Public Expenditure, Institutional Environment and Economic Growth

by

IFEOMA RITA EZEDEBEGO

***Supervisors*:**

1. Dr. Philip Kostov
2. Dr. Rami Salem

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Print Name: **IFEOMA RITA EZEDEBEGO**

ABSTRACT

This study, based on the endogenous growth theory, evaluates the effects of public expenditures and the institutional environment on economic growth using data from 67 developed and developing countries from 1984 to 2017. Specifically, it investigates the effects of public expenditures on communication and health sectors and institutional factors on economic growth. Using real GDP per capita as the dependent variable, the analysis employed the Unconditional Quantile Regression (UQR) method. The findings reveal that the effects of public expenditure on growth is largely determined by the income level of countries. Public spending on communication and health fosters growth in high-income countries, while it proves insignificant to growth in low-income countries. Similarly, human capital shares positive relationship with growth in high-income countries but it is not a significant driver of growth in low-income nations. Additionally, total factor productivity (TFP) is positively related to growth in high-income countries whereas it negatively affects growth in lower-income countries. The relationship between institutional environment and economic growth varies by income level: Government stability promotes growth in wealthier nations but does not matter for growth in poorer nations. Furthermore, while corruption reduces growth ("sands the wheels") in low-income nations, it appears to promote growth ("greases the wheels") in low-income contexts. Initial tests suggest that total factor productivity is endogenous. After correcting for endogeneity issues, the analysis indicates that health expenditures interact with institutional factors such as corruption and rule of law. While corruption reduces the growth effect of health expenditure, rule of law, enhances these effects. A major implication of this study is that the structure of public expenditure needs to differ between low and high income countries. Moreover, there may be need to adjust the proportion of spending allocated to various sectors in line with country's income level. This further implies that the total value or percentage of expenditure in poor countries may be insufficient to stimulate the desired level of economic growth.

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LIST OF ABBREVIATION

IV	Instrumental Variable
FE	Fixed Effects
RE	Random Effects
R&D	Research and Development
REWB	Random Effects Within Between Model
GAM	Generalised Additive Model
Edf	Effective Degrees of Freedom
OLS	Ordinary Least Squares
RIF-OLS	Recentered Influence Function Ordinary Least Squares
GMM	Generalised Method of Moments
ELF	Ethnolinguistic Fractionalisation
ICRG	International Country Risk Guide
OECD	Organization for Economic Cooperation and Development
SUR	Seemingly Unrelated Regression
IDF	Index of Freedom
CDF	Cumulative Distribution Function
SPEED	Statistics on Public Expenditures for Economic Development
IFPRI	International Food Policy Research Institute
PWT 10.01	Penn World Table 10.01
COFOG	Classification of Functions of Government
CQR	Conditional Quantile Regression
UQR	Unconditional Quantile Regression
ML	Maximum Likelihood

CHAPTER ONE

BACKGROUND OF THE STUDY

1.1 INTRODUCTION

This study contributes to the ongoing research on the empirical linkages between public expenditure, institutions and economic growth (Barro, 1991; Bose et al., 2007; Butkiewicz & Yanıkkaya, 2011; Connolly & Li, 2016; Devarajan et al., 1996; Easterly & Rebelo, 1993; Esfahani & Ramirez, 2003; Wu et al., 2010; Gemmell et al, 2016; Sidek & Asutay, 2020; Chu et al, 2020; Kutasi & Marton, 2020; Qeheja et al, 2023; Hu & Wang, 2024). Public expenditure plays a key role in shaping national policies (Yu et al., 2015; Zouhar et al., 2021). It serves as a tool for operationalising government strategies to achieve key functions and promote economic growth. Thus, accurate and consistent data on public expenditure provides information about allocative efficiency and reflects government priorities over time. Accessibility of such information promotes accountability as it gives citizens, civil society organisations, as well as development partners opportunity for criticisms aimed at improving government effectiveness. It also enables improvement in provision of goods and services as policymakers equally utilise such information to make necessary adjustments in sectoral allocation of resources and entrench policies to encourage private sector participation.

Overall, both theoretical and empirical evidence have shown that certain public spending may promote economic growth if they encourage private investment and the protection of property rights (Barro, 1991). On the other hand, evidence abound in the literature that institutional environmental factors play significant role in economic growth (North, 1991; Knack & Keefer, 1995; Mauro, 1995; Assane & Grammy, 2003; Acemoglu et al., 2001; Rodrik et al., 2004; Dias & Tebaldi, 2012; Aisen & Veiga, 2013; Acemoglu et al, 2014; Afonso, 2022; Nguyen & Bui, 2022; Nedanovski & Kocevska, 2023; Okunlola et al, 2024; Kwabi et al., 2024).

Despite significant efforts of governments worldwide to enhance growth through strategic spending, significant variations in growth rates persist. For instance, Acemoglu and Ventura (2002) in their comparison of the income gap between the USA and Mali, report that the income gap is so wide that the former is 30 times richer than the other. Regrettably, the authors also showed that the income gap has remained consistent for over 3 decades (Acemoglu & Ventura, 2002; Acemoglu, 2009). One might expect that with consistent efforts of government, the gap will diminish over time.

The Keynesian school of thought advocates for fiscal stimulus during economic downturns to reignite growth. This perspective aligns well with the endogenous growth theory, which recognises that investment plays a pivotal role in capital accumulation, and that output growth is intrinsically linked to the growth rate of aggregate demand (Palley, 1996). However, the dynamics of economic growth, whether in the short or long term, are influenced by a multitude of factors, including the availability of physical and human capital (Bosworth et al, 1995), and technological progress (Romer, 1990; Grossman & Helpman, 1994; Aghion & Howitt, 1998). There are two key issues to consider. First, it is important to question whether all types of expenditure effectively stimulate growth, as the Keynesian approach suggests. If not, then it becomes crucial to prioritise expenditure that enhances growth. The second issue pertains to the varying magnitudes of the effects of different types of expenditure. This leads to a 'value of money' type of arguments, and it is hence important to know this. For instance, policymakers continue to investigate if reallocation of expenditure composition can foster long-run growth. This would be particularly useful if the government decides to introduce austerity measures for some years to manage debt burden instead of increasing budget expenditure.

Since Barro's seminal work of 1990, which categorised expenditures into productive and nonproductive based on their impact on production, a surge of research has emerged, employing diverse estimation methods and yielding varied conclusions (Barro, 1991; Easterly & Rebelo, 1993; Devarajan et al., 1996; Kelly, 1997; Miller & Russek, 1997; Barro, 2003; Esfahani & Ramirez, 2003; Barro, 1996; Bose et al., 2007; Wu et al., 2010; Butkiewicz & Yanikkaya, 2011; Acosta-Ormaechea & Morozumi, 2013; Connolly & Li, 2016; Chu et al, 2020; Kutasi & Marton, 2020; Arvin et al., 2021). Despite the extensive exploration in this field, it remains a crucial area of research, as countries continually seek sustainable long-term growth.

Comparative development literature attributes variations in economic growth to differences in institutional environment of countries (Acemoglu et al., 2005; North, 1990, 1991; North & Thomas, 1973; Williamson, 2000). The path of influence has been traced to protection of property rights, improving market efficiency, improving quality of the labour force and efficient allocation of resources (Keefer & Knack, 1997; Assane & Grammy, 2003; Acemoglu et al., 2005). These institutional economists posit that long run higher living standards are consequence of good institutions. This has stirred up a lot of studies on the roles of institutional environment as a factor of economic growth abound in the literature.

The interplay between public expenditure, the institutional environment and economic growth is underscored by the endogenous theory (Lucas, 1988; Romer, 1990; Aghion & Howitt, 1992). This theory emphasises investments in infrastructure and human capital, promoting policies that encourage innovation and competition, and protecting property rights. In alignment with this theory, this study focused on the effects of communication and health expenditures on economic growth. Consideration is also given to other critical factors highlighted in the endogenous growth theory, such as the role of human capital (Becker, 1994; Kostov & Gallo, 2018) and total factor productivity (Easterly & Levine, 1997; Hall & Jones, 1999; Klenow & Rodríguez-Clare, 1997; Miller & Upadhyay, 2002; Baier et al., 2006; Dias & Tebaldi, 2012). Additionally, since empirical evidence establishes that institutions play a role in the economic growth of nations, the study included institutional variables such as government stability, corruption and the reliability of the justice system, on the relationships within the sample data (Mauro, 1995, 1998; Keefer & Knack, 1997; Williamson, 2000; Esfahani & Ramirez, 2003; Rodrik et al., 2004; Aidt, 2009; Dzhumashev, 2014; Nguyen & Bui, 2022; Okunlola et al, 2024).

The aim of the study is to examine the effects of public expenditure and institutional environment on economic growth using data from 67 developed and developing countries. The study will be relevant to other researchers to explore the role of government expenditure and institutional environment in fostering long term economic growth in these economies.

1.2 RESEARCH PROBLEM AND RATIONALE

Understanding the relationship between public expenditure and economic growth is a fundamental concern in economic research. Barro's (1990) endogenous growth model has prompted numerous studies, categorising government expenditures as either productive or nonproductive based on their entry into the production function. However, the reliability of such categorisations for policy making has been questioned. In line with Barro (1990), government consumption expenditure, including transfers and recurrent expenditures, is often considered either unproductive or potentially detrimental to growth. Empirical evidence has supported the idea that public capital expenditures, particularly in infrastructure stimulate growth (Aschauer, 1989; Bose et al., 2007; De Long & Summers, 1991; Easterly & Rebelo, 1993; Esfahani & Ramirez, 1999). However, there have also been findings of a negative relationship for capital expenditures and social security (Devarajan et al., 1996; Kelly, 1997),

suggesting that the classification of expenditures as productive or nonproductive may not always hold true in practical contexts and thus may be unreliable for policymaking.

Studies examining sectoral spending have consistently found a positive association between education expenditures and economic growth (Bose et al., 2007; Easterly & Rebelo, 1993; Nijkamp & Poot, 2004), with some exceptions (Devarajan et al., 1996; Kelly, 1997). Miller & Russek (1997) introduced the dimension of financing, showing that the means of funding government expenditures can determine their impact on economic growth.

Earlier research on the relationship between public expenditure on economic growth that takes into account institutional constraints, primarily relied on measures of political stability, such as assassinations and coups (Barro, 1991; Easterly & Rebelo, 1993). However, the role of institutional environment in determining growth levels has gained prominence in the literature (Acemoglu et al., 2001; Keefer & Knack, 1997; Mauro, 1995, 1998; Rodrik et al., 2004). More recent studies, such as those by Bose et al. (2007); Butkiewicz & Yanıkkaya (2011) and Esfahani & Ramirez (2003) have delved into the influence of institutions on the relationship between government spending and growth but their analysis lacks a comprehensive consideration of all expenditure sectors or economic variables. In particular, Butkiewicz and Yanıkkaya (2011) categorised countries into four distinct groups: developed, developing, effective, and ineffective. This complex classification introduced ambiguity, complicating the interpretation of their findings. Consequently, their study provided robust evidence only for consumption and capital expenditures.

On the other hand, Bose et al. (2007) empirically analysed data from 30 developing countries including sectoral expenditures. Although the study considered the budget constraint and other economic variables, the institutional environment variables included in their analysis were only measures of political stability as in Barro (1991) and Easterly & Rebelo (1993). This may not represent an elaborate assessment of the impact of institutional environment. Also, contrary to economic theories as in Becker (1994), it is surprising that the study reports a significant negative relationship between initial human capital and growth. This may be due to inadequacy of their human capital measure to capture in totality, what human capital stock represents as emphasised in Kostov & Gallo (2018). Lastly, their study did not consider the growth contribution of total factor productivity (TFP) emphasised in (Klenow & Rodríguez-Clare, 1997; Miller & Upadhyay, 2002). Such omission may introduce bias leading to unreliable inferences.

This study aims to address these gaps by evaluating the growth effects of public expenditure in a diverse set of developed and developing countries. It will also assess the effects of institutional environment - stability, corruption and law and order on the expenditure-growth relationship. Furthermore, the study will consider the role of technology adoption and diffusion, captured as total factor productivity, in influencing economic growth.

1.3 RESEARCH AIM AND OBJECTIVES

This study intends to look at the nexus between public expenditure and economic growth, looking at the impact of institutional environment on this relationship.

The study has the following research objectives:

i. To examine the effects of government expenditure on economic growth.
ii. To investigate whether institutional environment has effects on the relationship between public expenditure and economic growth.

1.4 SIGNIFICANCE OF THE STUDY

This study investigates the relationship between government expenditures in the communication and health sectors and economic growth, while also assessing the influence of institutional environments on this relationship. To ensure generalizability, the study draws on data from 67 developed and developing countries over a 33-year period, accounting for the contributions of factor accumulation and total factor productivity to economic growth.

Founded on the endogenous growth theory, this research contributes to the existing body of literature on the link between sectoral public expenditures and economic growth. It provides critical insights into the specific expenditures that stimulate growth, even amidst varying institutional factors. Although previous studies have explored this relationship (e.g., Bose et al., 2007; Wu et al., 2010; Sidek & Asutay, 2020), this study is distinctive in its separate consideration of the influence of technology diffusion, through the inclusion of total factor productivity (TFP). By employing a robust methodology to address endogeneity concerns, the study produces reliable and unbiased results.

A key methodological contribution of this study is its use of the Unconditional Quantile Regression (UQR) method, applied to a large dataset spanning 67 countries and 33 years. This approach enables the identification of variations in the effects of sectoral expenditures across

countries at different income levels, which is particularly valuable for designing policies that reflect the unique economic contexts of individual nations. The UQR method also facilitates a deeper understanding of the heterogeneous impacts of public spending across various income groups.

In terms of theoretical significance, this study advances the application of endogenous growth theory by demonstrating its relevance and applicability across countries with diverse income levels. Additionally, it provides a perspective on how sectoral expenditures and institutional factors interact to influence growth, enhancing our understanding of the drivers of long-term economic development.

The research holds significant implications for policymakers, particularly in the area of budgetary allocations and public expenditure decisions. It offers valuable insights for understanding the impact of sectoral expenditures on overall economic health, with a focus on the mediating role of institutional factors. Additionally, governments can benefit from the study's exploration of how institutional quality shapes economic outcomes, providing a clearer understanding of the institutional variables that influence growth.

1.5 OVERVIEW OF THE RESEARCH CONTRIBUTION

The present study makes three key contributions to this debate. While the first is empirical, the other two contributions are methodological. A key empirical contribution of this study is the inclusion of total factor productivity (TFP) in order to capture the residual effect on growth not accounted for by factor accumulation. This is the first study that included TFP in public expenditure-growth equation using disaggregated sectoral data of multi-countries. Lin (1994) merely controlled for the effect of TFP but their study is not sectoral based. Similarly, in Hansson & Henrekson (1994) not only is the study not sector disaggregated, but data was also sourced from private firms.

An outstanding methodological contribution of this study is the deployment of a robust method for addressing endogeneity concerns. Even though results from initial analysis are consistent with economic theories and previous empirical findings, the study employed systematic and logical procedure to account for endogeneity. In the first step, the study uses the Higher Order Least Squares (HOLS) test to detect endogenous and unreliable variables (Schultheiss et al, 2021). Subsequently, endogeneity is addressed, combining two known methods – the instrument-free method and instrumental variable (IV) method. The first method is the

Gaussian copula method (Park and Gupta, 2012; Eckert and Hohberger, 2021; Becker et al, 2022) while the second is the use of lagged values of unreliable variables as detected by the HOLS (Greene, 2011; Reed, 2015; Wang and Bellemare, 2019). Moreover, repeat tests were conducted after each test to confirm that these issues had been properly addressed. An important outcome of the procedures is that they highlighted the possibility of other nonlinear effects in the model, which were subsequently estimated.

The third major contribution of this study is that it deployed the use of Unconditional Quantile Regression (UQR) method for its final analysis. This method allows for the estimation of heterogeneity of effects across different quantiles of the conditional distribution of the growth variable. The current study, to the best of my knowledge, is the only study that has used this method for estimation of expenditure-growth equation.

1.6 DETERMINANTS OF ECONOMIC GROWTH

1.6.1 ECONOMIC DETERMINANTS

1.6.1.1 PUBLIC EXPENDITURES ON COMMUNICATION

Communication expenditure captures the total spending of government within the communication sector including communication services, infrastructure, and technology. In most growth studies, it is referred to as infrastructure spending. It includes spending on major infrastructure that facilitates connectivity and exchange of information within a country. It is expected to positively influence long term economic growth since information technology fosters knowledge diffusion and productivity. Thus, as a major infrastructure expenditure, it is considered as an input to private production, which has the potential of boosting growth (Barro, 1990). Little wonder it is classified as productive expenditure (Kneller et al., 1999).

There is considerable body of empirical evidence in support of the positive relationship between infrastructure expenditure and growth. Easterly & Rebelo (1993) reported that expenditure on transport and communications strongly enhances economic growth. This is also confirmed in Easterly & Levine (1997), who found a strong positive relationship between telephone lines and economic growth. Similarly, Esfahani & Ramirez (1999) concluded that investment in infrastructure plays a crucial and significant role in driving growth. Specifically, De Long & Summers (1991) strongly recommend that countries desirous of growth should increase their spending on equipment and machinery, although Hulten (1996) advised that the efficiency of infrastructure is dependent on the development level of countries.

While the above evidence is from cross-country studies of developed and developing nations, contrary evidence was found in developing nations. Devarajan et al. (1996) found that transport and communication expenditure is negatively correlated with growth. They explained that developing countries may be over-spending on infrastructure projects at the detriment of recurrent expenditures. In another study, Bose et al. (2007) found that expenditure on transport and communication is not significantly related to economic growth.

1.6.1.2 PUBLIC EXPENDITURES ON HEALTH

Public investment in health is also considered investment in human capital and earnings has significant relationship with emotional and physical health (Becker, 1994). Health is not just a capital but has been referred to as a durable capital which determines the total productive time of a person (Grossman, 1972). His model showed that with investment increases the initial stock of this capital which depreciates over time as a person ages.

On the relationship between health expenditures and productivity, Strauss & Thomas, (1998) noted that government investment in health infrastructure and education will improve the productivity of the working population. This is also confirmed in Jack (1999). Similarly, Bloom & Canning (2000) found that health outcomes are linked to tendency to invest in physical capital. According to them, people tend to save and acquire more physical capital if they consider their longevity. Positive health outcomes also incentivise people to further invest in education and skills acquisition. The expectation of higher longevity not only create incentives for investment, but also increase the investment horizon (term). Longer investment outlook reduces risk aversion thereby encouraging higher investment. Increased investment leads to higher expected returns, which in turn stimulates long-term growth. (Barro, 1996; Bloom & Canning, 2000).

Empirical evidence on the relationship between government health expenditure and economic growth has mostly been found to be negative or insignificant. For instance, Devarajan et al. (1996) and Kelly (1997) found that spending on health and education sectors is insignificant and negatively related to growth. Even a meta-analysis conducted by Awaworyi Churchill et al. (2015) yielded a significant negative result. Their results are similar to Miller & Russek (1997) except that their result is linked to the budget constraint.

However, there has been other empirical findings pointing to a positive relationship between health expenditures and economic growth (Beraldo et al. 2009; Cooray, 2009; Pradhan, 2010). Additionally, Pradhan (2010) also found a bi-directional causality between the variables.

Another study suggests that government's budget for health increases as national income increases (Easterly and Rebelo, 1993). It is important to note that cross-sectional studies such as theirs are often plagued by endogeneity which results to perverse conclusions if unaddressed.

Another reason for insignificant results between health expenditures and income especially in developing economies is increasing the percentage of expenditures on curative expenditures, which is more costly and does not improve health indicators such as mortality rates and life expectancy.

1.6.1.3 HUMAN CAPITAL

Though an intangible asset, human capital holds a place of great recognition in the economy of nations due to many reasons. Human capital accounts for the differences in growth rates among countries by enhancing productivity of both labour and capital (Lucas, 1988). Barro, (1990) rightly noted that inclusion of both physical and human capital in the production function will likely result to constant returns to scale but diminishing returns when separated. It is a key input to the research sector, since it is capable of generating new products or ideas that trigger technological products (Romer, 1990). In the endogenous model, constant returns to human capital and other reproducible capital, lead to high convergence levels (Barro, 1991). This implies that a country should continue to accumulate higher quantity of human capital in order to remain on the growth path. Similarly, (Cortright, 2001), posits that more investments in human capital, will boost the knowledge economy (technology) and open up opportunities for boundless growth. Therefore, governments are encouraged to make policies to promote investment in education, knowledge and training in order to generate higher quality labour force (Stengos & Savvides, 2009), which will in turn increase productivity and ultimately lead to growth.

However, scholars have grappled with a major challenge of determining the most acceptable measure of human capital (Klenow & Rodríguez-Clare, 1997). Thus, various measures of human capital have been applied in the literature such as the stock of human capital, school attainment rates, enrolment rates, investment in education as well as combination of these measures depending on data availability. For instance, Barro (1991) argues that while the stock of human capital may be considered a better measure since it relates to literacy rates, it is unlikely to be accurate especially in developing countries. Hanushek (2013) argues that school attainment may not reflect the magnitude of the relationship since it is not a good indicator of

quality education nor skills acquisition. Another dimension to the human capital measurement is the possibility of combination of measures to fully capture the human capital stock. Kostov & Gallo (2018) suggest employing a measure that can encompass the latent factor, as human capital arises from a blend of abilities, social environment and investments in education. The authors hold the viewpoint that inadequate measures can produce unrealistic results which may even contradict economic models. Most studies resort to measures of educational attainment. Specifically, mean or average years of schooling and returns to education (Barro & Lee, 2013; Psacharopoulos, 1994), while some others used enrollment rates (Barro & Sala-i-Martin, 1995; Easterly & Rebelo, 1993).

