption on public investment is also grounded in two competing theoretical perspectives. On the one hand, there is what is called the efficiency-enhancing hypothesis, and on the other hand there is called the efficiency-reducing hypothesis. These perspectives, first introduced in the literature by Leff (1964), Myrdal (1968), Huntington (1968), Shleifer and Vishny (1993), and Rose-Ackerman (1978), form the basis of much of the contemporary debate.

2.4.1 Efficiency-Enhancing Hypothesis

The efficiency-enhancing hypothesis, often referred to as the "grease-the-wheels" argument (Levy, 2007). The general idea is that corruption can improve economic efficiency by allowing firms and individuals to bypass bureaucratic delays and inefficiencies, especially in countries with weak institutions. Leff (1964) and Huntington (1968) were early proponents of this hypothesis, arguing that in highly inefficient bureaucracies, corruption can act as a tool for expediting decision-making and investment processes. Under this framework, corruption facilitates economic activity by cutting through red tape, particularly in developing economies where institutional bottlenecks hinder the timely execution of public investment projects.

2.4.2 Efficiency-Reducing Hypothesis

The efficiency-reducing hypothesis, strongly advocated by Buchanan and Tullock (1962), Myrdal (1968), Shleifer and Vishny (1993; 1998), and Rose-Ackerman (1978, 1999), posits that corruption generally leads to resource misallocation, distorts economic incentives, and reduces overall economic efficiency. In this context, Shleifer and Vishny (1993) introduced the concept of "the grabbing hand," which describes how corrupt officials exploit their positions to extract bribes and rents for personal gain. This "grabbing hand" distorts resource allocation by encouraging over-investment in sectors where officials can extract the most rents, rather than in sectors with the highest social or economic returns. According to this view, corruption undermines public trust in government institutions, diverts public funds from productive investments to rent-seeking activities, and results in misallocation, especially in large-scale public investment projects, where mismanagement and financial inefficiency are more prevalent.

This research draws upon Keynesian and modern economic perspectives, as well as both the efficiency-enhancing and efficiency-reducing hypotheses, to explore the impact of corruption on public investment outcomes in Nigeria. The public investment index used in this study includes proxies such as access to electricity for infrastructure, school enrolment rates for education, and life expectancy for health, alongside capital spending on economic and social services. Corruption is measured using the Corruption Perceptions Index (CPI) from Transparency International, which captures the perceived levels of public sector corruption, thus, allowing for a comprehensive analysis of how corruption influences public investment across different quantiles in this research paper.

3.1 Methodology

This section outlines the methodology used in this study, focusing on the data and sources, the econometric approaches (including quantile and simultaneous quantile regression), and the model specification. This section aims to provide a clear foundation for investigating how corruption impacts public investment outcomes across different quantiles of economic investments in Nigeria.

3.2 Data and Sources

This study employs data from a variety of reputable sources to investigate the effects of corruption on public investment in Nigeria. The data include key economic and institutional variables such as corruption, GDP per capita (as a proxy for economic growth), inflation, government effectiveness, political instability, and foreign direct investment (FDI), with the Public Investment Index (PII) as the dependent variable. Table 1 provides the variables with their measurement and sources.

Table 1: Variables, Measurements, and Sources

Variables	**Acronyms**	**Measurements**	**Sources**
Corruption	CORRUP	Corruption Perception Index (0-100)	Transparency International
GDP per Capita (proxy for Economic Growth)	GDPPC	GDP per capita (US$)	World Bank, World Development Indicators
Inflation	INFL	Percentage change in Consumer Price Index	International Monetary Fund (IMF)
Government Effectiveness	GOVTEFF	The Government Effectiveness Index, originally measured on a scale from -2.5 to 2.5, is adjusted for robustness by transforming it into a 0–10 scale, with higher values indicating greater levels of governance dysfunction.	World Governance Indicators (WGI), World Bank
Political Instability	POLISTAB	The Political Instability and Violence Index, originally ranging from -2.5 to 2.5, is adjusted for robustness by converting it to a 0–10 scale, with higher values representing more severe instability and violence issues	World Governance Indicators (WGI), World Bank
Foreign Direct Investment	FDI	FDI inflows as a percentage of GDP	World Bank, World Development Indicators
Public Investment Index	PII	Z-score of access to electricity, life expectancy, school enrolment, capital spending on economic and	Author's computation based on World Bank data and Central Bank of Nigeria (CBN).

		social services	

Sources: Authors' compilations

3.3 Estimation Technique

3.3.1 Quantile Regression Approach

Quantile regression, developed by Koenker and Bassett (1978), provides a flexible approach to analysing how the effects of independent variables vary across the distribution of the dependent variable, offering insights beyond the mean effects estimated by ordinary least squares (OLS). This method is particularly valuable in contexts where the relationship between the variables may differ at different points in the outcome distribution.

For this study, quantile regression helps explore how corruption impacts public investment across different scales of projects (small, medium, and large) by estimating the effects at the 25th, 50th, and 75th percentiles of public investment outcomes.

The quantile regression model can be expressed as:

$$Q_\theta(PII_t|X_t) = X_i\beta_\theta + \epsilon_\theta$$

$Q_\theta(PII_t|X_t)$ is the conditional quantile of the Public Investment Index (PII) for quantile τ given the explanatory variables X_t,

t refers to the time period (e.g., year t) for the country under study.

$PIIi_i$is the Public Investment Index at time t.