Barro (1991) showed that initial amount of human capital has substantial and positive relationship with growth rate which explains why poor countries' convergence is a factor of their initial level of human capital. Analysing data from 98 countries from 1960 to 1985 using cross-sectional regression, he found that growth rate of real per capita GDP shares positive association with initial human capital but is negatively related with initial level of real per capita GDP. The latter results is consistent with the convergence hypothesis. These findings are in support of the endogenous growth theory due to the increasing returns associated with increase in knowledge.

Another channel through which human capital influences growth is through increasing the rate of growth of growth of technology. Dias & Tebaldi (2012) developed a model and conducted an empirical study to show that increasing returns to human capital accumulation encourage non-educated workers to invest in education, which in turn increases the growth rate of technology and output which ultimately boosts growth. The positive effect of human capital on growth may also be due to significant institutional externality in the form of political stability, which increases security of lives and property thereby encouraging growth (see Glaeser et al., 2004).

In another study, Kostov & Gallo (2018) combined labour earnings and investment approach of human capital measures and found human capital to be a strong predictor of economic growth. Their study also showed that some measures contribute more to growth than others, suggesting that poor measures could be responsible for unrealistic findings which contradict economic theories. A typical example of such is Bose et al. (2007). Additionally, Benhabib & Spiegel (1994) and Pritchett (2001) argue that when education is mismatched with skills acquisition, increase in human capital may not yield expected result. This is in congruence with the emphasis on educational quality as opposed to mere schooling (Hanushek, 2013).

1.6.1.4 TOTAL FACTOR PRODUCTIVITY

Depending on available technology, a country's output is a function of both physical and human capital. These factors determine output growth and are usually considered as inputs in production, thus, making it easy to evaluate their effects. However, there are other factors such as technological progress, efficiency and innovation which also impact on output growth. These factors make for efficiency and are measured through total factor productivity (TFP). The growth rate of TFP is used to evaluate the rate of adoption of advanced technology across countries. As noted in Easterly & Levine (2001), the concentration of technological innovation, accounts for the sustained growth of rich countries over time.

Baier et al. (2006) noted that capital accumulation accounts for most variations in international growth rates while the contribution of TFP globally may be negligible but substantial regionally, which reflects its huge contribution to technology transmission and adoption. On their part, Klenow & Rodríguez-Clare (1997) confirms that productivity contributes more to growth than capital. They argued that the contribution of productivity to physical capital is usually unaccounted for. This point was also made by Barro & Sala-i-Martin (1995) and Easterly & Levine (2001).

1.6.2 INSTITUTIONAL DETERMINANTS

In line with its second objective, this this study seeks to determine whether or not, institutional environment have effect on the relationship between government expenditure and economic growth. There is empirical evidence that institutional measures may be responsible for the variations in income and economic growth rates of countries. Under this subsection, these evidences will be reviewed.

1.6.2.1 GOVERNMENT STABILITY

Government stability can be used to describe a country's state of consistent and peaceful political environment over an extended period of time. Some of its characteristics are infrequent political change through uncivilised means such as coups and revolutions and low number of political assassinations per year. Some literature used the opposite term, instability, to describe a state of institutional challenges affecting the political system. For instance, it has been defined as the propensity of government collapse, whether constitutional or not (Alesina et al. 1996).

Different authors have adopted different indices as measures of political instability. Some authors use political assassination and revolutions (Barro, 1991), number of coups (Londregan & Poole, 1990), government change (Alesina et al., 1996; Feng, 1997), etc. while some simply rely on definition(s) provided in the dataset being used. These may be in part, responsible for the variation in results across cross-country growth models.

However, empirical studies of the link between stability and growth has yielded contradictory findings. At the centre of most studies on institutional quality and growth is the influence on private investment. Political instability affects growth through its effect on savings and investment decisions making (Kwabi et al., 2023; Kwabi et al.,2024). It creates an atmosphere of tension and uncertainty for future policies (Kwabi et al, 2022). Investors feel uncertain about how policies of a new government will affect their investment plans, they may choose to delay investment decisions or even suspend action permanently (Kwabi et al. 2024). In some cases, it may cause discontinuity of an existing investment in that particular geolocation or relocation of businesses to foreign countries. Thus, Barro (1991) reports that political instability significantly and negatively affects growth due to its effect on property rights. On the contrary, some studies provide evidences of positive association of investment rate with growth, without robust relationship of government stability indices with growth (Levine & Renelt, 1992; Mauro, 1995).

Like Barro, (1991), Londregan & Poole, (1990) and Alesina et al. (1996) also reported an inverse relationship between political instability and growth. On the other hand, Easterly & Rebelo (1993), Glaeser et al. (2004) and Chomen, 2022) found that the variable is not significantly related to growth. The nature of the relationship may depend on the development level of the country. Sidek & Asutay (2020) report that a stable government is positively and significantly associated with growth. It may be necessary to consider differentiating categories of changes of government while carrying out analysis instead of lumping them into one. Feng (1997) adopted this approach and reported that irregular government changes affect growth negatively, while regular change has significant positive impact on economic growth. The variation in the results of these empirical studies may in part, be due to the various measures adopted for government stability or instability (Glaeser et al, 2004). Secondly, like some authors suggest, it may be due to the omitted variable and bias as suggested by Mauro (1995) or the development level of the country (Sidek and Asutay, 2021).

1.6.2.2 CORRUPTION

Generally defined as abuse of public office for private gains, corruption has been one of the institutional variables included in growth regressions. It can take various forms such as bribery, nepotism, embezzlement, kickbacks, money laundering, extortion, etc. Corruption has been defined as sale of government property for private gains (Aidt, 2009) and even tax evasion (Dzhumashev, 2014).

Evidences of a negative relationship between corruption and growth abound in the literature. Mauro (1995) found that corruption is negatively related with growth, though only at 10% significance level and its magnitude reduces when the political instability index is controlled for. Similar evidence of the significant negative effect of corruption on education expenditure by Mauro (1998) provided a better understanding of this relationship since there are numerous empirical evidences that education expenditure shares positive association with growth in existing literature.

A study by Easterly & Levine (1997) has linked corruption-prone policies to ethnicity. They argued that ethnic divisions are largely responsible for political instability and provision of poor public goods. They noted that aside from causing violence, ethnic-polarized countries increase the likelihood of poor policies and low provisions of public goods due in part to disagreement in choice of public goods. This is also consistent with Mauro (1995).

However, Dzhumashev (2014) concludes that corruption is a factor of differences in wage rates and noted that its incidences increase with increased government expenditure. He noted that corruption and rent-seeking activities cause a decline in growth due to social losses especially when tax is increased to fund government expenditure.

1.6.2.3 LAW AND ORDER

Popularly referred to as ‘rule of law’ in most empirical studies, the variable measures the strength of judicial system and popular adherence to laws. As a political risk measure, its influence on growth is largely linked to its influence on investment. In an economy where there is low risk of noncompliance with law and order, there is likelihood of better property rights protection and integrity of contracts are preserved (Haggard, 2008). Even at the corporate level, adherence to the rule of law promotes accountability, transparency (Ezeani et al., 2023) and reduces the risk of corruption commonly associated with earnings management. This enhances the firm's reputation and, consequently, boosts productivity (Salem et al., 2021a; Salem et al., 2022b; Usman et al., 2022a; Usman et al., 2022b). Increased trust in the law enforcement

authorities and the judicial system encourages investment which ultimately leads to economic growth (Barro, 1996; Butkiewicz & Yanıkkaya, 2011; Keefer & Knack, 1997; Nedanovski & Kocevska, 2023). It measures the extent to which property rights are protected and integrity of contracts are preserved (Haggard, 2008).

1.7 STRUCTURE OF THE THESIS

The thesis consists of seven chapters which dealt on different components of the study. The first chapter gives a background and introduces the research topic under different subsections. Section 1.1 introduces the subject of the thesis while section 1.2 elucidates the problem of the study. The chapter also spells out the objectives of the study (Section 1.3), and its significance (Section 1.4). Section 1.5 highlights key contributions of the study while section 1.6 provides detailed explanation of key variables deployed for the study. The last section of the chapter, i.e. section 1.7, presents a wholistic guide to the entire thesis, explaining key discourses or topics across the seven chapters.

Chapter two of the thesis deals with the theoretical framework of the study. Section 2.1 introduced key concepts of the study i.e. public expenditure, economic growth and institutions. Section 2.2 involves the detailed discussion on the endogenous growth theory upon which this study is founded. Detailed explanation of the evolution of growth theories is also given in this section 2.3 of this chapter. Section 2.4 discusses the role of government in the endogenous growth theory. The convergence hypothesis is explained in section 2.5 while the relationship between institutions and growth is discussed in section 2.6. The chapter ended with a brief summary (section 2.7).

Chapter three of the thesis deals with the review of empirical literature. The chapter commenced with a short summary of the chapter (Section 3.1). While section 3.2 deals on the empirical association between public expenditure and economic growth, section 3.3 discusses the effect of some other macroeconomic variables on growth. Section 3.4 is a discourse on the empirical relationship between institutions and growth. The last section, 3.5 highlighted the empirical literature gap which the study intends to fill.

Chapter four provides details of initial empirical analysis carried out in the course of the study. Section 4.1 gives information about sources of research data, sample size and justification, dataset construction and impact, sample size, and measurement of variables. Sections 4.2 and

4.3 presents preliminary data analysis and empirical model respectively. Results of analysis and discussion of findings were presented in sections 4.5 and 4.6 respectively.

Chapter five of the thesis gives information about the methodology adopted for the study. Sections 5.1 is on the research philosophy while section 5.2 discusses the normality tests carried out on the data. Section 5.3 covers the discourse on endogeneity testing using the Higher Order Least Squares. Detailed method for addressing endogeneity in the study was discussed in section 5.4 while section 5.5 dealt with estimating interaction effects in the model. Quantile regression method was discussed in section 5.6. Lastly, section 5.6 is the chapter summary.

Chapter six of the thesis contains a detailed empirical analysis. The chapter was introduced in section 6.1. The descriptive statistics was presented in section 6.2 while results of normality distribution tests was presented in section 6.3. Details of endogeneity testing and correction was presented in section 6.4 while interaction effects were discussed under section 6.5. The study introduced the UQR method in order to effectively capture heterogeneity of effects in the sample. Results of findings were discussed in subsection 6.6.2 while conclusion of findings were presented in section 6.7.

Chapter seven is the last chapter of the thesis, which talks about summary and conclusion of the study. The chapter commenced with a chapter introduction in section 7.1 Key findings of the study are presented in section 7.2. The conclusion of the study and the implications of findings are found in sections 7.3 and 7.4 respectively. The thesis concludes with section 7.5, with the discussion on the study's limitation and suggestions for further study.

CHAPTER TWO

THEORETICAL FRAMEWORK

2.1 INTRODUCTION

Public expenditure is one of the key tools of government's fiscal policy. It consists of the expenditure by governments towards provision of goods and services, social programs, as well as infrastructure development in various sectors of the economy. It allows the government to achieve certain key objectives such as allocation of resources, reduction of unemployment, improvement of social welfare and promote stability during recession periods (Yu et al., 2015). Thus, total public spending refers to the total amount spent by the government towards fulfillment of government functions in a particular year. In line with the critical role of public expenditure in a state and the need to promote standardisation of statistics and aid comparability across countries, ten (10) core functions of governments are captured in the Classification of the Functions of Government (COFOG) (Crnogorac & Lago-Peñas, 2023). Thus, for every country, the total public spending should be allocated to these critical areas, lest the government will fail to deliver in some of his functions.

Economic growth on the other hand, can be defined as positive changes in a country's economy which is measurable by increase in the GDP from one fiscal year to another year (Martins & Veiga, 2014). This is usually measured by the real gross domestic product (GDP), which is the monetary value of all final goods and services that are produced in a country for a given period, usually one year. In a much simpler vein, GDP can be calculated as a sum of all (private and public) expenditures, and since government spending is part of this it increases GDP. Comparing inter-country economic prosperity between 1960 and 2000 using available statistics, (Acemoglu, 2009b) showed that some countries are as much as thirty times richer than others. Growth rates over the years, make the difference between poor and rich countries, which explains why Spain closed the income gap as at 1960, catching up with USA and the UK by year 2000. Economic growth rate is significant as it determines the quality of life, health, and standards of living, and often reflect in consumption levels and life expectancy rate (Acemoglu, 2009). Not only does it provide information about the size and health of the economy, it also serves as the most common indicator of economic development (Martins & Veiga, 2014). Another popular measure of economic growth is the real GDP per capita. It

measures economic output per person in a country. It is usually calculated by dividing real GDP by population numbers (Helpman, 2004).

The influence of institutional factors, political, social and economic, on economic growth, is also supported by theoretical literature (Barro, 1990; North, 1990, 1991; Henisz, 2000; Williamson, 2000; La Porta et al., 2008).

This chapter is devoted to the review theoretical literature on public expenditure, institutions and economic growth. This will be further broken down into two categories. The first part will look at the theories linking public expenditure to economic growth while the second part will look at theories linking institutional environment to economic growth. Thus, the outline of the chapter is as follows: Introduction (2.1), the endogenous growth theory (2.2), the evolution of economic theories (2.3), the role of government within the endogenous growth theory (2.4), convergence hypothesis (2.5), institutions and economic growth (2.6) and summary of theoretical literature (2.7).

THEORETICAL FRAMEWORK

2.2 THE ENDOGENOUS GROWTH THEORY

This study is founded on the endogenous growth theory. The theory advocates that economic growth requires accumulation of factors and knowledge capital (technology). Accumulation of factors is driven by private sector investment. Thus, government activities can only influence long run growth through investment in capital, education, research and development (Folster & Henrekson, 1999). Essentially, the theory incorporates two important things. First, technological progress is a product of economic activities. Whereas previous theories view technology as a given product of non-market forces, the growth theory considers it 'endogenous' i.e. internal to the function of markets. Secondly, it considers knowledge and technology to generate increasing returns which in turn drives growth. Knowledge is not subject to diminishing returns; and increasing returns to knowledge propels growth because (i) it can be continually used at zero marginal cost (ii) it can be shared and accumulated without limit (Cortright, 2001).

The endogenous growth theory also recognises the role of institutions in the growth process of economies. Institutions provide the enabling environment for production and employment of knowledge (Cortright, 2001; Fedderke, 2002). Authors like Arrow (1962) laid a good

foundation for this by providing insight into the contemporary discussions on economic growth. Paul Romer's 1986 work, titled "Increasing Returns and Long-run Growth" is considered the foremost. The model showed that sustained long term growth, is a factor of endogenous technological progress which is attained through investment in research and development, education and innovation. Following closely is Lucas (1988) which places emphasis on the role of human capital through education in driving long term growth. Another key factor emphasised by endogenous growth theorists is competition and innovation. This is believed to promote sustained long-term growth through creation of new products and technologies (Aghion & Howitt, 1992). A model by Jones & Manuelli (1990) has shown that investment in human capital through education can lead to a long term economic growth through increased productivity. Similarly, Grossman & Helpman (1991) developed a model to show how economies can sustain long term growth through investment in research and development as well as the creation of enabling institutions to promote innovation. Public expenditure in research and development (R&D) is regarded as an investment in knowledge capital as it ultimately produces new technology (Scarpetta & Bassanini, 2002). Newer technologies help to maximise production inputs such as capital (physical and human).

These models have been classified according to the key factors that drive long term economic growth using endogenous factors. Thus, this subsection gives a summary of three models – Romer model, Lucas model and Schumpeterian model.

2.2.1 Romer-type Endogenous Growth Model

Paul Romer in the 1980s and 1990s improved on the standard neoclassical production function by including the knowledge factor to illustrate how technological progress can lead to economic growth. The central objective of the model is to show that technological progress is not an exogenous variable, but endogenously derived through the efforts of individuals and firms to generate and apply new ideas. In other words, investment in research and development gives rise to new ideas and technology. This is on the premise that knowledge and ideas are non-rival and not costly. The non-rivalry characteristic ascribed to knowledge and ideas, implies that they can be deployed by various firms at the same time without diminishing in value. Thus, long term economic growth is attained through production of knowledge since it has the potentiality of increasing returns to scale as more of it is produced and shared.

In line with Romer's (1990) model, technology is not a public good but a non-rival good that is partially excludable. This implies that the use of technology by a particular firm at a specific time, does not limit its use by another at the same time. The model is based on the premise that increased technological change is an outcome of the efforts of economic agents in response to market incentives. Thus, in order to earn a profit, these agents go the extra mile to engage in research, thereby creating the required technology to produce the goods in demand. These technologies when procured, require a set of instructions for production process which are procured one-off. These sets of instructions when procured are continually reused without an additional cost. Thus, in their quest for more profit, the economic agents introduce new technology, which increases market size, the income level and welfare in the State as well as economic growth.

On the nonrivalry of knowledge, an introduction of a product design driven by market incentives, triggers the use of the same design as well as technology by other firms within the same country. This action does not lead to additional technology cost or knowledge cost but rather increases the market size. This cannot be compared with human capital factor since it is costly to train an additional individual to acquire skills. Secondly, a single individual has limited number of years within which skills can be acquired. Thirdly, at the demise of an individual, investment on skills is totally lost. In comparison to innovation in form of idea, software, or any product created can be used by others beyond the person's life span. Thus, his endogenous growth theory is driven by three key factors, market incentives, economic agents who invest in research to produce new products, and instructions for working with raw materials. These factors are responsible for increasing returns to growth.

Thus, Romer's (1990) model yields increasing returns to scale where technological change is assumed to be an outcome of economic activities and not an external factor. Creation of knowledge generates a positive externality that influence both the creator as well as other individuals and firms who utilize the knowledge. The model illustrates that investment in research and development (R&D), human capital accumulation and innovation are major drivers of economic growth. Unlike the models of the neoclassicists, returns on capital investments do not diminish but rather multiplies due to the non-rivalrous and non-excludable nature of knowledge incorporated in the model.

2.2.2 Lucas-Type Endogenous Growth Model

Another significant contribution was made by the American economist Robert Lucas. His model emphasises the significant role of human capital in driving long term economic growth. In line with his model, human capital accumulation increases the efficiency of labour and physical capital. Investment in education and skill acquisition leads to increased capital accumulation as workers distribute their nonleisure time between working and skill acquisition. This yield increased on-the-job efficiency and productivity, thus impacting positively on economic growth.

In his model, Lucas (1988) considers human capital as the major factor responsible for growth differentials across countries rather than initial capital. Human capital affects growth rates via two major paths: internal and external effects. Internal effects refer to boosting of skills of workforce and directly enhancing their productivity. As individuals become more knowledgeable and skilled, they perform their jobs more efficiently, This translates into economy-wide boost in productivity and growth potential.

Like Romer (1990), the model showed that increased units of human capital leads to high rate of producing new designs. The higher the rate of stock designs, the higher the productive capacity of the labour force. Investment in skills acquisitions yields more knowledge, which is an excludable good while increasing the total while increasing the total stock of knowledge in the country. This is referred to as external effects.

Lucas' model shows that for a given level of physical capital, an increase in human capital accumulation generates efficiency which spurs even higher levels of physical capital accumulation. These effects also have implications for labour mobility. Due to wage rate differentials, there is high tendency of movement of labour force from low-wage (poorer) countries to higher-wage (richer) countries. High pressure for immigration exists regardless of variations in natural endowments across countries, which promote free trade in both capital and consumption goods. As long as possibility of higher earnings across countries on the same skill levels continue to exist, people would migrate to relieve migration pressure and narrowing the wage rate gap.

In summary, the endogenous growth model of Lucas's highlights the critical role of human capital in driving economic growth. It is a modification of the Solow's model of constant returns, which depends on initial income, savings and population growth rates. Lucas model showcases the gains from human capital relying on the non-rivalry and excludability of

knowledge and learning-by-doing which yields a positive externality on average human capital on output (Arrow, 1962; Romer, 1990).

2.2.3 Schumpeterian Model

This growth model is named after an economist, Joseph Schumpeter. He introduced the concept of creative destruction in his book titled "Capitalism, Socialism and Democracy". His work was later formalised into mathematical models between 1980s and 1990s by other economists namely Phillippe Aghion, Peter Howitt and Paul Romer.

The model agrees that technological progress leads to endogenous growth but also creates losses since it can also render skills, goods, markets, and production processes obsolete. This model allows the displacement of obsolete goods via the introduction of new goods. Generally, the model's framework is centered on the role of innovation and entrepreneurship in determining economic growth in the long run. Innovation and entrepreneurship drive economic. These two factors create enabling environment for production of new goods, processes, as well as markets to increase productivity and competitiveness. The model recognised the crucial role of entrepreneurs as risk bearers in bringing new ideas and technologies into the market to displace old ones through investment in R&D. New technology when adapted by these economic agents, leads to endogenous technological progress, which in turn enhances the quality of products (Grossman and Helpman, 1992). Thus, the creation of new ideas to displace the existing ones is referred to as 'creative destruction'. This implies that through this continuous cycle of innovation and displacement of old existing technology, the economy becomes dynamic and more efficient which in turn leads to long run economic growth (Aghion and Howitt, 1992).

2.3 EVOLUTION OF ECONOMIC GROWTH THEORIES

The key elements of modern theories of economic growth were identified by classical economists such as Adam Smith (1776), David Ricardo (1817) and Thomas Malthus (1798). Some of these include competitive behavior approach and dynamics of equilibrium, the interaction between income per capita and population growth rate as well as the role of diminishing returns and its link with physical and human capital accumulation. To follow things in the sequential order, the seminal paper by a British economist Ramsey (1928) is regarded as basic for modern growth theory. In this paper titled "A Mathematical Theory of Saving", Ramsey attempted to address the problem of optimal resource allocation aimed at

maximising social welfare. He developed a mathematical model which considered the trade-offs between present and future consumption as well as effects of those trade-offs on overall growth. As one of his key contribution to the field of macroeconomic growth, he introduced 'the concept of discounting future consumption'. His main argument was that for optimal resource allocation over time, the tendency of individuals and societies to place higher value on present consumption compared to future present consumption should always be considered.

In 1936, John Maynard Keynes made his input into the theory of economic growth which emphasised the intervention of government through fiscal policy to manage aggregate demand. His approach merely focused on the long run fluctuations in economic activity and does not provide a comprehensive framework for understanding economic growth in the long run. Following Ramsey's model, another model was proposed by Harrod (1939) and Domar (1946) referred to as Harrod-Domar model. The model shows the links between savings, investment, and economic growth. The model is based on two key assumptions (i) the rate of investment and economic growth exhibits stable relationship (ii) there is a fixed capital-output ratio in the economy, i.e. the amount of capital required for the production of a given output level is fixed.

Another great addition to this body of knowledge is the model proposed by an American economist, Robert Solow in 1956. His model analysed the interactions between capital accumulation, population growth rate and technological progress. In line with the model, savings and investment plays a vital role towards attainment of economic growth, noting however, that growth slows down when the rate of return to capital falls as the economy tends towards a steady state. Explaining the effects of population growth on the economy, the model shows that in the short run, increased population will lead to increased labour supply and subsequently, increased output and income. In the long run however, diminishing returns to capital and reduction in availability of resources may counterbalance population growth benefits. The Solow's model's recognition of technological progress as a critical driver of economic growth, is an improvement to the Harrod-Domar model.

Extending his 1956 work, Robert Solow, in collaboration with Trevor Swan, developed a model referred to as neoclassical growth model. Building on the Solow model, the Solow-Swan model introduced the concept of human capital and exogenous technological progress driven by research and development activities. Similar to the Solow model, it explains the long run economic growth as an interplay of capital accumulation, labour and technology. It however differs in its recognition of technological progress as an exogenous factor, that is to say, that is not explained by economic variables. The Solow-Swan model explains that in the short run,

output and income are increased through investment in physical capital. In the long run however, with the decrease in the return on investment, the economy moves to a steady state. In this state, the rate of investment equals the rate of capital depreciation, then output growth is determined technological progress and rises in human capital. This model is a key contribution to understanding how long run economic growth is determined by the interplay among human capital accumulation, technological progress and population growth rate.

While this model is applauded for providing a clear framework for understanding key factors responsible for economic growth, it has generally been criticised for two reasons. First is, its assumption of constant returns to scale, thus implying that the production function is loglinear and growth of output proportional to the growth of inputs. The second major point of criticism is that it is unrealistic to assume that technological progress is exogenous, i.e. independent of economic variables and decisions (Barro & Sala-i-Martin, 1995).

A general concern about slowdowns in economic growth globally during the mid-1980s led to a rekindled interest among researchers and policymakers in this area (Liu & Premus, 2000). Thus, many more scholars began to spring up. For instance, Romer (1986) challenging the assumption of constant returns to scale, introduced the concept of increasing returns to scale, describing a situation where the output of a firm or a country increases at a faster rate in relation to its inputs. Thus, average cost of production for a unit of output reduces as production scale increases. The key proposal of the model is that (i) increasing returns can be generated by accumulation of knowledge and ideas, stating that ideas are always available to all and does not diminish regardless of how many people or firms who use it. (ii) increasing returns scan be generated through accumulation of knowledge and ideas (iii) rather than a passive outcome of exogenous factors, deliberate investment in research and development (R&D) by firms and governments results in technological progress. Another significant contribution was made by Lucas (1988), in which he presented a new approach to growth process, with human capital at the core. His model also highlighted that technological progress is not merely to increase productivity but also ensures improved quality of goods and services, increased wages and improved living standards. Long run determinants of growth have been a major inspiration for these studies and endogenous growth models.

The study of economic growth has evolved over time, different theories have emerged and gained prominence in different periods in history. It is worthy of mention that other theories and approaches to economic growth have also emerged over time such as Marxist theories,

structuralist theories and post-Keynesian theories. These also contributed to a better understanding of the concept of economic growth and development as well as supported policy decisions during their era. However, for the purpose of this thesis, we will be looking at the theories which offered insights to the study of long-term economic growth. These have been categorised into four (4) key stages and will be discussed below: Keynesian growth theory, Classical theories, Neoclassical theories and Endogenous growth theories.

2.3.1 THE KEYNESIAN GROWTH THEORY

The Keynesian growth theory was developed by a British economist, John Maynard Keynes in an attempt to bring a solution to the great depression. The theory was captured in his book, *The General Theory of Employment, Interest and Money*, published in 1936 wherein he stated that government spending is a critical factor of aggregate demand. Keynes argued that if government spending increased, aggregate demand would also increase. Another key argument of this theory is that government spending is essential for an economy to maintain full employment (Dutt, 2013).

The theory can be summarised under two critical points:

1. Investment drives capital accumulation. This implies that the rate at which capital is accumulated is determined by the rate at which firms are willing to spend on investment.
2. At equilibrium, the rate of growth of aggregate demand, must equal the rate of output growth. The implication is that the low rate of growth of aggregate demand can deter output growth.

In line with the Keynesian thought, public spending promotes economic growth. Specifically, they advocate that through the multiplier effects on aggregate demand, increase in government consumption will promote employment, profitability and investment. Their thought is based on the assumption that rigidities in labour market may distort the self-regulating mechanism of the economy. Therefore, government spending can augment aggregate demand, leading to increased output although it depends on expenditure multiplier (Barro & Sala-i-Martin, 1992; Easterly & Rebelo, 1993).

2.3.2 CLASSICAL GROWTH THEORIES

During the eighteenth and nineteenth centuries, in an attempt to explain the sources of economic growth and development in a market economy, a group of economists developed some economic theories generally referred to as classical growth theories. At the centre of these theories is that economic growth is generally driven by capital accumulation, technological progress, and labour productivity.

Some of the foremost contributors to this theory is Adam Smith, David Ricardo and Thomas Malthus. Laying the foundation of classical growth theory, in his book, "Wealth of Nations", published in 1776, Adam Smith argued that technological progress depends on capital accumulation, which will in turn increase mechanisation and promote division of labour. However, the rate of capital accumulation is a factor of profit level and trend (Higgins, 1968). Another outstanding contribution is that of David Ricardo who on his part, developed the 'law of diminishing returns', suggesting that provided other factors are held constant, an increase in the amount of a factor of production leads to diminishing returns. He is also popular for his theory of comparative advantage, which suggests that countries should leverage on the production of goods which they can efficiently produce and engage in international trade for those they cannot efficiently produce. This theory has generally been of help in explaining situations where economic growth slows down over time. Popular for his theory of population growth, Thomas Malthus' argument is that eventually, population growth would exceed the available resources which would likely lead to famine and poverty. Other important contributors are Jean-Baptiste Say and John Stuart Mill. While Say is popularly known for his law of markets, which states that supply creates its own demand, Mill emphasised the role of education and innovation towards attainment of economic growth.

On government spending, the classicists argue that market forces are sufficient to bring the economy to a long run equilibrium. These economists believe that public expenditure is ineffective on the grounds of its crowding out effect, i.e. as public spending rises, public goods are substituted for private goods, thus causing lower private spending on education, health, transportation and other goods and services. Furthermore, when governments borrow heavily to fund capital projects, pressure on the credit market result in higher interest rates and increases in tax burdens which hamper private investments (Aschauer, 1989).

Overall, the classicists, emphasise the importance of factors of production and technological progress as drivers of economic growth. They believed that market forces are responsible for

ensuring efficient resource allocation as well as driving economic growth. Thus, they discourage government intervention on the grounds that they could lead to inefficiency and disruption of market forces. They also believe that recessions result from distortions in the production structure, resulting from efforts to create credit. Although, the classicists made a great contribution to understanding the sources of growth in their own era, their major limitation is the assumption that technical progress is dependent on savings and investment. The second limitation is that theory does not address the role of entrepreneurs in the production process (Kates, 2020).

2.3.2.1 Harrod-Domar Growth Theory

Harrod-Domar model is a macroeconomic framework proposed by Roy Harrod in collaboration with Evsey Domar to explain factors that could trigger economic growth. Bringing Keynesian analysis into the growth theory, the model shows that savings level and investment are major determinants of economic growth. From their analysis, growth can be achieved if savings rate and marginal product of capital is increased or depreciation rate decreased (Hochstein, 2006). In other words, the model indicates that as the rate of investment increases, economic growth increases. This was also explained in Hagemann (2009).

The model also establishes that there is an inverse relationship of economic growth to capital-output ratio. Thus, the model explains that for low income countries, growth rate is usually low over time because of their low savings rate, which is insufficient to manage their capital goods. Thus, reduced factor accumulation, reduces the growth rate of stock, which translates to low economic activities (Todaro & Smith, 2008).

Another key suggestion of the model is that at equilibrium, the rate of investment is equal to the rate of growth. If, however, the rate of investment drops below the growth rate, the economy is likely to be unstable and even tend towards recessions and increased unemployment. On the other side however, the model notes that inflationary pressures will set in if investment rises above the growth rate,

Although the model enjoyed a great deal of support from many economists as well as policymakers and spurred much research in its era, it has also faced a lot of criticisms such that its analysis is scarcely applied in economics of the present day (Barro & Sala-i-Martin, 2003). One of its major criticisms is its non-consideration of the impact of technological progress and

human capital development. It has also been criticised on the grounds that the growth of poor countries depends on borrowing from abroad for investments.

2.3.3 NEOCLASSICAL GROWTH THEORY

The industrial revolution of the 19th century brought about quite a good number of changes in the economic realities, which defied the classical economic theories and assumptions, thus leading to the emergence of neoclassical economists in the 20th century. They developed theories that refined the classicists' view in order to proffer solutions to match the economic challenges of the era. They made concerted effort to establish the linkage between long run economic growth and factors such as capital accumulation rate, labour, population growth rate and changes in productivity level. Their theories, birthed certain terminologies such as aggregate production functions, utility functions, aggregate capital stocks which are applied in the study of consumer growth theories.

In particular, the seminal work by Robert Solow and Trevor Swan in 1956, known as Solow-Swan model contributed immensely to the evolution of growth theory. Improving on the Harrod-Domar model, the Solow-Swan model recognised technological progress and human capital as critical drivers of economic growth. In line with the model, technological progress, which is driven by research and development (R&D) activities, combined with human capital and other factors of production determines the long run economic growth (Solow, 1956).

The model assumes that in the short run, capital-labour ratio is fixed but this changes gradually as the economy moves towards a steady state in the long run. However, as capital-labour ratio increases, output per worker increases, leading to diminishing returns to capital (Helpman, 2004). The model emphasises that growth is a factor of capital-labour ratio which increases output per worker (Reyes, 2011). This trend will continue but declines in the long run when a steady state is attained in the economy. In this state, the rate of investment equals the rate of capital depreciation, then output growth is determined by technological progress and rises in human capital.

The Solow-Swan framework supports the concept of conditional convergence, as countries with lower per capita income tends to grow at a faster rate than countries with higher levels of per capita income. The explanation is that countries with low per capita income will profit from investments in capital and technology which will boost their productivity in the short run,

whereas countries with higher income per capita may have reached a point where there is low returns for additional investment in capital (Barro & Sala-i-Martin, 2003). This is based on the assumption of diminishing marginal product of capital, at this stage, countries with higher income per capita may have reached a point where there is low returns for additional investment in capital (Barro and Sala-i-Martin, 2006). Thus, conditional convergence in this model has provided an explanation to the variations in growth levels across countries and regions as a result of differences in factors such as savings rate, population growth rate, and capital-labour ratio (Barro & Sala-i-Martin, 2003).

A key recommendation of the Solow-Swan model is that it recognised the role of technological progress in the process of economic growth. Economic growth is not achieved by increasing the unit of any factor of production, since an additional unit of input will result to increase in output at a decreasing rate. This trend will be gradual until per capita output becomes unproductive (Solow, 1956). If the rate of technological progress continues to improve, the output per capita will grow steadily, leading to long term growth as gains from technological progress tends to balance out the diminishing returns to capital (Liu & Premus, 2000).

While this model is applauded for providing a clear framework for understanding key factors responsible for economic growth, it has generally been criticised. The first criticism is its assumption of constant returns to scale, thus implying that the production function is linear and growth of output proportional to the growth of inputs. Some of the foremost criticisms was made by Romer (1990). With the introduction of endogenous technological progress, Romer argued that investment in research and development (R&D), education and creation of knowledge can yield technological progress. He argued that knowledge accumulation can be continuously renewed and multiplied across industries without rivalry to achieve sustained growth (Acemoglu, 2009b; Aghion & Howitt, 2009). Policies to boost education, innovation, research and development should be prioritised since it yields high return through higher quality labour force which leads to increased productivity and ultimately economic growth (Romer, 1990; Stengos & Savvides, 2009).

His argument is supported by Aghion & Howitt (1992) who consider the Solow-Swan model's assumption of constant returns to scale overly restrictive, thus limiting its ability to explain economic growth in the long run. Moreover, based on the assumption of constant returns to scale, the model has neglected key sources of increasing returns to scale which can be harnessed from knowledge spillovers and externalities (Acemoglu, 2009b).

The second major point of criticism of the Solow-Swan model is its assumption that technical progress is exogenous, i.e. independent of economic variables and decisions. By introducing the 'learning by doing' concept, Arrow (1962) explained that productivity can be improved if skills are accumulated for tasks that are done repetitively over time. Thus, he proposed a model in which firms can achieve technological progress endogenously if they leverage on accumulated skills (acquired through learning by doing) and invest in research and development. Further proof of attaining technical progress endogenously is found in the model proposed by Uzawa (1965), in which he showed how investment in physical and human capital can determine technological progress. Many other authors have criticised the model on the ground that it obviously neglects the role of human capital in influencing growth through economic factors such as investment in research and development (Lucas, 1988; Romer, 1986, 1990). While it provides a valuable yardstick for explaining the role of physical and human capital in promoting economic growth, it is clearly unrealistic and should be regarded as a simplified model that has no real world applicability (Aghion & Howitt, 1992; Barro & Sala-i-Martin, 2003). Due to its simplistic nature, it failed to capture the complex interactions between economic, social, and technological factors variables in influencing economic growth (Jones, 1995).

In summary, the neoclassical theorists recognise that growth starts from the aggregate production function where factors of production determine the total national output in three ways - increase in labour supply, capital stock and productivity. An increase in labour supply can be achieved through immigration or if people who are part of the labour force begin to work. Capital stock includes both physical and human capital. Physical capital increases output through its effect on productivity as investments are made on computers and machinery to reduce labour hours, while human capital stimulates growth since skilled persons are more productive than their unskilled counterparts. University education, skills acquisitions and on-the-job training are some of the ways of investing in human capital. However, when increased productivity is unexplained by factor inputs such as labour and capital, other factors are considered. One of such is technological change which encourages productivity in two major ways. Firstly, through advancement of knowledge, technological change promotes invention. Secondly, the use of knowledge leads to production efficiency which encourages innovation (Burda & Wyploz, 2001).

2.3.4 ENDOGENOUS GROWTH THEORY

The neoclassical economists' assumption that technological progress is exogenous led to the emergence of the endogenous growth theory. These growth theories which had shaped contemporary discourse on economic theory and policies generally emphasise the role of investment in education, research and development, competition, and innovation in determining sustained growth in the long run. Details has been discussed in section 2.2.

2.4 THE ROLE OF GOVERNMENT WITHIN THE ENDOGENOUS GROWTH MODEL

In the endogenous growth model, it is predicted that taxation and expenditure will produce long-term growth effects. Rebelo (1991) notes that a major cause of differences in growth levels is the rate of income tax. He observed that an increase in income tax reduces the rate of return for private sector investment activities, leading to a decline in capital accumulation and, subsequently, the growth rate. Most growth models share the characteristic of either constant returns to scale in the factors that can be accumulated or increasing returns to scale, depending on how capital (K) is treated within the production function. When capital is viewed as both physical and human, the result is likely to produce constant returns to scale. This outcome varies when K is disaggregated (Rebelo, 1991).

Additionally, since tax produces distortionary effects if increased beyond a certain threshold (Barro, 1990), the effective value of the tax rate can be substantially reduced only if government spending is channeled towards productive expenditures and those that protect property rights. Within the endogenous growth model, the allocation and execution of public spending are key factors in determining its growth effects, provided that the government is mindful of the nature and limit of expenditure. Barro (1990) noted that government spending contributes to growth via two channels. The first is that taxation negatively affects the after-tax marginal product of capital, while the second is that public services produce positive social effects. By this, he implied that economic growth increases when public spending is low due to the effect on the marginal product of capital. On the other hand, increased government spending beyond a certain point is likely to produce declining growth due to the distorting effect of taxation.

Therefore, government expenditures on public services such as transport, water, electricity, and other public capital are essential, as these are considered inputs into private production (Barro, 1990). Another implication of his work is that regardless of the combination of physical and human capital, production may still show decreasing returns if public expenditures exceed productive limits.

2.5 CONVERGENCE HYPOTHESIS

The main idea of Convergence or "catch up" hypothesis is that there are tendencies that poor countries (with lower per capita incomes) will grow at faster rates than their richer countries. The argument is made from the Solow-Swan growth model that economic growth is driven by the accumulation of physical capital. This accumulation continues until an optimum level of capital per worker is attained, where consumption, output and capital are constant. According to this model, growth is faster when the level of physical capital per capita is low, thereby suggesting that developing countries have the potential to grow at a faster rate than developed countries. This is partly due to diminishing returns to capital being lower in capital-rich countries. Also, in this association, poorer countries are said to replicate the technologies, institutions, and production potentials of developed economies. In line with the neoclassical growth model, initial level of income is negatively related to economic growth (Barro, 1996). It is usually included in growth models to test for convergence (Nijkamp & Poot, 2004; Afonso et al., 2021).

Justifying this further from the classical point of view, it is argued from the standpoint of the general rule that wealth of countries is improved when they associate or converge with countries with superior technology and skillful application of technology and trade. Thus, if countries come together, they can grow better as countries with superior technology and trade will influence others with lower capacity. This growth is measured in per capita income for the working population. While developed countries continue to experience growth, there is an improvement in the living standards in less technologically advanced countries (Elmslie & Criss, 1999).

Within the framework of endogenous theory, countries catch up in income and productivity levels over time. Technological progress and knowledge accumulation play a major role as internal drivers of growth. Research and development (R&D), innovation, and human capital accumulation are channels of generating sustained growth. Secondly, when countries benefit from technological spillovers, as well as invest in education and innovation, there is a tendency for them to move up the ladder, adding to their initial levels of human capital or technology infrastructure (Haq et al., 2022). Another possible way through which poor countries can catch-up with higher income countries within the endogenous framework is through continuous investment in knowledge and human capital. Endogenous growth models recognise these as growth drivers capable of guaranteeing increasing returns to scale. Romer's (1990) theory also emphasises that agent's heterogenous research and development (R&D) abilities is an important factor for long term growth (Arawatari

et al., 2023). In summary, to close the income gap between rich and poor countries, nations should pursue policies that encourage investments in education and skill acquisition, research and development, as well as create institutional environment that support innovation.

2.6 INSTITUTIONS AND ECONOMIC GROWTH

Before delving into the discourse of possible link between growth and institutions, it is pertinent to first and foremost, define what institutions stand for. From the earlier literatures such as that of Coase (1960), the importance of clear definition and enforcement of property rights has been emphasised. He emphasised that in finding solution to social cost, it is important to understand the limitation of certain rights, such as that of ownership of property especially when weighed against social cost.

Institutions can be referred to as systems of established and common social rules that shape social interactions which can be either informal (sanctions, taboos, code of conduct) or formal (laws, constitutions, property rights (North, 1991). This implies that any factor capable of constraining human interactions is an institution. Another implication of this is that individual's choices are defined and limited by institutions as they set the rules, pointing to prohibitions and conditionalities for interactions within society. They include those political, socio-cultural and economic entities that determine the structure of factor markets and terms of access to international factors of production (Delios & Henisz, 2003; Henisz, 2000a). The legal origins theory is another key pointer to the link between institutions and growth (La Porta et al., 2008). The theory explains how legal institutions determine investment rights protection, regulations and government efficiency and determine economic outcomes. Similarly, in support for the endogenous growth theory, Edquist & Johnson (1997) noted that innovation is usually a product of interactions between individuals and groups while institutions regulate such interactions by establishing practices, rules, or laws to govern them. It can therefore be noted that institutions determine factor markets by providing incentives for reduction of uncertainties and promoting efficiency. By this definition therefore, organisational entities, regulatory frameworks and procedural devices can all be classified as institutions.