X_t is the vector of explanatory variables (such as corruption, GDP per capita, inflation, etc.) for time t.

β_θ is the vector of quantile-specific coefficients.

ϵ_θ is the error term for time ii at quantileθ.

In this time series context, the equation models how the public investment index at each time period ii is related to the explanatory variables for that same time period.

3.3.2 Simultaneous Quantile Regression Approach

Simultaneous Quantile Regression extends the traditional quantile regression approach by estimating multiple quantiles of the conditional distribution of the dependent variable at once, rather than separately for each quantile. This method provides a thorough view of how the

effects of independent variables, such as corruption, vary across different points (quantiles) of the dependent variable's distribution.

Unlike standard quantile regression, which estimates one quantile at a time, simultaneous quantile regression allows for direct comparison of effects across multiple quantiles. This is particularly useful for detecting nonlinearities and differences in the relationship between variables at different levels of the distribution. For example, corruption may have a more significant impact on large-scale public investment projects where financial stakes and opportunities for rent-seeking are higher, compared to smaller projects.

The general form of the simultaneous quantile regression model is expressed as:

$$Q_\theta(PII_t|X_t) = X_t\beta_\theta + \epsilon_\theta, \qquad \theta \in \{0.24, 0.50. 075\}$$

$Q_\theta(In_PII_t|X_t)$represents the conditional quantile of the Public Investment Index (PII) at quantile θ,

X_t is the vector of explanatory variables (such as corruption, GDP per capita, inflation, etc.).
β_θ is the quantile-specific coefficients vector.
ϵ_θ is thequantile-specific error term.

3.4Model Specification

3.4.1 Public Investment Index Construction

The dependent variable, the Public Investment Index (PII), is constructed using normalized Z-scores of key public investment indicators, such as access to electricity (infrastructure), life expectancy (health investment outcome), primary school enrolment (education), and capital spending on economic and social services (as a percentage of GDP). Thus, PII can be constructed as the average of the standardised variables over time:

$$PII_t = \frac{1}{5}\left(Z_{elec_t} + Z_{sch\_enr_t} + Z_{sch\_enr_t} + Z_{cap\_eco_t} + Z_{cap\_soc_t}\right) \quad \text{----} \quad (3)$$

3.4.2 Model Specification

The final model specification for the simultaneous quantile regression is as follows:

$$Q_\theta(PII_t|X_t) = \propto_\theta + \beta_{1_\theta} CORRUP_t + \beta_{2_\theta} GDPPC_t + \beta_{3_\theta} INF_t + \beta_{4_\theta} GOVTEFF_t + \beta_{5_\theta} POLISTAB_t + \beta_{6_\theta} FDI_t + \gamma_\theta L\_CORRUP_t + \varphi_{1_\theta}(interaction\_terms)_t + \epsilon_\theta$$

$Q_\theta(In_PII_t|X_t)$is the conditional quantile function of PII,

$\beta_\theta$are the quantile-specific coefficients for each explanatory variable.

L_CORRUP is the is the lagged corruption variable.

Interaction terms capture the dynamic interactions between corruption and macroeconomic factors.

4.1 Results and Discussion

The results and discussion section begins by presenting the descriptive statistics, which provide an overview of the data used in the analysis. Following this, the section presents the findings from the simultaneous quantile regression analysis, which examines how corruption and other macroeconomic factors influence public investment outcomes across different quantiles.

4.2 Descriptive Statistics

The table 2 presents the descriptive statistics for the key variables used in the analysis, including public investment index (PII), corruption (CORRUP), GDP per capita (GDPPC), inflation, government effectiveness (GOVTEFF), political instability (POLISTAB), and foreign direct investment (FDI). These variables serve as the main drivers in understanding the interaction between corruption, other macroeconomic variables and public investment outcomes in Nigeria.

Table 2: Descriptive Statistics of Key Variables

Variable	Mean	Std. Dev.	Min	Max
PII	3.89E-09	0.412185	-0.930538	1.26792
CORRUP	21.10357	6.059916	6.9	28
GDPPC	2.011176	3.328284	-4.162059	12.2761
INFL	13.06214	5.160688	5.39	29.27
GOVTEFF	2.910777	0.175788	2.573432	3.20558
POLISTAB	1.527953	0.81562	0.577535	3.82351
FDI	1.249296	0.85144	-0.039522	2.90025

Authors computations using Stata 17

The descriptive statistics provide insight into the distribution of each variable used in the study. The Public Investment Index (PII), which measures public investment using normalised Z-scores for access to electricity, life expectancy, school enrolment, and capital spending on economic and social services, has a mean value of 3.89e-09. The minimum value of -0.93 and maximum of 1.27 show variability in public investment performance across different period. This range reflects the process of standardising various public investment measures into a common index, where positive values indicate higher levels of public investment compared to the mean, and negative values reflect lower levels of investment.