Institutional environment on the other hand, refers to formal rules that govern the game – laws, constitution, and property rights (Williamson, 2000). This implies that institutional environment goes beyond informal constraints and includes the recognised structure of modern day governance consisting of executive, judicial, legislative and bureaucratic. They are part of society's daily running and capable of promoting or hampering economic growth in so many

unambiguous ways. For instance, they protect property and contract rights, as well as its monitoring and enforcement thereby minimising bargaining costs. Empirical studies also suggest that institutional environment influences firm-level governance arrangement (Ezeani et al.,2022; Ezeani et al.,2023; Komal et al., 2023; Salem et al, 2023a). In this wise, institutional environment also supports innovation projects by providing access to information, management of conflicts and promoting cooperation to enhance acceptability towards enhanced productivity (Edquist & Johnson, 1997).

Literatures linking institutions to economic prosperity would not be considered too contemporary. Two main early ideas influenced this discussion directly or indirectly. The first is Adam Smith's seminal book, The Wealth of Nations (1776), which discussed the theory of social development, linking the different levels of subsistence earnings with existing social and political structures. This was followed by Marx's theory of capitalism, in which he explained that the market forces, not the entrepreneur, determine profitability. From the classical to neoclassical era, the role of institutions in economic growth were neglected. As at 1950s, economic growth theories discussed the role of capital accumulation, which was later refined to incorporate the roles of technological changes and human capital.

In combination with other factors, extant literature recognises the role of institutional environment in determining sustained economic growth as the choice drivers of members of society (Acemoglu, 2009b). Institutional environment partly determines incentives for investing in technology, physical and human capital. Thus, institutional factors can be classified as 'market-creating', since they determine the performance of the market by ensuring that contracts are enforced and property rights protected (Keefer & Knack, 1997). They include well defined rules, laws, regulations and policies capable of influencing investment, entrepreneurship and ultimately, economic growth (Rodrik et al., 2004).

Another evidence of the association between legal systems of countries and economic development is defined in La Porta et al. (2008). They examined the link between legal systems of countries and economic development. They carried out a critical analysis of the relationship between legal origins, civil or common law, and their features and regulatory frameworks of societies. Their study concluded that origins of legal systems play a crucial role in shaping the legal frameworks, property rights regimes, rule of law and legal enforcement mechanisms, which in turn influence economic investment decisions and ultimately economic growth. Their research birthed the Legal Origins Theory. Moreover, Barro's (1990) model links property

rights protection to reduction in marginal tax rates. In line with the model, savings and growth rates increase when property rights are protected.

From the foregoing, it can be seen that the effects of institutional environment on the growth process of nations is well documented in the theoretical literature. Regardless of the measure adopted in the study, it is evident that institutional measures play a pivotal role in the growth process of nations.

2.7 SUMMARY OF THEORETICAL LITERATURE

It is evident from the theoretical literature review, that a lot of research has been done to establish the linkages between government expenditure and economic growth and the critical role that institutions play in the relationship. However, till present time, there is still the challenge of which theory applies in changing the narrative in economies that seek improvement in their growth rates. In the neoclassical growth model, diminishing returns to capital investment implies that investment can only be profitable if there is improvement in technology. The endogenous growth model on the other hand, implies among other things that with improved technology, physical capital and well-equipped human capital, long run growth can be guaranteed. Additionally, the role of institutions in smoothening the process of growth is acknowledged (Helpman, 2004). A major distinction between both theories is that the neoclassical models consider technological progress as exogenous factor, while endogenous theory treats research and development and human capital as endogenous, that is, generated from the within the economy. In both theories, policy interventions influence growth.

There are several ways through which institutional environment influences economic performance of a country. Previous discussions have explained that if government through their taxation regime reduces interest for private investment, growth may be hampered. Secondly, if property rights are protected, investment is boosted which results in improved productivity. Thus, Barro (1990) classified public expenditures which encourage protection of property rights as productive. Thus, Keefer and Knack (1997) noted that if property and contract rights are not secure, there will be reduced incentive to move factors to sectors where technological progress increases rate of return. Secondly, they noted the importance of adequate institutions in enhancing acceptance of modern technology to drive factor productivity. In a similar vein, Henisz (2000b) noted that institutional environment can impact growth through two main routes. The first is that taxation or other regulatory policy sometimes creates an atmosphere of uncertainty thereby reducing investment. The second channel is that if institutional

environment promotes political positions by making it highly profitable, there is tendency for reallocation of funds from economic to political activities. These two channels cause a decline in productive investment which is unhealthy for growth. Some of the ways through which institutions influence growth positively is by encouraging investment through enactment of laws that protect property rights and contract repudiation (La Porta et al, 2008). While the protection of property rights refers to the reduced tendency of government to seize or confiscate foreign property or enterprise, contract repudiation relates to the rate of change or alteration of contract terms with foreign businesses. Usually, investors are unwilling to invest optimally, if there is no guarantee that their investments are protected. Rather, firms may choose to continue on the paths of old technology which yields sub-optimal returns since there is reduced trust in the system. Low incentive to move factors to sectors of higher productivity affects growth negatively (Keefer and Knack, 1997). These lead to low factor productivity since resources are not optimally engaged. Another likely negative result is that of reluctance to adopt modern technology and innovation, thus productivity and growth is hampered.

CHAPTER THREE

EMPIRICAL LITERATURE REVIEW

3.1 INTRODUCTION

This chapter discusses empirical literature on the association between public expenditure, institutional environment and economic growth. The first section presents summaries of empirical literature on the nexus between public expenditure and growth while the second part mainly discusses literature on the roles of institutional environment in economic growth. The chapter discusses these previous findings in line with empirical relationships between both public expenditure and growth as well as that of institutional environment and growth.

3.2 PUBLIC EXPENDITURE AND ECONOMIC GROWTH: EMPIRICS

In the endogenous growth theory, government expenditure can influence long term economic growth through many channels which have been discussed in the theoretical literature. Empirical studies on this relationship abound in the literature varying in terms of dataset, period of coverage, and methodology. While some literatures have looked at aggregate government expenditures, others literatures have combined both analysis of composite and disaggregated approach to arrive at a conclusion for policy making. Results of studies sometimes produce different results across developed or developing countries. This study shall look at the literatures on the relationship between government expenditures and economic growth.

Previous literature has identified some categories of expenditures as economic growth-enhancing, while some have also been identified as either contributing negatively or insignificantly to growth. Barro's (1990) endogenous growth model has triggered many studies on expenditure types, depending on how they enter the production function. He classified expenditures as productive or non-productive depending on whether they enter into production or household utility as well as how they are financed. Based on this categorisation, government consumption expenditure, including transfers and recurrent expenditures are non-productive expenditures and may negatively affect growth. Also, for Barro (1990), expenditures that encourage private-sector productivity or help to sustain property rights such as education and defense are considered productive. While the former is expected to promote economic growth, the latter is likely to have no effect on productivity. In line with previous studies, among key determinants of economic growth are public expenditures on infrastructure, health, human capital (education) as well as total factor productivity. However, institutional economists

continue to emphasise the role of institutional environment on these relationship (North, 1990; Keefer & Knack, 1997; Acemoglu et al., 2005). Government spending on activities that enhance property rights reduces the effective value of the marginal tax rate, thereby increasing savings and private investment and subsequently, boosting growth (Barro, 1990). Therefore, in the next subsection, the study discusses summaries of empirical literatures on the association between government expenditure and economic growth.

Barro (1991) conducted a cross-sectional regression analysis for 98 countries employing data from 1960 to 1985 and found that government consumption share of income has significant negative association with economic growth as measured by growth rate of real per capita GDP. He showed that average annual growth of real per capita GDP reduced with increase in non-productive expenditure in 98 countries. His results also showed that the ratio of private investment to real GDP per capita share negative association with government consumption expenditures which is considered nonproductive. Barro's classification of expenditures into two broad categories of productive and unproductive may not hold true in all circumstances and across all countries and times since countries differ in their developmental stages. Secondly, in some circumstances, there may be need to raise aggregate demand through consumption spending to trigger growth as Keynes recommended (Dutt, 2013)

In line with this, recurrent expenditures by their very nature are classified as non-productive as they do not enter into production nor support private sector investment. On other hand, capital expenditures are sometimes referred to as investment projects (De Long & Summers, 1991), because they enter into production as well as encourage private investment. Regardless of some empirical evidence, one questions the correctness of merely classifying expenditure into two broad categories, productive and non-productive. Analysis of some components under each category has shown varying results across studies. The existing empirical literature suggests that isolating expenditure components to assess their growth effects may be more effective than aggregating them into two main categories.

After a disaggregated analysis of the growth contributions of various compositions of total investment to the GDP per worker growth rate, De Long & Summers (1991) found that economic prosperity of nations will improve if investment is channeled to equipment and machinery. The study was conducted using data from 61 countries at different periods between 1960 to 1985 and different compositions of investments using the OLS method. This result stays same when separate analysis is done for high productivity and lower productivity

countries, i.e. is not sensitive to the two categories of countries while growth rate of labour force, the share of GDP committed to non-equipment investment and GDP level per worker is held constant. Their results further showed that machinery investment as the key driver of Japan's economic boost of an average of 2.2 percent within the study period.

Easterly & Rebelo (1993) studied the link between fiscal policy and economic growth using cross section data from 1970 – 1988 for 100 countries and historical (panel data) of 28 countries from 1870 – 1988. Their regression included some standard conditioning variables initial level of income, primary and secondary enrollment (decade averages), measures of political instability (assassinations, war, coup and causalities), and ratio of government consumption to GDP. They found that total public enterprise has no significant effect on growth, though result is not robust when subjected to instrumental variable regression. A key finding of their paper is that expenditure on transport and communications strongly enhances economic growth. Their study also revealed that budget surplus encourages private investment and subsequently, growth (see also Kelly, 1997). The authors advocated for equitable income distribution, noting that it holds much more importance than political system in driving growth. It can be concluded that there may be other country characteristics that influence public investment expenditure-growth relationship such as those captured in the conditioning variables.

Contrary to Barro's theory and categorisation of expenditure, Devarajan et al (1996) found that capital expenditure reduces growth while recurrent expenditure encourages growth. In their study, these authors employed the OLS to analyse macroeconomic data from 1970 to 1990 for 43 developing countries. Their findings show that capital expenditure is inversely related to economic growth, while recurrent expenditure shares a positive association with per capita GDP growth. Their study included 5-year forward moving average of per capital real GDP as the dependent variable as well as shares of government expenditure in GDP for defense, health, education sectors, black market premium (BMP), shock, among other variables. Results of their study also show that spending on health and education sectors is insignificant and negatively related to growth, while transport and communication expenditure is negatively correlated with growth. In this case, even if the coefficients of capital and recurrent expenditures are disregarded, their result on education sector clearly contrasts with Barro's (1990) theory and the classification of Kneller et al (1999). In the case of Devarajan et al (1996), education sector could be seen as nonproductive based on its negative coefficient.

Similarly, in another publication, Kelly (1997) analysed data from 73 countries using data from 1970 to 1989 to examine the relationship between public expenditures and growth. His analysis

included variables such as education expenditure, health expenditure, social security expenditures and private investment. He found a significant negative association between total education expenditure and growth. He further disaggregated the data into two (i) pre-primary, primary and secondary expenditures and (ii) tertiary expenditures and found that in the first group, the coefficients are positive while the second is consistently negative, even though the results are insignificant for both groups. The coefficient of health expenditures was negative and insignificant. A further look at the health data revealed that 67% of the data were retrieved from hospitals, showing that most developing nations invest more into curative medicare rather than preventive which is adjudged to be less effective but more expensive. This finding is consistent with that of Devarajan et al (1996). This indicates that the nature of the data may be a factor in determining results of growth regressions.

Another factor that may determine the nature and magnitude of effects of expenditure on growth is the 'source of financing.' Miller & Russek (1997) analysed the macroeconomic data of 44 countries between 1975 and 1984 using fixed and random effects model and the OLS. Firstly, they found that for expenditure-growth relationship, means of expenditure financing, i.e. debt or revenue, plays an important role. While financing through borrowing (debt-financing) decreases economic growth for developing countries, it produced no significant effect in developed countries. Also, they noted that revenue-financed increase in government expenditure is favourable to growth in developing countries but reduced growth in developed countries. Secondly, they found that while tax-financed spending is positively associated with growth in developing countries, it produces counter effect in developed nations. They also reported that debt-financed defence spending reduces growth in developing countries but has positive effects in developed countries. Similarly, for developing countries, increasing health or social security expenditures through debt reduces economic growth, while it has no significant effect in developed countries.

Similar evidence is found in Afonso & Furceri (2010), who studied the relationship between government size, composition, volatility, and economic growth using data from 15 OECD and 13 EU countries from 1970 to 2004. The authors concluded that the variability of fiscal variables such as revenue and expenditure not only affect government size but also negatively impacts economic growth. They found that a larger government size is detrimental to growth, while government investment is not significantly related to growth. Moreover, when revenue is disaggregated into direct taxes, indirect taxes, and social contributions, they found that

indirect taxes and social contributions hamper growth the most. This result is consistent across both OECD and EU countries.

In support of productive and nonproductive expenditure discussion, another contribution to this literature was made by Kneller et al. (1999). They concluded that productive expenditure is positively and significantly related to growth while non-productive expenditure shares no significant relationship with growth. However, their analysis differed from previous ones in that their study categorised expenditures and taxes into main groups each – productive and productive expenditures and distortionary and non-distortionary taxes. Using panel data methods, they analysed data from 22 OECD countries from 1970 to 1995. In their analysis, they included conditioning variables such as initial GDP, investment ratio and labour force growth rate. While general public services, defense, education, health, housing, transport and communication were classified as productive, social security, welfare, recreation, economic services were classified as non-productive. On the other hand, taxes on income and profit, social security contribution, taxation on payroll and manpower, taxation on property are distortionary, while taxation on domestic goods and services are non-distortionary.

Further support for the significant contribution of physical capital accumulation in terms of infrastructure to growth was published in Esfahani & Ramirez (1999). The authors examined the link between institutions, infrastructure and growth using data from 78 countries of including Africa, South Asia and China, MENA, Latin America, East Asia and OECD and others extracted from 1965 to 1995. Using a model for 3 decades each and applying the 2 stage least squares method (2SLS), they found a significant positive relationship between average infrastructure investment and per capita GDP growth. Their findings conclude that investment in infrastructure plays a very crucial and significant role in driving growth. This is in support of the findings by De Long & Summers (1991). The authors thus recognised the need to build strong, effective and credible institutions that foster infrastructure-led growth.

Regardless of variations in findings across studies for other sectors, the growth-enhancing effects of education expenditure abound in extant literature with a few exceptions like Devarajan et al (1996). Bose et al (2007) examined growth effects of public expenditure by sector for 30 developing countries using data from 1970 – 1980 using OLS. They also found a strong link between education spending and economic growth. In their regression, they included variables such as initial GDP per capita, population, initial human capital, life expectancy, as well as private investment. Their results also indicate that total capital spending

is positively associated with long run economic growth while recurrent expenditure has no significant with growth. Another key finding of theirs is that defense, transport and communication expenditure shares no significant association with growth. However, variation of findings between countries at different development levels indicates that economic prosperity of countries may also be an important factor. This also implies that sectoral expenditure may affect growth differently depending on whether the country is developing or developed instead of a mere classification into productive and non-productive.

Similarly, Acosta-Ormaechea & Morozumi (2013) established a strong link between education expenditure and economic growth. They deployed data from 56 countries comprising of 14 low, 16 medium and 26 high income countries to determine the growth channel for countries who have adopted fiscal austerity measures and would not increase their budgets in the preceding years. Using dynamic GMM panel data model, they found a negative relationship between the rise in the share of total expenditure to economic growth, proxied by the GDP. The authors attributed this result to the likelihood of distortionary effects of tax revenues (see also Kneller et al, 1999). Thus, their research concluded that reallocation of funds across sectors has no impact on growth, except in the education sector. This is supported by a meta-analysis of the relationship. In like manner, Churchill et al (2015) conducted a meta-analysis of the relationship between health and education expenditure and growth using 31 primary studies using 306 estimates. They found that education expenditure is positively related to growth while health expenditure is negatively related to growth.

In support of Barro's theory, Connolly & Li (2016) studied the effects of government spending on economic growth in OECD countries using GMM estimation technique by Arellano and Bond (1991). In their analysis, GDP per capita is the dependent variable while government consumption spending, public social spending, public investment, private investment, secondary education enrollment, population growth rate, fertility and life expectancy were independent variables. Results of their study showed that public social spending is negative and significant, while consumption expenditures and public investment spending is not significantly related to growth.

Sidek & Asutay (2020) employed panel analysis and the GMM estimator to analyse data from 121 countries, 91 developing and 30 developed countries from 1984 to 2017 to study government expenditure growth nexus. Their findings reveal among other things, that government consumption expenditure lowers economic growth while development (investment) expenditure encourages economic growth. They also found that good institutional

environment such as lesser corruptive practices, better socioeconomic conditions, lesser internal conflicts promotes economic growth.

Relying on the endogenous growth theory, Chu et al. (2020) also studied the impact of government expenditure on growth. The authors analysed the data for 59 countries (37 high income and 2 low-medium income countries) for the period 1993 – 2012) deploying the OLS fixed effects and GMM techniques. They found that income level is not a major factor since productive expenditures promotes growth irrespective of countries' income level while nonproductive expenditures retards growth. The authors concluded that countries desirous of long-term growth need to reallocate some portions of nonproductive spending to productive especially in low to medium income group.

Similarly, Nguyen & Bui (2022) studied the relationship between government expenditure, corruption control and economic growth. After analysis of data from 16 Asian countries using Generalised Method of Moments (GMM) and threshold model, their findings showed that both public spending and corruption control have negative effect on growth.

Arawatari et al. (2023) examined the empirical link between public expenditure and economic growth, testing the Romer's (1990) R&D model featuring heterogeneity of abilities. They concluded that the impact of government expenditure varies depending on the heterogeneity of abilities only when government spending is significantly large or small, noting that variation of results on the relationship may be attributed to moderate size economy.

Okunlola et al. (2024) studied the impact of government expenditure on economic growth using data from 15 ECOWAS countries from 1999 to 2021. Data analysis was conducted using POLS, FMOLS and DOLS techniques. Findings showed that government expenditure stimulates economic growth in ECOWAS countries. However, contrary to the findings of Nguyen and Bui (2022), they found that corruption control encourages effectiveness and efficiency of government expenditure.

3.3 OTHER MACROECONOMIC EFFECTS ON GROWTH

Asides aggregate or sectoral expenditures, scholars have studied the link between other macroeconomic variables and growth. These variables are based on economic theories as detailed in chapter two. Some of the variables appear as conditioning variables in growth regressions including macroeconomic variables such as initial human capital, private investment, initial income or GDP, savings, labour, investment ratio, labour force growth rate, population size, etc. Some empirical work has included these variables in their growth regression as control variables as earlier discussed (Barro, 1991; De Long and Summers, 1991; Devarajan et al, 1996; Bose et al, 2007). This subsection however, discusses some studies that employed these variables in growth models to ascertain growth effects of government aggregate expenditures, without including specific expenditure sectors.

In their study, Mankiw et al (1992) employed OLS analysis on Summers-Heston dataset from 98 non-oil producing countries, 75 intermediate countries (INTER) countries and 22 OECD countries to explain economic growth. INTER countries are characterised by population of less than one million as at 1960, thus there is high likelihood of measurement errors in income figures since it is computed from extremely small primary data. They found that that (i) income per capita depends on savings level, population and education; (ii) increased savings rate increases the level of human capital at the steady state which in turn raises total factor productivity. A critical implication of their findings is that population growth rate negatively affects income per capita since the available capital and human capital becomes insufficient to improve total factor productivity. Thus, their results noted that convergence occur if population growth and capital accumulation is held constant. Their finding is consistent with the Solow's model.

In another study, Scarpetta & Bassanini (2002) sought to establish the driving forces of growth in OECD countries using panel data 21 OECD countries from 1971 to 1998. Contrary to the findings of Mankiw et al (1992), their findings reveal among other things that accumulation of both human and physical capital, as well as research and development (R&D) drives economic growth. They however, highlighted the importance of incorporating technological innovation into new capital in order to maximise its growth effects.

In a similar manner, Barro (2003) conducted a study on determinants of economic growth employing data from 113 countries from 1965 to 1995. Using the three stage least squares method, his findings indicated that there is conditional convergence when initial human capital

is high, holding other variables constant. He also found that better health indices improve economic growth while consumption is detrimental to growth. Other findings of the study include that growth is negatively associated with initial per capita GDP and consumption expenditure. Unlike in Mankiw et al. (1992) who found that population does not affect growth.

Islam (1995) employed panel data with LSDV and Minimum Distance (MD) estimators on the same Summers-Heston dataset previously analysed in Mankiw et al (1992). The difference is his introduction of panel data while Mankiw et al (1992) used the OLS. Compared to the previous study, his findings reveal that higher convergence rates lower the elasticity of capital. He also found that although inclusion of human capital leads to higher rates of convergence, the value of output elasticities is lower and generally not significant. In the same vein, a study by Dias and Tebaldi (2012) using cross country panel data found that growth in human capital determines long run economic growth. The paper deployed the use of GMM estimators to show the interrelatedness of human capital and institutions in fostering long run economic growth.

A different approach was adopted in Afonso and Furceri (2010). In their study of 15 EU and 13 OECD countries. They sought to understand the relationship between government expenditure, composition, volatility, and economic growth. Their classification of expenditures is not sector-based but aggregates. Thus, they included variables such as government revenue, government expenditure, revenue volatility, and expenditure volatility. They also controlled for initial level of output per capita, output volatility, investment share, human capital, population growth and openness. They found, among other things, that shares of total revenue, total expenditure, direct and indirect taxes as well as social contributions hinder growth. Their study also found an insignificant relationship between government investment and growth. The authors thus concluded that possibly, on account of crowding out private investment, government activities if channeled to inefficient activities may not yield the expected effect.

3.3.1 SUMMARY OF EMPIRICAL LITERATURE: GOVERNMENT EXPENDITURE AND GROWTH

Empirical evidence in the literature highlights the relationship between government expenditure and economic growth, covering the period from 1990 to 2022. Overall, most studies agree that a significant relationship exists between government expenditure and economic growth. However, the nature and magnitude of this relationship depend on several factors, such as the sources of financing (Miller & Russek, 1997; Kneller et al, 1999; Arvin et

al, 2021) and the developmental stages of countries (Devarajan et al., 1996). The nature of data, aggregate or disaggregated, also plays an important role (Kelly, 1997).

On the issue of productive expenditures (Barro, 1990), studies using disaggregated sectoral expenditures have produced conflicting results, likely due to varying proxies and terminologies. For instance, some authors use terms like 'capital expenditures,' while others prefer to use the term infrastructure, physical capital or investment expenditure. However, this category of expenditures consists of spending for the acquisition of equipment, machines and structures (Helpman, 2004). Nonetheless, most studies suggest that these expenditures are indeed productive and promote economic growth (Bose et al., 2007; Chu et al, 2020; Kutasi & Marton, 2020). Even when disaggregated into specific types, such as machinery and telephones per worker, results indicate a positive relationship with growth (De Long & Summers, 1991; Easterly & Levine, 1997; Esfahani & Ramirez, 1999, 2003).

Similarly, capital or investment expenditures have been found to promote growth (Bose et al., 2007; J. Butkiewicz & Yanıkkaya, 2011; Sidek & Asutay, 2020, Okoli et al, 2023), with a few exceptions (Connolly & Li, 2016; Devarajan et al., 1996; Nguyen & Bui, 2022). Transport and communication expenditures, which fall under capital expenditures, have been found to promote economic growth (Easterly & Rebelo, 1993; Ahmed & Miller, 2000). However, Devarajan et al., (1996) and Bose et al (2007) reported negative and insignificant effects on growth, respectively. In line with the productive expenditures' argument, public social spending has been found to be insignificant (Connolly & Li, 2016)), except in a few cases where recurrent expenditure shows a positive relationship with growth (Devarajan et al., 1996).

Rebelo's (1991) theoretical model illustrates that combining factor accumulation, i.e. labour and capital, produces stronger positive effect on long term economic growth. He also showed that results vary when these factors are separated. Consequently, some expenditure-growth studies separate these factors to evaluate their individual contributions to growth. For human capital, expenditures on health and education, or health indicators, are sometimes used as proxies or included in the growth equation. For instance, Barro (1991) and Bose et al. (2007) included life expectancy rates in their equations. Ample empirical evidence suggests that human capital contributes significantly to growth (Glaeser et al., 2004; Mo, 2007; Kostov & Le Gallo, 2018; Ahmed & Miller, 2000; Scarpetta & Bassanini, 2002), with few exceptions such as Bose et al. (2007). Similarly, there are empirical evidences of the positive effects of physical capital (Bassassini and Scarpetta, 2001; Ahmed and Miller, 2000). While Barro (2003)

found that health expenditure positively impacts growth, Devarajan et al. (1996) and Kelly (1997) found it to be negative and insignificant, respectively.

Consumption expenditure is unproductive and may even be detrimental to growth (Barro, 1990). This has been backed by ample empirical evidence (Barro, 1991, 1996; Connoly and Li, 2016; Sidek and Asutay, 2020). Its reallocation to other types of expenditure has also been found to strengthen economic growth (Mo, 2007).

Theoretical models illustrate that public services can be considered inputs into private production to boost private investment (Barro, 1990). Without government intervention through provision of services, production would yield decreasing returns even with capital inputs (Rebelo, 1991). This implies that government expenditure in transport and communication should boost productivity (Easterly and Rebelo, 1993; Ahmed and Miller, 2000). However, Devarajan et al. (1996) and Bose et al. (2007) found negative and insignificant effects on growth, respectively.

In line with the productive expenditures' argument, government spending on welfare services such as public social spending has been found to be insignificant (Connoly and Li, 2016). On the contrary, recurrent expenditures have been found to be positively related to growth, although in developing countries (Devarajan et al., 1996).

The study also notes the significance of control variables in growth regressions across the literature. These variables are used to measure convergence, openness, institutional quality, human capital stock, and physical capital stock. These include initial income, population growth, savings, private investment, trade, and inflation (Barro, 1991; Mankiw et al., 1996; Islam, 1995; Devarajan et al., 1996; Nguyen and Bui, 2022).

3.4 EMPIRICAL EVIDENCE: INSTITUTIONS AND ECONOMIC GROWTH

Empirical evidences abound in the literature linking institutional effects to cross-country economic prosperity (Mauro, 1995, 1998; Zablotsky, 1996; Hall & Jones, 1999; Persson & Tabellini, 2004; Rodrik et al., 2004; Drury et al., 2006). For instance, in their seminal paper, La Porta et al. (2008) examined the link between legal systems of countries and economic development. They carried out a critical analysis of the relationship between legal origins, civil or common law, and their features and regulatory frameworks of societies. They concluded that origins of legal systems play a crucial role in shaping the legal frameworks, property rights

regimes, rule of law and legal enforcement mechanisms, which in turn influence economic investment decisions and ultimately economic growth. Their research birthed the Legal Origins Theory.

In another study, Acemoglu (2009) traced the link between countries' institutional structure and growth. They found that institutional structures set up by European colonialists depend on their ability to cope or survive within the lands they conquered, which in turn determine the nature of the institution bequeathed to the country. Using two proxies of economic prosperity – urbanisation rate and population density across nations, he proved that institutions are responsible for reversal of fortune in their colonies. Depending on the human or natural resources available within their colonies such as gold, silver, agricultural commodities, Europeans are likely to introduce institutions that facilitate extraction of resources as long as their interests allow.

To establish the quality of institutions, there must be an element of constraint. De Long & Shleifer (1993) provided empirical support using data from European regions, showing that growth occurs faster under limited government. In other words, democratic governments, characterised by political participation, civil and political liberties, and a high level of popular control, encourage economic growth (Zablotsky, 1996). Further support for this was reported in Feng (1997) and Drury et al. (2006). The authors utilised time series cross-section data analysis of over 100 countries from 1982 to 1997 and found that, compared to democratic economies, authoritarian governments suffer more negative effects of corruption. They argue that democracy promotes growth by cushioning the negative effects of corruption on the economy.

Many prior empirical studies have attempted to identify the channels through which political, economic, and social institutions influence growth. For instance, Mauro (1995) used nine indices from Business International (BI), which are compiled independently of macroeconomic assessments. These indices, based on the assessments of correspondents and analysts residing in the given countries, reflect investors' perceptions. To reduce measurement errors and multicollinearity, the nine indices were aggregated into two major composite groups: bureaucratic efficiency and political stability. Mauro (1995) applied statistical analysis and observed a strong correlation between growth and institutions. He noted that richer countries tend to have better institutions than poorer ones, and a higher bureaucratic efficiency index is associated with faster growth rates (see also Glaeser et al, 2004). To avoid bias due to

multicollinearity among these indices, Mauro introduced the ethnolinguistic fractionalisation (ELF) instrument, which measures the probability that two randomly selected individuals belong to different ethnolinguistic groups. The ELF variable showed a negative relationship with the political stability index, bureaucratic efficiency index, and corruption, implying that ethnic diversity can create disunity and even lead to civil war. It may also worsen corruption due to favouritism towards members of the same ethnic group. A second instrument to test the robustness of BI indices was the colonial history of countries, as used in Barro's (1991) dataset. Mauro (1995) found that recently colonised countries might be more prone to corruption. Although the ELF and colonial history instruments are validated from specification tests, their long-run exogeneity may be unreliable due to other factors affecting both colonial history and ethnolinguistic fractionalisation.

Regarding the relationship between corruption and investment, Mauro's (1995) empirical estimates using OLS and 2SLS showed the following results: (i) there is a significant and negative association between corruption and investment rate, regardless of the level of bureaucracy. (ii) the bureaucratic efficiency index is positively associated with the investment rate, with a higher coefficient in 2SLS with the ELF than in OLS. (iii) besides worsening corruption and political instability, ELF can slow the dissemination of knowledge and technological innovations. (iv) investment in equipment is more closely associated with bureaucratic efficiency than non-equipment investment. (v) corruption and bureaucratic inefficiency are negatively associated with the investment rate. The empirical results showed a negative but not robust relationship between corruption and growth, with significance only at the 10% level. Mauro (1995) concluded that the effect of corruption on growth may be through the total amount of investment rather than causing inefficient investment choices. Even in corporate settings, anti-corruption disclosure quality has also been found to reduce the likelihood of earnings management in firms (Salem et al, 2021b; Salem et al, 2023b; Gerged et al, 2023; Ghazwani et al, 2024), especially in more developed regions (Tan et al, 2022). This also has great impact on corporate governance (Komal et al, 2022; Usman et al, 2023).

Further confirmation of the negative effect of ethnic diversity on cross-country growth variations was found by Easterly & Levine (1997). Using the Seemingly Unrelated Regressions (SUR) method for pooled data from the 1960s, 1970s, and 1980s of 47 Sub-Saharan African Countries including dummies for Latin America and Caribbean Countries countries, they established that ethnicity is significantly and negatively associated with real per capita GDP

growth. Their model included initial income to capture the convergence effect, inflation, trade or export shares, school attainment, political stability, ethnolinguistic diversity, policies, and the number of telephones per worker. Other economic indicators associated with growth included black market exchange rate premium, central government surplus to GDP ratio, and liquid liabilities of the financial system divided by GDP. Additionally, their study indicated that telephones per worker and the percentage of paved roads share a strong positive relationship with growth. The authors also established that ethnic divisions are largely responsible for political instability, corruption-prone policies, and the provision of poor public goods, which are often delayed by disagreements on public goods choices. While concluding that convergence is slower for Africa due to low income, they also noted that high ethnic diversity is responsible for growth-retarding policies in Africa. Thus, their study blamed continued poverty in Africa on a number of institutional and social factors such as low schooling rate, political instability, substandard forex markets, underdeveloped financial systems, poor infrastructure and high public deficits.

Feng (1997) studied the relationship between democracy, political stability and economic growth. He classified political instability into 3 different types – irregular political change, regular political change and minor regular government transfer. They deployed the 3SLS to analyse data of ninety six countries from 1960 – 1980 using the following variables average growth rate of GDP per capita as the dependent variable, while human capital, ratio of private investment to GDP, inflation and trade were the independent variables. The first category is exemplified by forceful removal of government such as in coup d'etat. It is mainly characterised by uncertainty and usually slows down economic activities. The regular political change refers to the change in government in line with the national political framework, example, end of tenure. Its disruption may cause a short-run decrease in economic activity. While the minor regular transfer refers to change in cabinet member of the ruling party. Results of his findings reveal that while irregular government change affects growth negatively, regular change have significant positive impact on economic growth. Also, initial per capita income has a significant negative sign which shows conditional convergence. There is a positive relationship between initial level of human capital accumulation and growth. Also the ratio of private investment to GDP and trade both share positive relationship with growth. As expected, inflation showed negative association with GDP though not significant. Democracy shares a positive significant association with regular change and a negative insignificant association with irregular change. He noted that it is erroneous to lump together the various types of

political change as this has the tendency to produce different results on economic fortunes of nations.

Keefer & Knack (1997) blamed poor institutions for the relative backwardness of countries regardless of growth potentials. They modeled three (3) institutional variables, country risk, business risk, and executive constraints and found that generally, institutional variables play a key role in determining income level of countries. Using cross sectional regression, they analysed data from 1960 to 1989. Of the three, business risk index shows the most effect on average real per capital growth in GDP. Countries with higher business risks tends to diverge while country risk and executive constraint variables show that poor countries can catch up if their institutions are improved. They concluded that poor institutional quality also leads to low levels of human capital acquisition, machinery, foreign trade and investment.

In explaining variations in growth and development across nations, Acemoglu et al (2001) showed that colonial origin is a possible cause of institutions-linked growth. They employed the use of OLS to analyse two sets of data – (i) the whole world and (ii) 64 ex-colonies. Their results reveal a strong association between institutional variables and economic growth. They considered the possibility of biased result, possibly from omitted variables and the possibility that richer countries tend to have better institutions, thus, they used mortality data from the local people, their population density and mortality rate data of early settlers as explanatory instrument to show that (i) the higher the mortality rate of colonial masters, the worse the institutions they are likely to set up. They used the America, New Zealand and Australia to show that in places where there are favourable health conditions, they tend to settle in well and establish a neo-Europe kind of institution. In contrast, in Africa and Asia with their malaria and cholera prone environment, they mainly set up extractive institutions which retard growth and development. They also applied the 2SLS estimation to show that institutional difference is a key determinant factor for poverty especially in Africa and Asia. Their results were robust to either income per capita or output per worker.

The primacy of institutional factors for long term economic prosperity is further confirmed in the empirical work of Rodrik et al (2004). The authors analysed 3 different data samples of (i) 79 countries (analysed by Acemoglu et al (2001) (ii) 64 countries (for which Acemoglu et al 2001 had data on settler mortality (iii) 137 country sample (including non-colonised countries). They sought to determine the causal relationship between income level, integration, institutions and geography. Using OLS, they found that institutional quality, based on property rights and

the strength of the rule of law, had the most impact on the GDP per capita. Their results also reveal that if institutions are controlled for, integration has no direct effect on level of income. On the other hand, trade has negative effect on income. Overall, their results showed that in comparison to human capital, institutions impact more on physical capital accumulation. Their findings also implied that improved institutional quality can cause a huge boost in income per capita.

Further confirmation of a significant relationship between institutions and growth is found in Wu et al (2010). Their study reports that country's corruption levels show significant relationship with growth. They studied the impact of government expenditure on economic growth using panel unit root tests and causality tests to analyse 182 countries from 1950 – 2004. Their study sample was grouped into 3 different categories – (i) OECD and non-OECD. (ii) low, middle and high income countries and (iii) based on corruption perception index (CPI) as published by Transparency International. With a set mean of 4.03, 64 countries and 118 countries were classified as low and high corruption countries respectively. They found a positive relationship between government expenditure and economic growth. They also observed that when countries are classified according to income levels and degree of corruption, the results stayed consistent except for low income countries. The authors attributed it to inefficiency of government and poor institutional environment.

Similarly, Dias & Tebaldi (2012) developed a model to demonstrate the interaction between human capital and institutions in driving long term growth. Their model shows that structural institutions enable human capital accumulation, which encourages the growth rate of technology and output. Through the model, they demonstrated that productivity leads to increasing returns to human capital accumulation and thus encourages non-educated work force to invest in education. When the authors estimated the model empirically using data from 61 countries from 1965 – 2005, the results mirrored the model in many ways. They used the dataset from Barro and Lee (2010), Penn World Tables 6.3 and Polity IV project and included the following variables (i) growth rate of output per capita (ii) growth rate of physical capital per worker (iii) human capital growth rate (iv) human capital level (v) per capital level of human capital (vi) Institution variable (vii) time indicator variables (viii) Geography (regional indicator).

Firstly, the authors observed that when institutional variables are excluded from the model, the model fails preliminary tests at first difference or system GMM instrument validity tests. They

used dynamic panel data estimation technique and found the following results (i) institutions have a strong positive association with long run economic growth but not on the short run. Their short run result is explained in the likelihood of impact of institutions to be felt in a longer term and not in the short run. (ii) output per capita growth rate is positively related to growth rate of physical and human capital not levels. (iii) inclusion of institution variables in the model increases the coefficient of long run growth effect of physical capita growth rate. Unlike Rodrik et al (2004), they found that geography impacts growth through human capital and structural institutions. However, the index of political institution, Polity IV, which measures autocracy and democracy is not significantly related to growth in all the models. This is explained on the grounds that political institutions do not affect individual investment behavior and would not directly relate to output nor growth.

Following empirical evidence that corruption is prevalent in developing countries, Dzhumashev (2014) developed a model to study the link between corruption and growth around three key bases (a) quality of governance (b) size of the public sector and (c) the economic development level. He noted that governance plays two major roles in the relationship between corruption and economic growth. Firstly, it drives the incidence of corruption and secondly, it promotes efficiency of public sector activities. He found that incidences of corruption may improve efficiency of government activity if the size of government is above the optimal level. Corruption tends to force government size back to optimal size, thereby improving efficiency. He noted that levels of rent-seeking behaviours vary across countries depending on their development and institutional environment. He identified difference in wage rates as the chief cause of rent-seeking behavior which varies with level of development. His paper concluded that incidences of corruption increase with increasing public expenditure while it reduces with tax evasion, borrowing costs and economic development. His findings found support in Aidt (2009) that in an environment with good quality political institutions economic growth promotes corruption.

Still on the link between institutional indicators and growth, Arvin et al (2021) analysed data from 51 countries, 22 low income countries and 29 lower middle-income countries, from 2005 – 2019 using panel vector error correction model. They studied the interaction among institutional quality, tax revenue, government expenditure and growth using per capita economic growth as the dependent variable and included other variables such as tax revenue (percentage of GDP), government consumption expenditure (percentage of GDP) and aggregate index of institutional quality within the study countries. Results of their long run

dynamics show that tax revenue, government expenditure and institutional quality all play important roles in determining growth in both groups. They also found that stronger systems and regulations discourage rent-seeking behaviours and enhance government revenue. In the short run, while government expenditure significantly impacts tax revenue, government expenditure and growth, institutional quality shows no causal relationship with any other variable in the low-income group. Again, they traced the finding for the low-income group to prevalence of poor quality institutions.

Gründler & Potrafke (2019) found that that corruption retards growth. The authors studied the relationship between corruption and growth using data from 175 countries for the period 2012 to 2018 using the corruption perception index compiled by transparency international. Their study revealed that corruption discourages Foreign Direct Investment (FDI) and increases government instability.

Afonso et al (2021) and Afonso (2022) are recent studies validating the critical role of institutions on economic growth. Both studies were conducted using data from OECD countries while adopting different measures of institutional quality. The first study adopted a combination of World Governance Indicators and legal origins introduced by La Porta et al (2008), while the second study modelled index of freedom (IDF) from the Heritage Foundation. Afonso et al (2021), analysed data from 36 countries from 1995 to 2006 using two stage least squares method and concluded that while debt is significantly detrimental to growth, the interaction of debt and institutional variable shares a positive significant relationship with growth. Thus, the study concluded that highly indebted developed countries should maintain good institutions in order to mitigate the effect of debt on their economies. Similarly, Afonso (2022), showed that good institutions make for improved factor efficiency usually captured as total factor productivity. He found that IDF shares a strong relationship with labour efficiency which translates to growth.

Regardless of the various pieces of evidence supporting the significant relationship between institutions and growth, there are other opposing empirical evidences that institutions may not be as critical to economic performance as commonly believed (Glaeser et al, 2004) especially for poor or developing countries (Berggren et al., 2012; Chomen, 2022). They contend that many popular institutional measures may reflect good policy choices but are flawed because they do not adhere to the standard of effectively constraining power (North, 1991). Their findings suggest that human capital promotes growth and that good policies by authoritarian

governments can be sufficient to sustain growth. Using the growth trajectories of North and South Korea as examples, they emphasised that indices of democracy (such as those used in Polity IV measures) and other institutional metrics are inadequate for assessing economic growth variations and fluctuations across countries.

3.4.1 SUMMARY OF EMPIRICAL LITERATURE: INSTITUTIONS AND GROWTH

Extensive research has shown that institutions, political, economic, and social, play a significant role in economic growth. Across the empirical literature, indicators such as political stability or instability, corruption, rule of law, ethnolinguistic heterogeneity, and legal origins have been consistently linked to economic growth (Acemoglu, 1998; Acemoglu et al, 2001; Sidek and Asutay, 2020; Arvin et al, 2021; Afonso et al, 2021; Acquah et al., 2023; Uddin et al., 2023). The channels of influence identified include poor investment decisions due to uncertainty, inefficient resource allocation, misallocation of resources, and negative effects on human capital accumulation (Aisen and Veiga, 2013). Good institutions have been associated with the growth of total factor productivity (TFP), significantly enhancing labor efficiency (Afonso, 2022).