Corruption (CORRUP), measured on a scale of 0-100, has an average value of 21.10 with a standard deviation of 6.06, indicating a relatively high perception of corruption in Nigeria during the study period. The corruption perception index ranges from 6.9 to 28, suggesting considerable variation in the corruption levels across different periods, and highlighted both periods of relatively lower corruption and episodes where corruption reached significant levels. GDP per capita (GDPPC) has a mean of 2.01 and a standard deviation of 3.33, pointing to significant variability in economic performance over time. The minimum value of -4.16 indicates negative growth periods, while the maximum value of 12.28 represents periods of more robust economic growth. This wide range reflects the economic volatility experienced in Nigeria. Inflation (INFL) averages 13.06%, with a standard deviation of 5.16%, showing moderate inflationary pressure across different time periods. The minimum inflation rate of 5.39% and the maximum of 29.27% indicate that Nigeria has faced significant inflationary fluctuations, likely driven by both internal and external economic factors. The Government Effectiveness (GOVTEFF) index, adjusted from its original scale to range between 0 and 10, shows a mean of 2.91 with relatively low variation (standard deviation of 0.18). This suggests that while there are some changes in governance quality, government effectiveness remains consistently low during the observed periods, with only minor improvements or declines. Political Instability and Violence (POLISTAB) also varies significantly, with a mean of 1.53 and a standard deviation of 0.82. The minimum value of 0.58 and the maximum of 3.82 highlight substantial differences in the political stability and security situation during the periods analysed, with some periods being marked by more severe political unrest than others (with periods of unrest and violence likely undermining public investment efforts). Foreign Direct Investment (FDI) averages 1.25% of GDP, with a standard deviation of 0.85%. The minimum value of -0.04% indicates that at some points,

FDI was negative, reflecting capital flight, while the maximum value of 2.90% suggests that during certain periods, Nigeria attracted significant foreign capital inflows

4.3 Estimates for simultaneous quantile regression

Table 3 presents the results of the simultaneous quantile regression analysis, which examines the impact of corruption on public investment outcomes across different quantiles in Nigeria. Unlike traditional OLS regression, which estimates average effects, this method provides quantile-specific estimates, with focus on capturing the effects of corruption and other macroeconomic variables on low, medium, and high levels of investment.

The empirical findings presented in Table 3 reveal that corruption consistently exerts a negative and significant effect on public investment across all percentiles in Nigeria. Specifically, at the 25th percentile, corruption reduces public investment by -0.105, indicating that even at lower levels of public investment, corruption has a corrosive impact. The effect becomes more pronounced at the 50th percentile, with the coefficient increasing to -0.154, where corruption plays a more detrimental role. This adverse effect worsens at the 75th percentile, where corruption significantly reduces public investment by -0.305. This finding suggests that larger public investment projects in Nigeria are especially vulnerable to the harmful effects of corruption. Several factors may explain this outcome. Firstly, the involvement of larger sums of money in significant infrastructure or development projects creates greater opportunities for rent-seeking, mismanagement, and embezzlement, which are pervasive issues in the Nigerian context. Secondly, the complexity of large-scale projects, often involving multiple contractors and agencies, may facilitate corruption through non-transparent procurement processes, inflated contracts, and weakened oversight. In addition, the limited capacity of anti-corruption institutions to effectively monitor and enforce transparency in such large projects worsens the issue, which makes larger investments more vulnerable to the adverse effects of corruption.

The lag of corruption also has a significant and negative effect on public investment across all percentiles in Nigeria, with the magnitude of this effect increasing as we move up the distribution. At the 25th percentile, the lagged effect of corruption is -0.057, indicating that past corruption slightly diminishes smaller-scale public investments. This negative impact becomes more evident at the median percentile, where the coefficient is -0.087, reflecting a more sustained and damaging influence of past corrupt practices on medium-sized public investment projects. The largest effect is observed at the 75th percentile, where the lagged

impact of corruption significantly reduces public investment by -0.185. These findings suggest that the lingering effects of corruption are particularly severe for larger projects in Nigeria, which are more vulnerable to delays and cost overruns caused by previous corrupt practices. Several factors may explain this stronger impact of lagged corruption. Firstly, corruption often results in long-term inefficiencies in public projects, with its effects becoming more apparent over time, particularly in larger and more complex investments. Secondly, the delayed consequences of corrupt practices, such as misallocated funds or substandard work, accumulate and further worsen the outcomes of public investments. Lastly, larger projects in Nigeria may face greater challenges in correcting corruption-related issues from the past, as their extended timelines and scale make it harder to recover from earlier mismanagement.

Table 3: The results of the Simultaneous Quantile Regression (Public Investment Index as Dependent variable)

Variable	Q(0.25) Coefficients	Q(0.50) Coefficients	Q(0.75) Coefficients
Corruption (CORRUP)	-0.105***	-0.154**	-0.305***
	(0.043)	(0.061)	(0.094)
Lag of Corruption (L_CORRUP)	-0.057*	-0.087**	-0.185***
	(0.030)	(0.032)	(0.073)
GDP Per-capita (GDPPC)	0.079*	0.150***	0.126**
	(0.040)	(0.051)	(0.051)
Inflation (INFL)	-0.069**	-0.066**	0.054**
	(0.021)	(0.023)	(0.022)
Govt Effectiveness (GOVTEFF)	0.205**	0.354***	0.255***
	(0.018)	(0.100)	(0.102)
Political Instability (POLISTAB)	-0.306**	-0.205***	-0.196**
	(0.050)	(0.073)	(0.070)
Foreign Direct Investment (FDI)	0.079	0.176**	0.146*
	(0.053)	(0.072)	(0.081)
CORRUP*GDPPC	-0.024	-0.129**	-0.157**
	(0.043)	(0.052)	(0.063)
CORRUP*INFL	-0.063*	0.052**	-0.061**
	(0.03)	(0.014)	(0.015)
CORRUPT*GOVTEFF	0.121**	0.184***	0.082**
	(0.063)	(0.071)	(0.041)
CORRUP*POLISTAB	-0.213***	-0.029*	0.210**
	(0.004)	(0.015)	(0.097)
CORRUP*FDI	-0.022	-0.074**	-0.122***
	(0.036)	(0.004)	(0.005)
Constant	1.501***	2.104***	2.802***
	(0.060)	(0.750)	(0.880)
Number of obs = 21			
0.25 Pseudo R2 = 0.8873			
0.50 Pseudo R2 = 0.9167			
0.75 Pseudo R2 = 0.9583			

Notes: ***, ** & * indicates significance at 1%, 5% & 10% level respectively. The bootstrap standard errors are in parenthesis ().