Political instability is detrimental to growth (Alesina et al., 1996; Bose et al., 2007; Aisen & Veiga, 2013), although its impact varies depending on whether the change in government is regular or irregular (Feng, 1997). The negative economic effects of corruption on growth are well documented (Mauro, 1995, 1998; Keefer & Knack, 1997; Wu et al., 2010). Nonetheless, some suggest that minimal corruption control might be beneficial, as it can "grease the wheels," thereby promoting public sector efficiency (Dzhumashev, 2014; Nguyen & Bui, 2022). The rule of law encourages growth by affecting contract enforcement, property rights protection, and enhancing confidence in the judicial system (Nedanovski & Kocevska, 2023).

3.5 EMPIRICAL LITERATURE GAP

The literature review reveals that the empirical relationship between government expenditure, institutional quality, and economic growth remains unresolved. While numerous studies provide evidence of a positive relationship between government expenditure and growth, there is also considerable evidence suggesting a negative relationship. Barro's (1990) classification of expenditures into productive and non-productive categories provides a theoretical framework, but the empirical findings continue to vary across studies.

Specifically, the relationship between sectoral expenditures and growth has been inconsistent, except for the education sector. Various factors may explain these discrepancies, including the source of finance (Kneller et al., 1997), data availability and the time periods analyzed (Cohen & Soto, 2007), data types (Kelly, 1996), measurement of variables (Kostov & Gallo, 2018; sampling methods, and the econometric techniques applied. Furthermore, evidence on the impact of institutional environments on economic growth also varies across studies (Afonso et al., 2021; Nguyen & Bui, 2022; Nedanovski & Kocevska, 2023; Okunlola et al., 2024).

This study seeks to bridge these gaps by addressing key methodological challenges. First, it adopts a robust approach to handling endogeneity, ensuring that potential biases are minimized and that the results are reliable. This method captures the true effects of government expenditures on growth across countries with diverse institutional environments. Second, the study employs the unconditional quantile regression method, which allows for the analysis of heterogeneous effects across different quantiles of the dependent variable. This approach provides a more detailed understanding of the variations observed in previous studies and offers new insights into the relationship between public spending, institutional environments, and economic growth.

CHAPTER FOUR

INITIAL EMPIRICAL ANALYSIS

4.0 OVERVIEW OF CHAPTER

This chapter of the study presents the methods and econometric procedures followed in the initial empirical analysis. It commences with information on the sources of data, sample size and justification, dataset construction and impact, and measurement of variables (4.1). Section 4.2 deals with preliminary data analysis, while section 4.3 presents the empirical model. Empirical analysis and results of analysis are discussed in sections 4.4 and 4.5 respectively. Lastly, the chapter presents discussion of initial findings in section 4.6

4.1 DATA SOURCES

The data for this study comprises of two main classes of secondary data, economic variables and institutional environment variables. Details of both classifications is provided in the following subsections.

ECONOMIC VARIABLES

Economic variables include data of macroeconomic indicators and public spending of governments drawn from two main sources, the Penn World Tables (PWT) 10.01 and Statistics on Public Expenditures for Economic Development (SPEED) 2019.

The PWT 10.01 contains aggregate national data on relative income levels, productivity, input and output for of 183 countries from 1950 to 2019. Similarly, the SPEED 2019 dataset hosts public expenditure data of 164 countries across sectors from 1980 to 2017 (Researchers, 2022; International Food Policy Research Institute (IFPRI), 2019; *PWT 10.01*, 2023).

INSTITUTIONAL ENVIRONMENT VARIABLES

Data for institutional measures was accessed from the International Country Risk Guide (ICRG) published by the Political Risk Services (PRS) group. The database provides information for 22 variables covering 3 key risks of political, financial and economic. Political risk indicators

represent subjective measures of political risks on businesses and governments. From political risks indicators, three (3) institutional variables considered important to this research were selected - corruption, government stability and law and order (Researchers, 2022).

Corruption measures cover corruption as it affects politics, as well as the level of influence on foreign businesses and with potentiality of destabilising the economy's political institutions. Its coverage is the likelihood of nepotism, secret party funding, job reservations, etc. It is rated score points 0 – 6, where 0 implies very high risk and 6 very low risk.

Government stability variable covers government unity, legislative support and popular support. It is rated score points 0 – 4, where 0 implies very high risk and 4 very low risk. Law and Order variable measures the strength and independence of the country's legal system as well as popular adherence to the law. The total points rating is 6. Whereas law and order are assigned 0 - 3 points each.

4.1.1 SAMPLE SIZE AND JUSTIFICATION

The sample size of this study is 67 countries drawn from both developing and developed economies. The size of the sample ensures generalisability and improve the statistical power of results (Shadish et al., 2002). It also ensures the applicability of the research across different contexts and time periods as well as reduces the likelihood that research findings are influenced by short-term anomalies (Greene, 2011; Wooldridge, 2016). Thus the period covered by the research is determined by the data availability.

The sample countries covered in this study are listed in table 4.1.

TABLE 4.1 LIST OF SAMPLE COUNTRIES

1	Angola	35	Jamaica
2	Argentina	36	Jordan
3	Armenia	37	Kazakhstan
4	Austria	38	Kenya
5	Belgium	39	Republic of Korea
6	Bulgaria	40	Kuwait
7	Bahrain	41	Lithuania
8	Bolivia (Plurinational State of)	42	Luxembourg
9	Brazil	43	Latvia
10	Switzerland	44	Republic of Moldova
11	Chile	45	Malta
12	Colombia	46	Mongolia
13	Costa Rica	47	Malaysia
14	Cyprus	48	Namibia
15	Czech Republic	49	Netherlands
16	Denmark	50	Norway
17	Dominican Republic	51	Peru
18	Egypt	52	Philippines
19	Spain	53	Poland
20	Estonia	54	Portugal
21	Finland	55	Qatar
22	France	56	Russian Federation
23	United Kingdom	57	Serbia
24	Greece	58	Slovakia
25	Guatemala	59	Slovenia
26	China, Hong Kong SAR	60	Sweden
27	Croatia	61	Thailand
28	Hungary	62	Trinidad and Tobago
29	Indonesia	63	Tunisia
30	Ireland	64	Turkey
31	Iran (Islamic Republic of)	65	Ukraine
32	Iceland	66	South Africa
33	Israel	67	Zambia
34	Italy		

4.1.2 DATASET CONSTRUCTION AND IMPACT ON SAMPLE SIZE

The construction of dataset for this study involved combining data from three different databases. This combination process however, reduced the overall sample size. Note that the Penn World Table (PWT) 10.01 and SPEED databases contained relevant data dating back to 1970 and 1980 respectively, while the International Country Risk Guide (ICRG) database only provides data from 1984 onwards. The limited data availability in the ICRG database, substantially shrunk the sample size for the study to the period 1984 to 2017 with a total of 928 observations.

4.1.3 MEASUREMENT OF VARIABLES

This section explains the measurement or definition assigned to each variable, both dependent and independent.

Real GDP per Capita (RGDP_PC)

The dependent variable, Real GDP per capita (RGDP_PC) measures economic output per person in a country. It is usually deployed to measure standard of living in a country (Helpman, 2004). It is derived by dividing real GDP at constant 2017 national prices (in mil. 2017US$) by the value of total population. Both variables were sourced from the PWT 10.01 (*PWT 10.01*, 2023). Real GDP per capita is widely used in the literature as a fundamental measure of economic growth, in both historical and recent studies. For instance, Devarajan et al (1996), employed a 5 year moving average of RGDP per capita to measure economic growth trends, while Easterly and Levine (1997) utilised real GDP per capita growth. Similarly, Kostov & Gallo (2018) used the growth rate of per capita GDP to evaluate the impact of human capital on the economy. Moreover, it is generally accepted and serves as a key indicator in evaluating the influence of various non-macroeconomic factors. Easterly & Levine (2003) deployed the variable to investigate how endowments influence economic development, while Rodrik et al. (2004) employed it to analyse the economic impact of institutions, geography and integration. Gründler & Potrafke (2019) also adopted this measure as a dependent variable in their study of the impact of corruption on economic growth.

Government expenditure on communications (COM_PCTEXP): This variable represents total government expenditure in the communications sector. It includes spending on major infrastructure that facilitates connectivity and exchange of information within a country. It is expected to positively influence long term economic growth since information technology fosters

knowledge diffusion and productivity. The proxy variable used in this research is percentage of communications expenditure in total expenditure (International Food Policy Research Institute (IFPRI), 2019). Considerable amount of evidence exists in the literature on the use of this measure. It has been used in line with Barro (1990) model, which considers infrastructure expenditure as an input to encourage private production. Easterly and Rebelo (1993) documents that expenditures in infrastructure enhances growth. Specifically, Easterly and Levine (1997), included telephone per worker as a variable in their growth model. Other literature that employed this measure include (Devarajan et al., 1996; Kneller et al., 1999; Bose et al., 2007).

Government Expenditure on Health (HL_PCTEXP): This variable is measured by the value of total expenditure of government in the health sector. Government spending on healthcare infrastructure and services is expected to contribute to the overall wellbeing of the working population and thus boost productivity (Strauss & Thomas, 1998; Jack, 1999). The proxy variable used in this research is the percentage of health expenditure in total expenditure. The use of this measure is also popular in the literature (Easterly & Rebelo, 1993; Devarajan et al., 1996; Kelly, 1997; Miller & Russek, 1997;Cooray, 2009; Pradhan, 2010).

Human capital (HC): This represents the knowledge and skills of the employed population, which arises from a combination of abilities, social environment, skills acquisition and education (Kostov and Gallo, 2018). Stock of human capital constitute an input to production and thus expected to be positively related to economic growth. In line with the growth models, human capital enhances the growth of both labour and capital (Lucas, 1988). Other theoretical evidence also supports its link with economic growth (Barro, 1990; Barro, 1991; Cortright, 2001). The proxy variable for this research is the human capital index, based on years of schooling and returns to education (International Food Policy Research Institute (IFPRI), 2019). This measure is widely accepted and included as a variable in empirical studies, since the early 1990s till date (Mankiw et al., 1992; Barro, 1991, 2003; Glaeser et al., 2004; Cohen & Soto, 2007; Barro & Lee, 2013).

Total Factor Productivity (TFP): This variable reflects the technical progress of a country that increases efficiency of productivity of factors of production such as physical capital and labour since it captures concentration of technology. It explains the residual effects on economic growth unexplained by other production factors. Thus, technological advancement of countries is estimated by the growth rate of this variable. It is thus expected to be positively related with

economic growth. For this research, the TFP at constant national prices (2017) is used (*PWT 10.01*, 2023). Previous literatures have also deployed this measure (Barro & Sala-i-Martin, 1995; Klenow & Rodríguez-Clare, 1997; Easterly & Levine, 2001; Miller & Upadhyay, 2002; Baier et al., 2006).

Government Stability (GOVTSTAB): Being one of the variables for assessing institutional environment, this variable represents the stability of the political environment in a country. The variable captures key governance issues such as government unity, legislative strength and popular support. The apriori expectation is that economic growth will be enhanced if the political environment is stable. The proxy variable used in this research is 'government stability' as published in the International Country Risk Guide (ICRG) (Researchers, 2022). This measure has been used by Assane and Grammy (2003). Even in corporate governance, it has been deployed to evaluate its relatedness with cost of capital (Belkhir et al., 2017; Kwabi et al., 2024).

Law and Order (LAWORDER): This is a measure of the strength and the independence of the legal system as well as the reliability of the judicial system. The proxy variable used in this research is 'law and order' as published in the International Country Risk Guide (ICRG) (Researchers, 2022). This was equally used in Keefer and Knack, 1995; 1997). They used this measure for proxies of risk of expropriation, repudiation of contracts and security of property and contract rights. Other recent research works that have also adopted this measure include Asongu & Nwachukwu (2016); Struthmann et al. (2023) and Spyromitros & Panagiotidis (2022a).

Corruption (CORR): This is an index of corruption level in a country. Corruption is expected to distort resource allocation, hinder public and private investment, and reduce efficiency of public services in a country. The variable is therefore expected to have negative effect on real GDP per capita. The proxy variable used in this research is 'corruption' as published in the International Country Risk Guide (ICRG)(Researchers, 2022). This has been used in several studies though, sometimes in combination with other measures. For instance, Hall and Jones (1999) included this measure to form what they referred to as government's anti-diversion policies (GADP). This index has been used in many recent literatures (Aidt, 2009; Knack, 2001; Fisman & Gatti, 2002).

TABLE 4.2 MEASUREMENT OF VARIABLES AND DATA SOURCES

SN	VARIABLE	DEFINITION	MEASUREMENT	SOURCE
1	RGDP_PC	Economic Growth	Real Gross Domestic Product (RGDP) per capita. Real GDP divided by the total population	Penn World Table 10.01
2	COM_PCTEXP	Government Expenditure on Communication	Percentage of Communication Expenditure in total expenditure of government	SPEED 2019
3	HL_PCTEXP	Government Expenditure on Health	Percentage of Health Expenditure in total expenditure of government	SPEED 2019
4	HC	Human Capital	Human capital index, based on years of schooling and returns to education	Penn World Table 10.01
5	TFP	Total Factor Productivity (TFP)	TFP at constant national prices	Penn World Table 10.01
6	GOVTSTAB	Political Stability	Based on risk ratings based on factors that might impede government's political stability such as unity in government, strength of legislation and popular support.	ICRG Researchers' Dataset
7	CORR	Corruption in government	Based on risk ratings based on corruption within the political system that impede efficiency of government.	ICRG Researchers' Dataset
8	LAWORDER	Law and Order	Based on risk ratings based on the strength of the legal system as well as popular compliance with the law.	ICRG Researchers' Dataset

It is important to state the institutional coverage level of the data across countries deployed for this research. The data used for this research is the central government expenditure as published in the Statistics on Public Expenditures for Economic Development (SPEED) (Institute (IFPRI), 2020) https://www.ifpri.org/publication/statistics-public-expenditures-economic-development-speed. The indicator used for analysis is percentage of sector expenditure in total expenditure.

4.2 PRELIMINARY DATA ANALYSIS

4.2.1 PANEL DATA

The empirical analysis of this research is done using the panel data analysis to examine the effects of government expenditure and institutional environment on economic growth. Panel data is also referred to as longitudinal data, and consists of several entities with repeated observations on the same units for different periods of time (Kennedy, 2008). Through the use fixed effects (FE) or random effects (RE) models, the panel data analysis accounts for country-specific variations or heterogeneity that are constant or vary randomly over time (Baltagi, 2013; Wooldridge, 2010).

Panel data analysis is best suited for this research work for many reasons. Firstly, it allows for differences in aggregate production functions across countries (Islam, 1995) and also helps to control for country-specific effects or unobserved heterogeneity (Greene, 2011). Secondly, panel data analysis also helps to control the impact of omitted variables (Hsiao, 2003) since it may be short or long, balanced or unbalanced. For instance, a short panel data may have large number of individuals (N) but short in time periods (T), while a long panel there may be few individuals (N) but more time periods (T). A key advantage of panel data analysis which makes it more reliable for estimation of data of this nature is that it not only contains more degrees of freedom, but also allows for sample variability than time series or cross-sectional data). It is thus considered to be a quite efficient econometric technique (Hsiao, 2003).

Brief explanations of various methods for panel data analysis will be presented in the next subsections - the fixed effect model and random effects model.

4.2.2 FIXED EFFECTS MODEL

The fixed effects (FE) model accounts for individual specific effects or unobserved effects α_i, among various countries in the study sample which affects the dependent variable, real GDP per capita. In the fixed effects model, unobserved effects α_i are assumed to be correlated with the dependent variables x_{it}. This helps to obtain estimates that are not influenced by entity-specific factors. This was deployed in Miller & Upadhyay (2002).

There are many methods for estimating fixed effects model namely (a) Dummy variable regression (b) First Differencing Estimator (b) within estimator (c) between effects transformation. The accuracy of estimation or application of these methods is based on certain key assumptions.

Dummy Variable Regression: This is the traditional approach for fixed effects estimation. It is also known as the least squares dummy variables (LSDV) method. This method puts in a dummy variable for each cross-sectional observation (or time period). The method assumes that unobserved effects a_i, are parameters to be estimated, say for each country i.

Sometimes, estimating using this method would result in many explanatory variables and sometimes not practicable for estimating panel data sets with many cross-sectional observations (Wooldridge, 2016). This is usually due to a fixed number of time periods and infinite number of groups. Parameter estimates of regressors may be consistent while coefficients of group effect are inconsistent (Baltagi, 2013).

First Differencing Estimator: This method involves subtracting each observation equation from the previous to remove unobserved entity-specific effects. Then the OLS is deployed to estimate parameters of the differenced equation across different observations and time periods. In estimating for more than two time periods, pooled OLS is deployed on the differenced data, causing a loss of the first time period to differencing. However, in addition to other assumptions such as strict exogeneity of explanatory variables, this method also assumes that there is homoskedasticity and that idiosyncratic errors are serially uncorrelated (Wooldridge, 2010).

Fixed Effects or Within Estimator: Another method for estimating fixed effect model is known as the fixed effects transformation or within transformation. This method removes unobserved effects and time-invariant differences among entities in a panel data before estimation (Wooldridge, 2010). Individual time averages (in the context of this study these are time averages for each country) are subtracted from the corresponding variable. This method removes the unobserved effect $\alpha_{i,}$ making it possible to estimate above using the pooled OLS. Thus, applying the pooled OLS to estimate time-demeaned variables is referred to as fixed effect estimator or within estimator because it deploys the time variation in both dependent and explanatory variables within each cross-sectional observation.

This method strictly assumes that explanatory variables are exogenous. Another assumption of this method is that errors u_{it}, should be homoscedastic and uncorrelated across time.

Between Effects Estimator: This method uses the time averages for both dependent and explanatory variables to run a cross-sectional regression. It is not popular since it produces biased

results if fixed effects α_i, is correlated with explanatory variables, x_i. It is thus recommended to estimate using random effects if this condition is not met.

4.2.3 RANDOM EFFECT MODEL

On the other hand, a random effect model or error component model is based on the assumption that individual specific effect is uncorrelated with any explanatory variable (Greene, 2018). It estimates error variance specific to countries or time periods. Thus, the individual effect (country or time) is a component of the composite error term. Across country, the intercept and slopes of independent variables remains the same. The differences among countries or time periods is measured not by their intercept but by their individual specific errors.

$$Cov(\alpha_i, X_{it}) = 0.$$

For random effects, it is ideal to retain all the assumptions of fixed effects model and also include the assumption that unobserved effect a_i, is independent of all explanatory variables in all time periods (Wooldridge, 2010). Consider the unobserved model equation below:

$$y_{it} = \beta_0 + \beta_1 X_{it1} + \ldots + \beta_k X_{itK} + \alpha_i + u_{it} \quad \ldots. \quad t = 1, 2, \ldots T$$

the inclusion of an intercept is to aid the assumption that the unobserved effect has zero mean. Time dummies are also allowed among the independent variables. Then a composite error term V_{it} is incorporated, which is a combination of individual-specific effect a_i and the error term u_{it}, such that

$$Vit = \alpha_i + u_{it}$$

The composite error V_{it} is serially correlated across time due to the presence of α_i and the GLS is usually applied to correct the problem of serial correlation. While the fixed effects estimator subtracts time averages from the corresponding variable, the random effects merely subtracts a fraction of that time average, leaving a quasi-demeaned data on each variable (Wooldridge, 2010). It also captures the variance in unobserved individual-specific characteristics that might be correlated with the explanatory variables, and incorporates same into model estimation. This helps to achieve more efficient estimates provided that all assumptions are valid.

Then the pooled OLS regression is used for estimation. This allows for the inclusion of explanatory variables that are constant over time. This is because of the assumption that the unobserved effect

is not correlated with explanatory variables whether or not they are fixed over time. Thus, the RE model helps to capture other factors that contribute to the variation in the independent variable which are constant over time.

A random effect model can be estimated using generalised least squares (GLS) or the feasible generalised least squares (FGLS) method. The GLS method is deployed for the estimation if the covariance structure, Σ is known while the FGLS is used for estimation when Σ is unknown. However, since Σ is usually unknown, the FGLS is more popular.

4.2.4 HAUSMAN (1978) TEST

The Hausman test is one of the statistical tools which guides the choice between fixed effect and random effect model. A major consideration is whether individual specific effects α_i, are correlated with the explanatory variables x_{it} (Wooldridge, 2010). If these are uncorrelated, both the RE and FE estimators are consistent, while if they are not only the FE estimator is consistent. Hence, if the individual effects are uncorrelated with the error term, the RE specification would be preferable since it will be more efficient (it assumes the uncorrelatedness and hence uses more information than the FE estimator. If however the individual effects are correlated with the error term the FE estimator should be preferred since in this case, unlike the RE estimator, it is still consistent.

H_0 (Random effect model): α_i is not correlated with the explanatory variables x_{it}

H_1 (Fixed effect model): α_i is correlated with the explanatory variables x_{it}

The null hypothesis is rejected when the p-value is less than 5%. Ideally, if Hausman tests is rejected, it is taken to imply that key random effects assumption is false and then the fixed effects estimates are used (Wooldridge, 2010). So many computing software packages are commonly used to compute these tests in order to decide which model to adopt.

4.3 EMPIRICAL MODEL

In line with the objectives of this research, the following empirical model is employed in estimation of the panel data regression model.

$$RGDP\_PC = \beta_0 + \beta_1 COM\_PCTEXP_{it} + \beta_2 HL\_PCTEXP_{it} + \beta_3 HC + \beta_4 TFP_{it} + \beta_5 GOVTSTAB_{it} + \beta_6 CORR_{it} + \beta_7 LAWORDER + \mu_i + \varepsilon_{it}$$

Where u_i represents unobserved heterogeneity across the countries

ε_{it} represents the error term across each country over time.

The definition of the variables, measurement and data sources have earlier provided (see Table 4.2).

4.4 EMPIRICAL ANALYSIS

This section deals with the initial data analysis. It commences with diagnostic tests to understand the nature of the data as well as selection of appropriate model for meaningful analysis.

4.4.1 PANEL TESTS

The panel data is subjected to some diagnostic tests in order to identify and address potential problems in the data set, as well select to enable the selection of the most appropriate modelling approach. Thus, based on the Lagrange Multiplier (LM) Tests for panel models in the plm package, table 4.3 below shows the panel tests and results.

TABLE 4.3 DIAGNOSTIC TEST RESULTS

SN	TEST	STATISTICS	p-value
1	Tests for Two-Ways Effects To examine the joint significance of individual-specific and time-specific effects on the model, the Langrange Multiplier Tests was applied. As proposed by different authors, 4 different tests were done:		
i	The Gourieroux, Holly, and Monfort (GHM) Test	3985.10	0.00
ii	The Honda Test	45.43	0.00
iii	The Breusch-Pagan (BP) Test	3985.10	0.00
iv	King and Wu (Kw) Test	34.52	0.00
2i	Unobserved Individual Effects The Wooldridge's test for unobserved individual effects was applied to the panel data to test for the presence of individual-specific effects in the model.	3.03	0.00
ii	Unobserved Time Effects The Wooldridge's test for unobserved time effects was applied to test for unobserved time-specific effects in the model.	1.13	0.26
3	Tests for Individual Effects The model was tested for individual effects using the Honda, Breusch-Pagan (BP) and King and Wu(KW) tests. These tests were all found to be significant. This implies that there is the presence of individual-specific effects which affects the dependent variable other than those specified in the model.		
I	The Honda Test:	63.12	0.00
ii	The Breusch-Pagan (BP)Test	3983.9	0.00
iii	The King and Wu (KW)Test	63.12	0.00
4	Test for Time Effects		
i	The Honda Test:	1.134	0.13
ii	The Breusch-Pagan (BP) Test	1.29	0.26
iii	The King and Wu (KW) Test	1.13	0.13
5	Hausman Test (Phtest)		
i	Chi-square method	25.44	0.00
ii	Auxiliary method	259.11	0.00

Table 4.3 shows results of various tests for two-ways effects, time effects and individual effects. The first set of tests for joint significance of both effects are significant. This indicates that the model specification needs panel type of effects and hence the poolability is rejected.

Then the time and individual effects are tested separately. All the tests for unobserved time effects are insignificant, while those for individual effects are highly significant. Thus, the battery of tests suggests that there are individual (i.e., country) effects, but not time effects. The final issue to resolve is the nature of these individual effects. For this, a Hausman test employing the specification suggested by the above tests (i.e. one that only contains individual effects) is conducted.

The Hausman test establishes that the correct specification for the individual effects is that of a fixed effects model. Both the chi-square (25.44) and the auxiliary test (259.11) have p-values less than 0.05 which suggests that the fixed effects model is preferred.

4.5 RESULTS OF ANALYSIS

This subsection presents results of preliminary findings and discussions in line with the underpinning theory.

TABLE 4.4 MODEL ESTIMATION RESULTS

Variable	Coefficient	Standard Error	p-value
COM_PCTEXP	1083.77	277.70	0.00
HL_PCTEXP	494.87	52.15	0.00
HC	24272.32	1019.78	0.00
TFP	21538.57	1301.56	0.00
GOVTSTAB	202.565	75.14	0.00
CORR	-422.05	201.29	0.04
LAWORDER	444.10	242.69	0.07
R-squared (R^2)	0.63		
Adjusted R-squared	0.60		

4.6 DISCUSSION OF FINDINGS

Table 4.4 shows the regression result of the relationship between real GDP per capita and seven (7) independent variables used in this study. The fixed effect model is considered most appropriate for the study since the result of the Hausman (1978) shows that the p-value is less than 5%, thus the null hypothesis is rejected. The results of the analysis show that all the variables except corruption, are positively related to economic growth. Notably, the coefficient of "law and order" is of marginal significance, with a p-value of 0.07. This implies that it is significance at 90% confidence level but falls short of the 95% level.

The coefficient of communication expenditure (COM_PCTEXP) shares positive and significant association with growth. Theoretical support for this relationship is found in the endogenous growth literatures on knowledge spillovers, entrepreneurship and innovation (Lucas, 1988; Romer, 1990). It includes spending on major infrastructure that facilitates connectivity and exchange of information within a country (Hulten, 1996). Information technology fosters knowledge diffusion and productivity. Thus, as a major infrastructure expenditure, it is considered as an input to private production, which has the potential of boosting growth (Barro, 1990). Little wonder it is classified as productive expenditure (Kneller et al., 1999).

Like this study, there are other empirical evidences in support of the positive relationship between infrastructure expenditure and growth. Easterly & Rebelo (1993) reports that expenditures on transport and communications strongly enhances economic growth. Another evidence of a positive relationship between infrastructure expenditure and growth is found in Easterly and Levine (1997). The authors found a positive association between telephone per worker and economic growth. Similarly, Esfahani & Ramirez (1999) documents that investment in infrastructure play a very crucial and significant role in driving growth. For countries to remain on the growth trajectory, De Long & Summers (1991) specifically recommends public spending on infrastructure, although Hulten (1996) advises that the efficiency of infrastructure is dependent on the development level of countries.

Regardless of the above evidences of positive relationship from cross-country studies, there may be contradictory evidences from developing studies. For instance, Devarajan et al. (1996) found that transport and communication expenditure is negatively correlated with growth. They explained that developing countries may be over spending on infrastructure projects at the detriment of recurrent expenditures. In another study, also Bose et al. (2007) found that expenditure on transport and communication is not significantly related to economic growth.

In a similar vein, the coefficient of public health expenditures (HL_PCTEXP) is positive and significant is consistent with economic theories. Earnings are significantly related to emotional and physical health (Becker & Tomes, 1986), while a person's stock of health determines the total time period of earnings (Grossman, 1972). The association between health outcomes and economic growth is mainly explained through improvement in productivity of labour force. First, government spending on health improves the productivity of the working population thereby

improving economic growth (Strauss & Thomas, 1998; Jack, 1999). Secondly, improved health outcomes such as low mortality and fertility rates, translates to increased working population (Bloom & Canning, 2000). Thirdly, increased health outcomes bring about incentives for further investment in education and skills acquisition (Barro, 1996; Bloom & Canning, 2000).

The finding of this study is consistent with Beraldo et al. (2009) and Cooray (2009) which report a positive and robust relationship between health expenditures and economic growth. This confirms the need for nations to continue to invest in their health systems in order to achieve their growth goals. Nevertheless, there is a possibility that healthcare spending rises with higher income ((Easterly & Rebelo, 1993; Pritchett & Summers, 1996). This is further confirmed by a bidirectional causality between the two variables reported by Pradhan (2010). Other empirical findings on this relationship resulted in either negative or insignificant relationship (Churchill, et al., 2015; Devarajan et al., 1996; Kelly, 1997).

The positive coefficient of human capital (HC) variable is consistent with the endogenous growth models (Barro, 1990; Becker, 1994; Cortright, 2001; Grossman & Helpman, 1991; Lucas, 1988; Romer, 1990). As an input into the R&D, human capital supports generation of new products and ideas that trigger invention of technological products (Romer, 1990) and enhances productivity of both labour and capital (Lucas, 1988). Abundant empirical evidence supporting this relationship can be found in the literature including (Barro, 1991; Mankiw et al., 1992; Glaeser et al., 2004; Hanushek, 2013; Kostov & Gallo, 2018). Likewise, Becker (1994) provided a comprehensive explanation of how investing in education and skill acquisition contributes to the accumulation of human capital. Consistent with this, numerous disaggregated studies exploring the impact of education expenditure on economic growth have identified a positive and significant relationship between these variables (Nijkamp & Poot, 2004). Even, Acosta-Ormaechea & Morozumi, (2013) argues that reallocation funds in favour of education sector is likely to lead to long term growth, although their findings are at odds with those of Barro (2003). Nonetheless, if education is reduced to mere schooling or mismatches with skills acquisition, human capital can have a negative effect on economic growth (Benhabib & Spiegel, 1994; Pritchett, 2001). This highlights importance of incorporating measures of educational quality (Hanushek, 2013) in order to fully capture the latent factor that contributes to the human capital stock (Kostov & Gallo, 2018).

The positive and significant coefficient of total factor productivity (TFP) at 5% level of significance aligns with endogenous growth models proposed by Schumpeter, formalised by Aghion & Howitt (1992), and further elaborated by Grossman & Helpman (1993). These models emphasise how innovation and entrepreneurship drive long term growth by creating new products and technologies. The finding of this study corroborate many empirical evidences which highlight the increasing returns to growth associated with technological innovation and diffusion (Barro & Sala-i-Martin, 1995; Benhabib & Spiegel, 1994; Easterly & Levine, 2001; Klenow & Rodríguez-Clare, 1997; Miller & Upadhyay, 2002).

As expected, the coefficient for government stability (GOVTSTAB) shares positive association with economic growth, given the potential negative impact of government stability on private investment and property rights protection (Barro, 1991). Government stability plays a critical role in reducing the risks of expropriation, contract repudiation and safeguarding property rights, all of which influence economic growth (Keefer & Knack, 1997). This viewpoint is supported by many research works (Alesina et al., 1996; Feng, 1997; Gani, 2011; Londregan & Poole, 1990; Sidek & Asutay, 2020). In contrast, studies such as Easterly & Rebelo (1993) and Glaeser et al. (2004) have reported that government instability does not share a significant relationship with growth.

The coefficient of corruption (CORR) is not only statistically significant but also negatively associated with economic growth. This aligns with the established view that corruption, defined as the sale of government property for private gain, tax evasion, abuse of power, and misuse of resources has adverse effects on governance and economic growth (Aidt, 2009; Dzhumashev, 2014; Jain, 2001; Mauro, 1995; Rose-Ackerman, 1999; World Bank, 2020). Research indicates that corruption hampers private investment (Mauro, 1995), worsens income inequality (Gupta et al., 2002) and hinders economic growth. While Dzhumashev (2014) suggest a potential link between increased government expenditure and higher corruption rates, Aidt (2009) argue that economic growth can even heighten rent-seeking activities.

The coefficient for law and order (LAWORDER) is positive but does not attain statistical significance at the 5% level of significance (p-value =0.06). The study’s findings indicate that the quality of the judicial system and compliance with the law do not have a substantial impact on economic growth. This result is in line with Gani's (2011) findings that the rule of law lacks a significant relationship with growth. This can be attributed to underdeveloped legal systems and poor rule enforcement. In contrast, Barro (1996) places significance on the maintenance of the rule of law for fostering economic growth.

4.7 CHAPTER SUMMARY

This chapter has provided information of data sources and construction as well as methodology for empirical analysis for this research work. Fiscal data of central governments which cover a total of 67 countries from 1984 to 2017 were deployed for the analysis. Data were sourced from three main secondary sources and constructed into one dataset for the purpose of this research. The data collected is central government data. In order to evaluate the effects of government spending and institutional environment on economic growth, the public expenditure variable deployed for this research is public expenditure as proportion of total expenditure. This is different from most existing empirical literature in this field which uses government expenditure compositions as a percentage of GDP. Thus, it will help to compare and contrast the results of this study with existing literature.

Overall, preliminary findings reveal that public spending in these sectors has a stimulating effect on economic growth. Furthermore, the study confirms the significance of government stability and the detrimental effect of corruption on economic growth. Specifically, government stability is found to be conducive to economic growth, while corruption deters it. However, it is worth noting that the relationship between law and order and economic growth, while suggestive, only reaches marginal significance with a p-value of 0.06 at the 5% level of significance. Although this suggests a potential connection, it does not meet the conventional threshold for statistical significance. Thus, there is underscores the need for further analysis into the statistical relationship between these factors. In many empirical analyses, the preliminary regression presented is the ultimate result of such studies, with any further refinements deferred as future work. Here however, this is used simply as a starting point for further analysis. The fact that the above results largely agree with theoretical expectations and previous empirical findings does not necessary provide an iron-clad guarantee that these are reliable. In order to ensure that we use the above specification as an empirical blueprint, but dig deeper to address any potential shortcomings in this model. We do this in a consequential manner, discussing and addressing potential shortcomings. While this process is highly logical and easy to follow, the next chapter presents the diverse methodologies employed in this process, followed by an exposition of this modelling process in the subsequent chapter.

CHAPTER FIVE

METHODOLOGY

5.0 INTRODUCTION

This chapter contains detailed econometric procedures to be employed for further analysis in a sequential order. It also presents in detail, the explanations and justifications for procedures adopted in the study. In a way, this is a departure from established practices, since the previous chapter already included some element of methodology. It is nevertheless useful to separate the initial analysis (and its associated methods) from the main flow of analytical treatment. One may consider the analysis in the previous chapters as simply establishing a starting point, an initial empirical and conceptual model, upon which to improve. Therefore, the initial analysis is viewed hereafter similarly to 'data'.

The present chapter outlines the methodological tools used to investigate and further interrogate this preliminary empirical model. The logic and the need to introduce these particular methodologies is elaborated and fully explained in the next chapter. Yet where appropriate, this chapter briefly explains the rationale for such methods, something that will be further elaborated in chapter six.

The chapter begins with the explanation of philosophical assumptions that informed research methodology (5.1). This is followed by the explanation and presentation of normality tests (5.2). This is followed by endogeneity tests (5.3) and methods employed for endogeneity corrections (5.4). Section 5.5 presents models for analysing nonlinear effects in the model using the Random Effects Within Between (REWB) model and the Splines modelling. Subsequently, the study would employ the unconditional quantile regression (UQR) method in order to capture any heterogeneity of effects in the model (5.6.2). Lastly, the summary of methodological approach to be adopted is presented in section 5.7.

5.1 RESEARCH PHILOSOPHY

Understanding the philosophical assumptions that underpin research methodology is essential for shaping the direction of research and evaluating findings (Bryman, 2016; Creswell & Poth, 2017; Leavy, 2017). The choice of an appropriate paradigm and understanding its methodological implications significantly influences the entire research activity process – from methodology and methods to findings (Bryman, 2016; Leavy, 2017). It also sheds light on potential constraints that may affect the research (Easterby-Smith et al., 2001).

Research paradigms comprise beliefs and principles recognised over time, influencing research from inception to conclusion and the interpretation of findings across all fields (Bryman, 2003; Crotty, 1998; Saunders et al., 2015). Stating the approaches and philosophical principles upon which the research is founded is an important ingredient of good research practice. This section discusses the approaches and philosophical positions for this study.

Firstly, it is recognised that attempts to provide solutions to social concerns often rely on existing theories, hypotheses, and certain a priori expectations, shaping researchers' selection of research paradigms (Crano et al., 2014). The decision on how to approach research mainly depends on the relationship between theory and research (Bryman, 2016). Two key research approaches exist – deductive and inductive. While the former explicitly states the theory backing up the research and develops hypotheses to test it, the latter considers theory as an outcome of the research, wherein findings lead to the formulation of theory. Thus, the deductive approach, commonly employed in quantitative research, involves establishing research on a pre-existing theory, which aligns with the present study underpinned by the endogenous growth theory.

Regarding philosophical paradigms for this study, the discussion revolves around two dominant paradigms: epistemology and ontology. Epistemology concerns how research is conducted and what constitutes acceptable knowledge within a discipline (Phillips & Burbules, 2000; Creswell, 2014; Bryman, 2016; Leavy, 2017), encompassing theories of knowledge and justifications (Audi, 2004). Key positions in epistemology include positivism (post-positivism), interpretivism, and realism (Bryman, 2016), each with distinct implications for research methodology.

Positivism advocates the study of social reality using methods similar to those of natural sciences, emphasising sensory confirmation to validate science and the use of quantitative research methods (Collis & Hussey, 2009; Gray, 2009; Almeida et al., 2017; Leavy, 2017; Sale et al., 2002). Post-

positivism represents a slight departure from positivism, questioning the rigidity of scientific methods and advocating for empirical testing and evidence-building (Crotty, 1998). Interpretivism holds that social phenomena differ fundamentally from those in the natural sciences, advocating for a different logic and often favoring qualitative strategies (Bryman, 2016). Realism aligns closely with positivism, asserting the existence of an external reality that can be approximated through theory and observation (Gray, 2009; Bryman, 2016).

Ontology studies the nature of reality, exploring whether social entities are objective or subjective (Bryman, 2016). It has two major views - objectivism and constructivism. Objectivism refers to a belief that reality exists independently of consciousness, prioritising precision and measurability in analysing social phenomena, and often favoring quantitative research approaches (Leavy, 2017; Almeida et al., 2017). In contrast, constructivism argues that truth is relative and dependent on individual perspectives, emphasising the role of social interaction in knowledge creation and often favoring qualitative research approaches (Bryman, 2016).

Based on the above expositions, research philosophy guides researchers' choice of strategy for data collection and analysis, broadly categorised as either quantitative or qualitative (Gelo et al., 2008; Bryman, 2016; Leavy, 2017). Quantitative research involves reducing social phenomena to numerical values and analysing them using objective means such as statistical methods, while qualitative research entails non-numerical data collection and textual analysis (Yilmaz, 2013; Bryman, 2016).

In alignment with positivism and objectivism, this study adopts a quantitative strategy, deploying statistical and econometric techniques to confirm the existence of knowledge. Acknowledging the criticisms against positivism and recognising the complexity and context-dependency of the research topic, this study aims to provide insights while remaining cognisant of subjective interpretations. This study also acknowledges criticisms against positivism and recognises the complexity and context-dependency of the research topic. It aims to provide insights while being mindful of subjective interpretations especially as it relates to institutional environment measures.

5.1.1 RESEARCH DESIGN

As noted from the previous section, the topic of this research aligns with positivism and objectivism research paradigms. This implies that quantitative (deductive) research approaches will be most suitable to investigate the effects of public expenditure, institutional environment and economic growth.

Most empirical studies relating to this research also deployed quantitative methods to evaluate relationships (Bose et al, 2007; Kelly, 2007; Gemmell et al, 2016; Chu et al, 2020; Okunlola et al, 2024). In alignment with this, this research will deploy econometric techniques for analysis of data.

5.2 NORMALITY TESTS

Econometric methods often rely on the critical assumption of Gaussian data. The most common application of normality tests is related to the classical linear regression model, which assumes Gaussian distribution for the residuals. Therefore, normality tests on the residuals from regression models is a common specification diagnostic. Here however, we consider a totally different application of normality testing, namely testing the raw data for normality. In standard econometric analysis there is usually nothing that requires the raw data to come from any pre-specified statistical distribution. It is usually only the conditional distribution of the dependent variables (i.e. the residuals from the regression model) which may be consistent with some statistical distribution. Yet some of the methods that are employed in the further analysis do impose some distributional requirements on the raw data.

Therefore, it imperative to study the distributional nature of research data since some analyses, particularly those addressing endogeneity, require non-normality. As a preliminary step, the data for this research undergoes an assessment for distribution normality. This evaluation is essential to ensure the suitability of the data for the planned econometric analyses. In this case, the study will employ the higher order least squares (HOLS) method and Gaussian copula method, which we discuss further below. The (non-) Gaussianity of certain variables in the modelling specification is a pre-requisite for the applicability of these methods and therefore this needs to be established. While HOLS requires non-Gaussianity of the dependent variable (Schultheiss et al., 2023), the Gaussian copula method requires that the suspected endogenous variables follow non-Gaussian distribution (Park & Gupta, 2012; Becker et al., 2022).

To assess the distribution patterns of the research data, both parametric and non-parametric normality distribution checks were applied. The parametric Shapiro-Wilk (SW) test was applied to determine the distribution of the endogenous variables (Papies et al., 2017). This test is highly sensitive, capable of detecting the slightest deviation from normality (Cortina and Dunlap, 1997; Becker et al, 2022). On the grounds of its high sensitivity, it is recommended that the SW test be complemented with other normality check tests to ensure robust assessment (Becker et al, 2022). The study will use the Kolmogorov-Smirnov (KS) test to further confirm the distribution pattern of the data. It is a non-parametric test which is also employed to verify the nature of the distribution of the data. Specifically, the KS test observes whether there is a significant difference between observed frequency distribution and a theoretical frequency (in this case Gaussian) distribution. With values ranging from 0 to 1, the KS statistics, D, indicates the maximum absolute difference between the cumulative distribution function (CDF) and that of the expected normal distribution of the sample data. It is considered most suitable for larger distribution samples where observations are more i.e. $n > 50$.

For both tests, at 5% significance level, the null hypothesis that the values are from a normal distribution is accepted if $p > 0.05$, otherwise it is rejected.