The finding suggests that economic growth, as proxied by GDP per capita, exhibits a positive and significant relationship with public investment, though the strength of this effect varies across percentiles. At the 25th percentile, economic growth increases public investment by 0.079, indicating that higher income levels modestly support smaller-scale investment projects. The effect becomes stronger at the median percentile, where a 0.150 increase in public investment is observed, suggesting that rising income levels play a more substantial role in driving medium-sized projects. However, at the 75th percentile, the effect of economic growth weakens slightly to 0.126. This indicates that while higher income levels generally support public investment, their marginal benefit is more pronounced for medium-sized investments and diminishes somewhat at higher levels, possibly due to inefficiencies or challenges in effectively managing larger-scale projects. This pattern can be attributed to the nature of investment absorption and project management. In Nigeria, smaller and medium-scale projects often have more flexible structures and are better equipped to swiftly utilise additional resources stemming from economic growth. In contrast, larger projects may face issues such as bureaucratic delays, capacity constraints, or the need for more complex oversight, thereby limiting the marginal returns from increased income. Moreover, as income levels rise, the impact on public investment may reach a point where further increases in income yield diminishing returns, particularly as the allocation of resources becomes less efficient in larger-scale ventures

Inflation has a varied effect on public investment in Nigeria, showing a significant negative impact at the lower and median percentiles, but a positive effect at higher percentiles. At the 25th percentile, inflation reduces public investment by 0.069, suggesting that rising prices erode the purchasing power of smaller projects, making it harder to finance essential goods and services. Similarly, at the median percentile, inflation continues to have a negative effect, reducing investment by 0.066, indicating that medium-sized projects also struggle to absorb increased costs in the face of rising inflation. However, at the 75th percentile, inflation exerts a positive effect, with a coefficient of 0.054. This suggests that larger projects may be better equipped to adjust for inflation, potentially through more flexible funding arrangements or the ability to renegotiate contracts to account for rising costs. This variation in the effect of inflation can be attributed to several factors in the Nigerian context. Smaller and medium-sized projects generally have limited financial reserves, which makes them more susceptible to price increases, often resulting in cost overruns and delays in project completion. On the other hand, larger projects, particularly those with long-term horizons, often have better

access to hedging mechanisms, inflation-linked contracts, or contingency funds that help mitigate the impact of rising prices. In addition, larger projects may benefit from economies of scale, allowing them to absorb inflationary pressures more effectively by taking advantage of bulk purchasing and stronger negotiating power with suppliers. Furthermore, inflation could prompt greater public investment in larger projects, as the Nigerian government may channel more funds into infrastructure development to stimulate economic growth and counteract inflationary pressures in key sectors.

Government effectiveness has a consistently positive and significant effect on public investment across all percentiles in Nigeria, with the magnitude of this effect being particularly strong at the median level. At the 25th percentile, government effectiveness increases public investment by 0.205, indicating that effective governance provides essential support for smaller projects. This effect is even more evident at the median percentile, where government effectiveness increases public investment by 0.354, which reflects its critical role in promoting medium-scale projects. At the 75th percentile, the positive impact of government effectiveness remains significant but decreases slightly to 0.255. The varying impact of government effectiveness across percentiles in Nigeria stems from several factors. In both theory and practice, effective governance fosters an enabling environment for public investment by ensuring efficient resource allocation, enhancing oversight and accountability, and building capacity for managing complex projects. For smaller projects in Nigeria, strong governance provides stability and clear policy direction, which boosts public confidence and encourages further investment. Effective governance also plays a pivotal role in medium-scale projects, where coordinated planning and strategic oversight are essential to ensure successful outcomes. However, the complexity and scale of larger projects in Nigeria can sometimes undermine the effectiveness of governance. This is largely due to the involvement of multiple stakeholders, intricate procurement processes, heightened risks, and increased bureaucracy, all of which can erode governance and create vulnerabilities to corruption, mismanagement, and inefficiencies. Additionally, entrenched interests and external factors may further diminish the benefits of effective governance in larger projects, limiting its capacity to mitigate these challenges effectively.

Political instability and violence negatively affect public investment across all quantiles. At the 25th percentile, the coefficient of -0.306 indicates that increased political instability and violence significantly reduce public investment in smaller-scale projects. The uncertainty arising from political unrest makes investors reluctant to commit resources, particularly in

smaller projects that tend to have lower financial buffers to withstand the risks associated with governance instability. In such an environment, even minor political disruptions can cause project delays, resource misallocation, or even complete abandonment of smaller projects. At the 50th percentile, the coefficient is -0.205, which indicates that medium-scale public investments are also negatively affected by political instability and violence. These projects, which often require longer-term commitments, are vulnerable to political disruptions, such as shifting priorities, governance changes, or interruptions in funding. This leads to inefficiencies in project execution and hinders the completion of infrastructure or social services projects, especially when political unrest heightens the uncertainty of future resource flows. At the 75th percentile, the coefficient of -0.196 suggests that large-scale public investments are similarly affected by political instability, although the magnitude is slightly smaller than for medium and smaller projects. Large-scale projects, which often involve significant financial resources and longer timelines, may suffer from stalled progress, shifting policy priorities, or even corruption, particularly when political stability is compromised. However, the slightly smaller impact could be due to the fact that these large projects often have stronger governmental and international oversight, which may cushion some of the effects of political instability.

Foreign Direct Investment (FDI) has a positive and significant impact on public investment at the median and upper percentiles in Nigeria, though its effect is not significant at the lower end of the distribution. At the 25th percentile, FDI has no significant impact on public investment, which suggests that smaller-scale projects may not attract or rely heavily on foreign capital. However, at the median percentile, FDI increases public investment by 0.176, reflecting its importance in financing medium-sized projects, which often require more substantial external funding sources. The positive effect of FDI continues at the 75th percentile, where it increases public investment by 0.146. Several factors explain this pattern in the Nigerian context. Firstly, medium and large-scale public projects often require higher levels of funding and technical expertise, which foreign investors are more likely to provide. In Nigeria, these projects typically involve infrastructure or industrial development that aligns with the interests of foreign investors seeking returns from long-term ventures. Secondly, FDI is often directed towards sectors or areas where projects are already sizable and where the Nigerian government has established frameworks conducive to international investment. Smaller projects, on the other hand, may struggle to attract FDI due to their lower returns and limited visibility in international markets. Finally, foreign investors are generally more

attracted to stable environments where larger projects can offer a higher degree of profitability and long-term security, further explaining why FDI has a stronger impact on medium and large-scale investments in Nigeria.

The interaction between corruption and economic growth is negative and significant across all percentiles, indicating that as economic growth increases, the negative effect of corruption on public investment becomes more evident. At the 25th percentile, the interaction is -0.024, suggesting that for smaller-scale investments, the relationship between corruption and economic growth does not significantly impact investment outcomes. However, at the 50th percentile, the coefficient becomes more severe at -0.129, reflecting that as the economy grows, corruption exerts a stronger negative influence on medium-sized public investments. This effect intensifies further at the 75th percentile, where the interaction term is -0.157, indicating that for larger public investment projects, the detrimental effect of corruption worsens as economic growth continues. This finding can be explained by several factors specific to Nigeria. As the economy grows, larger public investment projects are often initiated, particularly in infrastructure and development sectors, which are vulnerable to mismanagement and corrupt practices. Economic expansion creates more opportunities for rent-seeking, where government officials and elites divert funds for personal gain, further weakening the positive effects of economic growth on public investment. Moreover, in Nigeria, the allocation of public investments is often influenced by political patronage, meaning that more resources are misallocated as the economy expands, particularly in larger projects that attract significant funding. Furthermore, the absence of strong institutional frameworks allows corruption to become more entrenched as economic growth increases, worsening the negative impact of corruption on public investments.

The interaction between corruption and inflation reveals a notable dynamic, with significant negative coefficients across all percentiles. At the 25th percentile, the interaction term is -0.063, indicating that inflation worsens the negative effect of corruption on smaller public investments. This negative relationship is also observed at the 50th percentile, where the interaction remains at -0.052, showing that higher inflation levels further exacerbate the corruptive impact on medium-scale investments. At the 75th percentile, the negative interaction coefficient of -0.061 demonstrates that in larger public investment projects, inflation compounds the adverse effects of corruption, making it even more challenging to achieve efficient outcomes. This pattern can be explained by several factors. In the Nigerian context, inflation erodes the real value of public funds, which is particularly harmful when

corruption is already diverting resources away from productive uses. For smaller projects, inflation squeezes already-limited budgets, while corruption further reduces the funds available for essential project components, leading to delays, cost overruns, and incomplete projects. As inflation rises, it increases the cost of goods and services, and in an environment where corruption is prevalent, public officials may inflate prices even further to siphon off more funds. This impact is magnified in medium and large-scale projects, where inflated costs and corrupt practices become more systemic and deeply embedded in the procurement process. In addition, corruption often leads to poor fiscal management, which worsens inflationary pressures, creating a vicious cycle where inflation and corruption reinforce each other, particularly in larger projects that are highly resource-intensive

The interaction between corruption and government effectiveness is positive and significant across all percentiles, indicating that higher levels of government effectiveness help to mitigate the negative effects of corruption on public investment. At the 25th percentile, the interaction coefficient is 0.121, showing that even for smaller investments, effective governance reduces the harmful impact of corruption. This effect becomes stronger at the 50th percentile, where the interaction term is 0.184, suggesting that in medium-sized public investments, improvements in government effectiveness play a significant role in counteracting the negative influence of corruption. At the 75th percentile, the interaction remains positive but diminishes slightly to 0.082, implying that while government effectiveness continues to mitigate corruption's impact, its influence is somewhat reduced in larger public investments. Several factors explain this pattern, particularly in the context of Nigeria. Government effectiveness is crucial in ensuring that public investment projects are properly monitored and managed. In smaller investments, effective governance may be able to provide tighter oversight and accountability, making it harder for corrupt practices to take root. As a result, the impact of corruption is significantly reduced. In medium-sized projects, improvements in government effectiveness can lead to better allocation of resources, more transparent procurement processes, and stronger enforcement of regulations, which collectively limit the opportunities for corruption to divert funds. This is why the interaction effect is stronger at this level. In larger projects, while government effectiveness still plays a vital role, the sheer scale and complexity of these investments make it harder to fully neutralise the impact of corruption. Larger projects often involve more stakeholders, longer timelines, and bigger budgets, which can increase the opportunities for corrupt practices, even when governance structures are in place. As such, although government effectiveness

continues to help reduce negative effects of corruption, its influence is somewhat diluted at the upper end of the distribution.

The interaction between corruption and political instability and violence also has negative effects on public investment across different quantiles. At the 25th percentile, the interaction term coefficient of -0.213 suggests that the combined effects of corruption and political instability further reduce investment in smaller-scale public projects. When political instability and corruption coexist, they create a particularly hostile environment for smaller investments. Political unrest makes it easier for corrupt practices to flourish, as oversight weakens, and smaller projects, which typically receive less scrutiny, become more prone to fund misappropriation and delays. The combined uncertainty of political instability and corruption creates an unstable environment where public resources are siphoned off, and smaller projects struggle to proceed effectively. At the 50th percentile, the interaction between corruption and political instability has a coefficient of -0.029, which is significant at the 10% level. Although this interaction effect is relatively weak, it suggests that political instability exacerbates the negative impact of corruption on medium-scale public investment projects in Nigeria. This could be because, in politically unstable environments, corruption thrives more easily, leading to further misallocation of resources, project delays, and inefficiencies in governance. In this context, political instability may weaken institutional frameworks, making it harder to mitigate corruption's effects, especially in medium-scale projects that rely on consistent policy and oversight. At the 75th percentile, the interaction term of 0.210 suggests that for large-scale public investments, political instability may slightly mitigate the negative impact of corruption. Although corruption still negatively affects public investment, large-scale projects often involve multiple stakeholders and higher levels of international and governmental scrutiny, which could help offset some of the corruption's negative effects. In large projects, political stability (or even a semblance of it) may help ensure that certain key governance mechanisms remain in place, which provides some level of continuity despite ongoing corruption. This might explain why the interaction term shows a slight positive effect at the upper quantile.

The interaction between corruption and Foreign Direct Investment (FDI) is negative and significant at the median and upper percentiles, indicating that FDI worsens the negative effects of corruption on public investment, particularly in medium and large projects. At the 25th percentile, the interaction term is negative but insignificant (-0.022), suggesting that for smaller investments, FDI does not significantly interact with corruption to influence

outcomes. However, at the 50th percentile, the interaction term is -0.074, indicating that for medium-sized investments, corruption reduces the potential benefits of FDI. This negative interaction becomes even stronger at the 75th percentile, where the coefficient is -0.122, showing that in larger public investment projects, corruption significantly undermines the positive effects of FDI. There are several reasons that explain this dynamic in Nigeria's context. Firstly, FDI often involves large sums of money and complex transactions, especially in sectors such as infrastructure, energy, and construction, in which public investment overlaps with foreign capital. In environments where corruption is prevalent, these projects become susceptible to embezzlement, misallocation of funds, and inflated costs. As a result, the potential benefits of FDI, such as technology transfer, job creation, and improved infrastructure, are weakened by corrupt practices. For medium-sized projects, this corruption-FDI interaction can lead to inefficiencies and delays, as corrupt actors divert resources meant for productive investment. In larger projects, the impact is even more evident. Large-scale public investments often require substantial foreign input, either through direct capital injections or partnerships with multinational companies. However, corruption distorts the allocation of these foreign funds, with government officials or intermediaries seeking personal gain, which reduces the effectiveness of FDI. Furthermore, foreign investors may become discouraged by corruption, leading to reduced investment or increased costs associated with managing corruption risks, such as bribes or bureaucratic delays. This explains why the negative interaction between FDI, and corruption is strongest in larger public investment projects, as corruption erodes the very gains that FDI is intended to deliver.

5.1 Conclusion and Policy recommendations

5.2 Conclusion

This study has empirically examined the impact of corruption on public investment outcomes across different quantiles in Nigeria, using simultaneous quantile regression to capture variations in the effects across small, medium, and large-scale investments. The findings consistently show that corruption exerts a significant and negative influence on public investment across all quantiles, with the effect intensifying as the scale of investment increases. Larger projects, which involve higher financial stakes and greater complexity, are particularly vulnerable to the corrosive effects of corruption. This result aligns with the understanding that larger projects create more opportunities for rent-seeking, mismanagement, and inefficient use of resources, making them susceptible to delays, cost overruns, and incomplete execution.

The study also reveals that the lagged effects of corruption exacerbate the negative impact on public investment, particularly for medium and large-scale projects. The persistence of corruption over time results in accumulated inefficiencies, which hampers the long-term success of public investment projects. The interaction between corruption and other macroeconomic variables further highlights the complexity of the issue. While government effectiveness helps mitigate the detrimental effects of corruption by improving oversight and resource allocation, factors such as inflation and foreign direct investment (FDI) intensify the negative impact of corruption, particularly in medium and large projects. Political instability was found to have a dual effect: it worsens corruption's impact on smaller projects, which are more vulnerable to governance disruptions, but in larger projects, it may alleviate corruption's effects due to stronger oversight mechanisms.

The role of economic growth, as proxied by GDP per capita, provides a positive contribution to public investment, particularly for medium-scale projects. However, the marginal effect weakens for larger investments, suggesting that while economic growth supports public investment, larger projects may still face inefficiencies and governance challenges that limit their effectiveness. Inflation was shown to reduce public investment in smaller and medium-sized projects but had a positive impact on larger investments, likely due to the ability of large projects to better absorb rising costs through more flexible financing arrangements or stronger negotiation power. FDI plays a positive role in medium and large projects but, when combined with corruption, its benefits are significantly diminished, particularly in larger projects.

5.3 Policy Recommendations

Given the findings of this study, several policy recommendations emerge to address the challenges posed by corruption on public investment outcomes in Nigeria.

Firstly, stronger institutional frameworks are needed to improve transparency and accountability in the public sector, particularly in large-scale projects where corruption is most pronounced. Strengthening anti-corruption institutions and enhancing the effectiveness of procurement processes will be essential in curbing rent-seeking behaviour and ensuring that public resources are efficiently allocated and utilised.

Secondly, governance reforms must focus on enhancing government effectiveness, especially in terms of oversight and resource management. Effective governance can play a crucial role

in reducing the adverse effects of corruption, as evidenced by the positive interaction between corruption and government effectiveness across all quantiles. By improving transparency, streamlining administrative procedures, and ensuring stricter monitoring, the government can create a more favourable environment for public investment.

Thirdly, addressing the macroeconomic factors that exacerbate corruption's effects is equally important. Policies aimed at stabilising inflation and creating a conducive environment for foreign direct investment will help mitigate the negative interactions between these variables and corruption. Inflationary pressures, in particular, undermine the real value of public funds, especially in smaller projects. Therefore, maintaining price stability and reducing inflation volatility should be a key priority for the Nigerian government.

Fourthly, political stability is critical for improving public investment outcomes, particularly in smaller projects, which are highly sensitive to governance disruptions. Ensuring a stable political environment will reduce uncertainty, build investor confidence, and improve the execution of public projects. This requires a concerted effort to address the underlying causes of political instability, including ethnic tensions, governance reforms, and better conflict resolution mechanisms.

Lastly, while economic growth positively influences public investment, its impact on larger projects is limited by inefficiencies and governance challenges. Policymakers should focus on creating an investment-friendly environment that not only fosters economic growth but also ensures that larger-scale projects are efficiently managed. This includes improving project management capacity, addressing bureaucratic delays, and ensuring that public investments align with broader economic development goals.

In conclusion, tackling corruption in public investment requires a comprehensive approach that strengthens institutional frameworks, improves governance effectiveness, ensures macroeconomic stability, and promotes political stability. By implementing these recommendations, Nigeria can enhance the efficiency and effectiveness of its public investment, thereby supporting long-term economic development and improving the well-being of its citizens.

References

1. Ajie, H. A., & Gbenga, O. (2015). Corruption and economic growth in Nigeria: An empirical analysis. *European Journal of Business and Management, 7*(5), 224–235.

2. Aidt, T. S., Dutta, J., & Sena, V. (2008). Governance regimes, corruption and growth: Theory and evidence. *Journal of Comparative Economics, 36*(2), 195–220.
3. Allan, S. W., & Roland, C. (2013). Economic growth and corruption in developing economies: Evidence from linear and non-linear panel causality tests. *Business, Finance and Economics in Emerging Economies, 8*(2), 21–43.
4. Amundsen, I. (2010). *Good governance in Nigeria: A study in political economy and donor support*. Chr. Michelsen Institute.
5. Aschauer, D. A. (1989). Is public expenditure productive? *Journal of Monetary Economics, 23*(2), 177–200.
6. Bardhan, P. (1997). Corruption and development: A review of issues. *Journal of Economic Literature, 35*(3), 1320–1346.
7. Barro, R. J. (1974). Are government bonds net wealth? *Journal of Political Economy, 82*(6), 1095–1117.
8. Becker, G. S. (1993). *Human capital: A theoretical and empirical analysis with special reference to education* (3rd ed.). University of Chicago Press.
9. Blinder, A. S., & Solow, R. M. (1974). *Analytical foundations of fiscal policy*. Cambridge University Press.
10. Buchanan, J. M., and Tullock, G. (1962), *The Calculus of Consent: Logical Foundations of Constitutional Democracy*, Ann Arbor, MI, University of Michigan
11. Densumite, S. (2023). Corruption and economic growth: An empirical study in 12 countries. *Asia Social Issues, 17*(2), e262107.
12. Djouadi, I., Zakane, A., & Abdellaoui, O. (2024). Corruption and economic growth nexus: Empirical evidence from dynamic threshold panel data. *Business Ethics and Leadership, 8*(2), 49–62.
13. Duong, T. H. M., & Nguyen, T. A. N. (2021). Social capital and the shadow economy: A Bayesian analysis of the BRICS. *Asian Journal of Economics and Banking, 5*(3), 272–283.
14. Friedman, M. (1962). *Capitalism and Freedom*. University of Chicago Press.
15. Gründler, K., & Potrafke, N. (2019). Corruption and economic growth: New empirical evidence. *European Journal of Political Economy, 60*, 101810.
16. Huang, C. J. (2016). Is corruption bad for economic growth? Evidence from Asia-Pacific countries. *The North American Journal of Economics and Finance, 35*, 247–256.
17. Huntington, S. P. (1968). *Political order in changing societies*. Yale University Press.
18. Ibrahim, W., & Sheu, O. A. (2016). Corruption and economic growth in Nigeria (1980-2013). *Journal of Academic Research in Economics, 8*(1), 1–13.
19. Iheanachor, N., Ogbechie, C. I., & Ozegbe, A. E. (2023). Corruption, environmental sustainability, and economic performance in emerging economies: Evidence from Nigeria. *International Journal of Management, Economics and Social Sciences, 12*(1), 52–78.
20. Johnston, M. (1996). The search for definitions: The vitality of politics and the issue of corruption. *International Social Science Journal, 48*(3), 321–335.
21. Kaufmann, D., Kraay, A., & Zoido-Lobatón, P. (1999). Governance matters. *World Bank Policy Research Working Paper No. 2196*. https://doi.org/10.1596/1813-9450-2196
22. Kesar, A., & Jena, P. K. (2022). Corruption and its impact on economic growth: Evidence from BRICS countries. *Journal of Business and Economic Policy, 9*(2), 65–79.
23. Keynes, J. M. (1936). *The General Theory of Employment, Interest, and Money*. Macmillan.
24. Klitgaard, R. (1988). *Controlling corruption*. University of California Press.

25. Leff, N. H. (1964). Economic development through bureaucratic corruption. *American Behavioral Scientist, 8*(3), 8–14.
26. Levy, D. (2007). Price Adjustment under the Table: Evidence on Efficiency-enhancing Corruption, *European Journal of Political Economy*, 23, 423-47.
27. Makar, T. A., Ngutsav, A., Ijirshar, V. U., & Ayaga, J. M. (2023). Impact of corruption on economic growth: An empirical evidence from Nigeria. *Journal of Public Administration, Finance and Law, 27*, 254–268.
28. Mauro, P. (1995). Corruption and growth. *The Quarterly Journal of Economics, 110*(3), 681–712. https://doi.org/10.2307/2946696
29. Méon, P. G., & Weill, L. (2010). Is corruption an efficient grease? *World Development, 38*(3), 244–259.
30. Miah, M. M., Akter, T. R., & Majumder, S. C. (2021). The impact of corruption on the economic growth in Bangladesh, India, and Pakistan: An ARDL approach. *Independent Journal of Management & Production, 12*(8), 2079–2083.
31. Mo, P. H. (2001). Corruption and economic growth. *Journal of Comparative Economics, 29*(1), 66–79.
32. Musgrave, R. A. (1959). *The theory of public finance: A study in public economy*. McGraw-Hill.
33. Ngakosso, A., & Owonda, F. (2021). Corruption and growth in the Economic and Monetary Community of Central Africa (EMCCA): The role of democracy. *Theoretical Economics Letters, 11*(4), 858–870.
34. Nguyen, H. T., & Duong, M. C. T. H. (2021). Shadow economy, corruption and economic growth in BRICS countries. *Journal of Asian Finance, Economics and Business, 8*(4), 665–672.
35. Olken, B. A. (2007). Monitoring corruption: Evidence from a field experiment in Indonesia. *Journal of Political Economy, 115*(2), 200–249. https://doi.org/10.1086/517935
36. Pigou, A. C. (1932). *The Economics of Welfare*. Macmillan.
37. Ricardo, D. (1817). *On the Principles of Political Economy and Taxation*. John Murray.
38. Romer, P. M. (1990). Endogenous technological change. *Journal of Political Economy, 98*(5), S71–S102.
39. Rose-Ackerman, S. (1978). *Corruption: A Study in Political Economy*. Academic Press.
40. Rose-Ackerman, S. (1999). *Corruption and Government: Causes, Consequences, and Reform*. Cambridge University Press.
41. Samuelson, P. A. (1954). The pure theory of public expenditure. *Review of Economics and Statistics, 36*(4), 387–389.
42. Shleifer, A., & Vishny, R. W. (1993). Corruption. *The Quarterly Journal of Economics, 108*(3), 599–617. https://doi.org/10.2307/2118402
43. Shleifer, A., and Vishny, R. W. (1998). *The Grabbing Hand, Government Pathologies and Their Cures*, University
44. Smith, A. (1776). *An Inquiry into the Nature and Causes of the Wealth of Nations*.
45. Tanzi, V. (1998). Corruption around the world: Causes, consequences, scope, and cures. *IMF Staff Papers, 45*(4), 559–594.
46. Tanzi, V., & Davoodi, H. (1997). Corruption, public investment, and growth. *IMF Working Paper, WP/97/139*. https://doi.org/10.5089/9781451929515.001
47. Transparency International. (2018). *Corruption Perceptions Index 2018*. Transparency International.
48. Transparency International. (2021). *Corruption Perceptions Index 2021*. Transparency International.

49. Trabelsi, M. A., & Trabelsi, H. (2021). At what level of corruption does economic growth decrease? *Journal of Financial Crime, 28*(4), 1317–1324.
50. United Nations Development Programme (UNDP). (1999). *Governance and Sustainable Human Development*. New York: UNDP.
51. World Bank. (1997). *Helping countries combat corruption: The role of the World Bank*. Washington D.C.
52. World Bank. (2012). *Public investment management in developing countries*. Washington D.C.: World Bank.
53. World Bank. (2017). *Public investment management: A review of country practices*. Washington D.C.
54. Yusuf, M., Malarvizhi, C. A., Mazumder, M. N. H., & Su, Z. (2014). Corruption, poverty, and economic growth relationship in the Nigerian economy. *The Journal of Developing Areas, 48*(3), 95–107.