5.3 ENDOGENEITY TEST USING THE HIGHER ORDER LEAST SQUARES (HOLS)

Endogeneity arises when one or more explanatory variables are correlated with the error term, leading to biased, inaccurate, and inconsistent parameter estimates (Wooldridge, 2010). It is often caused by sample selection measurement errors, bidirectional causality and omitted variable bias (Hill et al., 2020). When an important variable is omitted from a model, it amounts to misspecification of the model which often leads to estimation bias. This is often caused by unavailability of data, especially for unobservable variables. This bias often occurs when the omitted variable affects the dependent variable and also correlates with one or more of the independent variables (Wooldridge, 2010). Depending on the correlation between the omitted and included variables, the bias may also impact coefficients of other variables in the model. This amounts to endogeneity, and estimation with the ordinary least squares (OLS) produces inconsistent, inaccurate and biased results, undermining the reliability of inferences.

Omitted variables can introduce confoundedness in a model, contributing to endogeneity (Schultheiss et al., 2023). Confounding refers to a situation when the relationship between independent and the dependent variables is mixed up with the influence of a third variable i.e. the confounding variable. As Hill et al (2020) captures it, correlation of the omitted variable with the error term introduces bias in the dependent variable. Thus, confounding can result in a type of omitted variables bias, a common cause of endogeneity. Therefore, one might use these terms interchangeably. Additionally, endogeneity can also arise from mutual causation, a factor not addressed by the omission of variables.

One effective method of detecting omitted confoundedness in a model is by applying the higher order least squares (HOLS) technique. Introduced by Schultheiss et al. (2023), the technique handles endogeneity based on residuals from the OLS in linear equations.

If we denote the dependent variable vector as y and the covariates matrix as X, the HOLS uses a regression of Xy on XX (instead of a regression of y on X as in the OLS). If the regression model is correctly specified then the regressions should be asymptotically equivalent.

The authors used univariate and multivariate analysis to demonstrate that when there are hidden confounders in an estimation, coefficients of HOLS deviate from those in the OLS. The OLS assumes that the distribution of the regression model is normal. Thus, its efficiency depends among other things, on the correctness of the specified model. While the efficiency of the OLS relies only on the first two moments, the HOLS incorporates information from higher order moments. Thus, in a correct specification of a model with Gaussian errors, the HOLS is expected to be asymptotically equivalent to the OLS estimator. Any difference between the estimations of the two methods, would be an indication that the HOLS is superior, which is likely due to the inclusion of the higher moments and further highlighting the biasedness of the OLS. It is important to note that the HOLS test can be considered a general misspecification test which simply reveals whether or not the model is correct. The technique not only detects deviations from the ordinary least squares, but also identifies specific covariates which may be potentially unreliable in the model. The HOLS test is similar to the reweighting of data to detect model misspecifications described in Buja et al. (2019). It can also be applied to detect deviations due to residual prediction (Shah & Bühlmann, 2018). Since the model is assumed functionally correct in form and specification, then the HOLS will be applied to check for endogeneity, possibly from omitted variable bias.

5.4 ADDRESSING ENDOGENEITY CONCERNS

In this stage, the research will rely on the recommendation of the HOLS to conduct further statistical assessments on potentially endogenous variable(s). While endogeneity issues are popularly addressed using suitable proxy or instrumental variables (Wooldridge, 2010; Eckert & Hohberger, 2023), firstly, I will consider an instrument-free approach to detecting and handling endogeneity. This is due to the difficulties associated with obtaining a valid instrument (Conley et al., 2012; Rossi, 2014; Eckert & Hohberger, 2023). Finding a good instrument is a complex task which must satisfy two key requirements: it must be correlated with the endogenous regressor(s) in a clear and validated manner and it must not be correlated with the error term, referred to as the exogeneity requirement. Testing these assumptions is usually quite tasking and time-consuming. Its incorrect execution may result in biased results, leading to wrong inferences (Park and Gupta, 2012; Eckert and Hohberger, 2023).

Failure to meet the requirements for instrumental variables (IV), the method may be ineffective in addressing endogeneity, even in large samples, if the instruments are weak or invalid (Wooldridge, 2010; Park and Gupta, 2012). Weak instrumentation refers to a situation where instruments are not sufficiently correlated with the endogenous regressors as in the case of Angrist and Krueger (1991), producing results similar to the OLS estimate with very small significance (Staiger & Stock, 1997; J. M. Wooldridge, 2010). In order to avert the challenges associated with the IV method, I opt for the Gaussian copula method, introduced by Park and Gupta (2012). This instrument-free method optimises the log-likelihood derived from the joint bivariate distribution of the endogenous regressors and the structural error term.

5.4.1 Gaussian Copula Method

The Gaussian copula (GC) method addresses the limitations of assuming specific joint distributions for variables, providing flexibility in variable distribution by utilising copulas. This flexibility enables wider range of correlations between endogenous regressors and the error term, thus overcoming the restrictions imposed by traditional joint distributions (Park and Gupta, 2012; Eckert and Hohberger, 2023). The method is suitable in the case of weak instruments or when exogeneity is uncertain, in non-linear models, and in cases of endogeneity of multiple regressors (Park and Gupta, 2012).

In simple terms, copula correction can be viewed as a control function, which uses Gaussian copulas instead of control variables to correct for endogeneity. The validity of this approach rests on the crucial assumption that the endogenous variables are not normally distributed, and in the case of continuous endogenous variables (as in this study), it is preferable that they follow some type of skewed distribution. However, non-normality of the continuous endogenous variables is a necessary, but not sufficient condition for applicability of the method. The underlying idea is that the marginal distribution for the error term (which is given by the statistical model estimated, typically a conditional Gaussian) can be complemented by assuming marginal distribution(s) for the endogenous variable(s). Then copula specification can be used to specify a flexible multivariate joint distribution of the error term and the endogenous variables, given the covariates. This specification allows for a very wide range of possible correlations between the marginals.

To apply the Gaussian copula method, firstly, marginal distributions of the endogenous regressors and the error term are obtained using observed data. Then, flexible multivariate distributions are derived using the copula, thus enabling a wider range of correlations between the marginals. In place of control variables, the method applies Gaussian copulas, thus allowing for modelling of the joint distribution variables so as to capture both marginal distributions and the dependence structure. In standard regression model, the conditional distribution of the residuals is Gaussian. Modelling the dependence between a potentially endogenous variables and the residuals using a copula, implies combining a Gaussian marginal of the residuals via a copula structure. Instead of assuming multivariate Gaussian distribution as in the standard model, the Gaussian copula which allows for Gaussian marginals, is a natural choice.

The joint multivariate distribution includes an additional term which represents the correlations between the error term and endogenous variables. This term acts as a control function and helps to correct the effect of endogeneity on the estimation.

The effective application of the Gaussian copula method depends on the following assumptions:

i. The distribution of the endogenous regressors should be highly non-normal: If the departure from normality is relatively small, it increases the correlation between exogenous and endogenous regressors, which leads to multicollinearity issues and poor identification of parameter estimates. Failure of this assumption also increases standard errors, which might lead to conclusion of insignificant relationship.

ii. The distribution of the model error term should be normal: This is a standard assumption of the classical regression model which can be detected through a standard model diagnostic. Violation of this assumption poses a problem to the model irrespective of whether there is endogeneity or not. This assumption is impossible to test and justify apriori (Eckert & Hohberger, 2023), but is standard regression diagnostic after the model estimation
iii. The dependency structure between the distribution of endogenous regressors and the error term, as defined by the Gaussian copula, must be clearly understood and this can be tested.

For applicability of the Gaussian copula in handling endogeneity issues, it is critical to ensure compliance with the assumptions, otherwise non-detection of significant relationships may result. To enable proper identification, it is critical to ensure sufficient distinction between the distribution of endogenous variables and that of the error term (Park & Gupta, 2012; Eckert & Hohberger, 2023).

The Gaussian copula estimation requires that endogenous variables be non-Gaussian (Park & Gupta, 2012; Kostov et al., 2020; Eckert & Hohberger, 2023). Thus, normality tests will be conducted for all the variables instead of isolating the endogenous ones.

5.4.2 Instrumenting with Lags of Endogenous Variables

The use of lagged values of dependent variables as instrumental variables is widely accepted in the literature provided that they meet the basic requirement of a good instrument (Greene, 2011). To ensure that endogeneity issues are properly handled, this study explores the use of lagged values of 'unreliable' variables as instruments. This practice rests on the argument that lagged variables precede the endogenous variable in time, and that the lagged variable causes the endogenous variable (Wang and Bellemare, 2019). Provided that a lagged variable does not have any direct causal effect on either the dependent variable nor on the unobserved confounder, it reduces endogeneity problem through reduction of bias as well as root mean squared errors (Reed, 2015; Wang & Bellemare, 2019).

5.5 INTERACTION EFFECTS

Interaction effects denote the joint impact of two or more variables on the dependent variable (Balli & Sørensen, 2013).Within the same model, effects of a variable on the dependent variable, may be influenced by the values of another variable. Understandably, combined effects of two independent variables may alter their individual effects on the dependent variable (Balli and Sorenson, 2012). Prior the interaction tests, the within-between model (WBM) from the panelr package in R statistics was employed for the estimation of the model. It estimates the FE model through the within-transformation, thereby replicating the Fixed effects (FE) model.

Thus, in order to effectively handle endogeneity problems, the control function approach (CFA) is employed. It allows for inclusion of both endogenous variable as well as an appropriate control function variable, *pstar.variable. Conditional on the first stage regression, the approach allows for the inclusion of residuals captured in the original regression equation in order to obtain consistent estimations of regressions (Wooldridge, 2015). This approach is similar to the two stage least squares (SLS) method of correcting for endogeneity which incorporates fitted values in the second stage. In this case however, the control function variable, pstar.tfp included as an additional variable in the equation, retained alongside the original endogenous variable helps to make the model exogenous after the second stage of the regression (Greene, 2011; Wooldridge, 2015). Thus, the pstar.tfp is included in the further model specifications in order to control for endogeneity. This additional 'control' variable, although it has no direct interpretation, will be reported in all further results, since its statistical significance indicates that the endogeneity correction is significant and therefore the corresponding estimation results are corrected for endogeneity due to total factor productivity.

Estimation of interaction effects creates issues for the FE model since within, differencing and other transformations, routinely used, do not remove the fixed effects (Giesselmann & Schmidt-Catran, 2020). Recall that the fixed effects model accounts for unobserved heterogeneity i.e. individual-specific effects among various countries in the study sample which may introduce bias in the estimation since they are correlated with dependent variables (Wooldridge, 2010; Baltagi, 2013). In linear models, these effects are usually handled by the introduction of transformations such as the dummy variable regression, first differencing, within estimator, and between effects transformation (Wooldridge, 2010). These transformations are targeted at removing all unit-

specific characteristics, both observable and unobservable in order to produce reliable estimates (Allison, 2009; Wooldridge, 2010). The standard FE model would also regard interaction terms as any other variable and demean it. Regrettably, this demeaning does not result in the within estimator of the interaction term (Giesselmann & Schmidt-Catran, 2000). While the parameters for the main variables may use within-country differences, the parameter for interaction term uses between-country differences in the effects of the independent variables. The between-unit estimation introduces correlated effect heterogeneity across countries (Giesselmann & Schmidt-Catran, 2000). Another challenge of the FE model is that while identifying interaction coefficients, the model confounds within-unit and between-unit variation, thus producing estimates devoid of desirable properties (Shaver, 2019).

Thus, in models involving interaction effects, all between-unit heterogeneity can only be successfully removed by double differencing, which implies the demeaning the products of demeaned variables (Giesselmann and Schmidt-Catran, 2020). The panelr package in R statistics software was employed for a more reliable estimation of interaction effects. It has a number of advantages over the plm model. Firstly, the package offers a wbm multilevel model, which provides flexibility in estimation, leveraging on the unique characteristics of the research data (Bell & Jones, 2015; Long, 2023). Secondly, by default, the package offers a within-between model estimator designed to double-demean interaction term (Giesselmann & Schmidt-Catran, 2020).

Due to the overly simplistic nature of the FE model, it does not explicitly model context and heterogeneity, rather it controls them out (Bell & Jones, 2015). This may lead to loss of important facts and biased results, and subsequently, wrong inferences (Nerlove, 2005). Thus, in lieu of the FE model, the study considers the Mundlak (1978) specification. A key advantage of this choice is its flexibility to account for mixed effects, i.e. effectively capturing the between and within estimate. Yang (2022) demonstrated that correlated random effects (CRE) model derived through the Mundlak model is equivalent to the FE estimates in a one-way panel (Bell and Jones, 2015; Yang, 2022). This equivalence suggests ways to allow independent variables correlate in linear models (Wooldridge, 2019, 2021).

5.5.1 Random Effects within between (REWB) Model

Since the Mundlak's device reproduces the FE model and also accounts for additional effects, it is thus pointless to apply the fixed effects model (Bell et al, 2019; Wooldridge, 2021). Though the Mundlak's original argument applies to individual effects model (Mundlak, 1978), it can also be extended to time effects and two-way effects specification as well (Wooldridge, 2019; Wooldridge, 2021).

The FE (within effects) and the RE (mix of within and between) models are specific cases of within-between (WB) models since the WB retains the best characteristics of the two estimators (Bell et al, 2019). It is noteworthy that in panel analysis, FE can only explain deviations from the mean over time and thus, unfit to explain about relationships with independent variables which do not vary over time (Bell et al, 2019). Thus, time-invariant variables cannot be included in the FE model since they get absorbed by the fixed effects and hence cannot be efficiently estimated (Wooldridge, 2021; Baltagi, 2023) but can be included in RE specifications. The bias even worsens when the model involves interaction effects as earlier explained (Giesselmann and Schmidt-Catran, 2020).

In the present research, institutional measures i.e. CORRUPT, GOVTSTAB and LAWORDER, though not strictly time-invariant, change quite slowly over the years. For instance, FE cannot efficiently capture the effects of the interaction of health expenditures and government stability on economic growth since government stability is slow-changing. Due to over-differencing, applying the FE model for such estimation will generate high SEs, unreliable point estimates, and possibly leading to wrong inferences. The FE is thus not recommended and in fact, should be completely avoided in estimating slowly changing variables (Plümper & Troeger, 2007). Thus, this justifies the selection of the REWB specification to identify interaction effects. The second reason is that non-linear effects are generally much easier to specify and estimate in RE framework (Bell & Jones, 2015; Bell et al., 2019; Wooldridge, 2019).

5.5.2 The Smoothing Spline NonParametric Regression Model via the Generalised Additive Model (GAM)

To better capture the nonlinearity effects in the model, I consider the use of splines modelling. Splines refer to a piecewise function which enables a smooth connection of data segments when relationship within a model is considered nonlinear. They are made up of a set of polynomial functions, which are joined at certain intervals referred to as knots. Through the use of splines,

polynomials within the data set are connected to define the nonlinearity within the dataset. The higher degree of polynomials that constitute the spline, the more its strength to capture nonlinearities and complexities in relationships. This however, increases the risk of overfitting the data and with that, comes with the possibility of roughness of the spline model.

There are different types of splines depending on the number of knots contained and the placement positions within the function. Some examples of splines are cubic splines, thin plate splines, linear splines, B-splines, natural splines, random effects splines, etc, each having specific property. For instance, cubic splines are mainly composed of polynomials of degree =3 (x^3) and would likely capture nonlinear effects better than a linear spline, even though the latter may make a smoother spline. Spline fit is determined by the number of knots within the function as well as their placement within the function. However, it is complicated to choose knots location in a regression spline modelling (Hastie & Tibshirani, 1990). Therefore, the use of smoothing splines is popular in the literature as it helps to circumvent the challenge of knot placement (Wood, 2003; Maharani & Saputro, 2021). Smoothers are applied to remove rough curves by minimising the differences within the data that does not affect the main characteristics, thereby allowing the actual effect to emerge (Maharani & Saputro, 2021). The study also assumes the model to be nonparametric since the regression's curve (shape) and parameters are unknown and would be determined by the data (Mahmoud, 2019; Maharani & Saputro, 2021).

5.6 QUANTILE REGRESSION METHOD

When it is important to understand the heterogeneity of effects along the distribution of the outcome variable, quantile regression methods are the most suitable analytical tool (Borgen et al, 2022; Rodriguez-Caro et al., 2016). These methods are introduced by Koenker and Bassett (1978) as an extension of the classical least squares method, which assumes homogeneity of effects. While the least squares method allows the estimation of conditional mean models, quantile regression allows for the estimation of conditional quantile functions (Hallock & Koenker, 2001). The method considers the variations around the mean depending on the values of exogenous variables and across the distribution of the endogenous variable.

Another important reason for the choice of quantile regression method is its efficiency in estimation since it employs distributional information of the dependent variable (Zhao & Xiao, 2014). The QR method utilises every single data point for estimation at all quantiles and therefore

inadequacy of data and degrees of freedom does not present serious challenges. Thus, this study adopts this method since it has not sufficient data for nonparametric analysis.

5.6.1 Conditional *versus* Unconditional Quantile Regression: Justification for UQR

Within the quantile regression methods, two popular methods are conditional quantile regression (CQR) and the unconditional quantile regression (UQR) methods. The CQR method differs from the UQR in many different ways. This section provides justifications for the choice of UQR in the present study

Firstly, the CQR estimates the effects at various conditional quantiles, showing the effects of independent variables on the dependent variable, not just the mean, conditional to the values of the exogenous variables. This limits its interpretation to the quantiles of the conditional distribution provided by the values of covariates, making it impossible to compare individual population in the sample (Firpo et al, 2009). That is also to say, that the method only estimates the partial effects of the conditional quantiles of dependent variables given a specific value of the exogenous variable. The UQR on the other hand, produces effects on the unconditional distribution across the various quantiles of the response variable. This makes it more generalisable and easier to interpret heterogeneous distribution of outcomes since unconditional quantile values are directly observable.

Secondly, in terms of averaging up to their population, conditional quantiles are also not suitable since their estimates are generated from the median while that of the UQR is generated using the mean i.e. via the OLS. In this case, conditional means method such as the OLS even provides a more accurate representation of the distribution (Fortin et al., 2010). The third reason for preference for UQR is that it has been proven to be more effective at capturing nonlinearities than the CQR (see Firpo et al., 2009). Based on the above, this study wants to consider the UQR method for further analysis.

Furthermore, CQR and UQR are different in that they model different quantities and hence have very different interpretation. In this present specification, the UQR models the unconditional quantiles of the dependent variable, which is in this case the real per capita GDP. Hence upper (i.e. close to 1) and lower (close to zero) unconditional quantiles have the straightforward interpretation as higher and lower income countries. What is more for any specific unconditional quantile, since

the unconditional distribution of the dependent variable is directly observable, the exact value of the income can be easily calculated at any specific quantile. In CQR on the other hand, the conditional distribution of the dependent variable is modeled, i.e. conditional on the set of covariates used in the model. In this case, upper quantiles would not refer to higher income countries, but to countries, which given their characteristics (as specified in the adopted model, i.e. level of expenditure, institutional environments, openness, etc) manage to generate higher per-capita income compared to other countries with similar characteristics. In other words, in CQR of the present specification, the study would be modelling the (unobservable) earning capacity of nations. More so, while this might be an interesting question on its own, it is more difficult to interpret. Furthermore, relying upon unobservable traits makes it much more difficult to derive policy recommendation.

Finally, the dependence of CQR on the available sample makes it difficult to generalise results. For these reasons, the study opted to use the UQR model. There would be instances of analysis where one or the other form of quantile regression might be more appropriate, since they ask qualitatively different questions. It is important to note that the choice of UQR in this research and arguments do not assume one or the other model is superior in any way or form. Factors that guide choice of method based on appropriateness with the research objective was well explained in Borgen et al (2022). The next section presents a brief overview of the UQR method.

5.6.2 Unconditional Quantile Regression (UQR) Method

From the foregoing, the choice of the UQR method for this analysis is premised on its appropriateness for the present study. Firstly, the method allows for the comparison of magnitude of the effects and their variation across different quantiles of the unconditional distribution. In other words, across different quantiles, its coefficients explain the variation in relationships between predictor and response variables across quantiles of the dependent variable's distribution. Thus, for a specific quantile, estimated coefficients can be interpreted as the effect of small changes in the distribution of the independent variables on the corresponding quantile of the dependent variable.

The method uses the Recentered Influence Function (RIF) whereas the influence of an observation on a specific distributional statistic is calculated using the influence function (IF). For example,

the computation of IF for a commonly used statistic such as the mean is equal to the demeaned value. When this statistic is added back, it yields a function referred to as the Recentered Influence Function (RIF).

Mathematically represented as

$$RIF\ (y;\ q_\tau) \ = \ q_\tau + \frac{\tau - I\ [y \leq q_\tau]}{f_y\ (q_\tau)}$$

where q_τ is the value of the percentile τ, $f_y\ (q_\tau)$ is the density function in the percentile τ, I is the dichotomous variable that assumes the value of 1when the value of y is less than the corresponding percentile.

The RIF-regressions allows for detailed compositions for any distributional statistic which allows the computation of influence function (Firpo et al, 2009; Fortin et al, 2010). It is quite similar to the standard regression, except that the RIF replaces the dependent variable. The recentered influence function (RIF) is defined as

$$RIF(y;v) = v\ (FY) + IF(y;\ v)$$

which allows it to aggregate back to the statistics of interest.

Secondly, the UQR also allows for the estimation of unconditional quantile partial effects (UQPE), which represents a weighted average of the conditional quantile partial effects (CQPE). Estimates derived from the UQPE can be employed for approximation of the effect of a more general change in the distribution of covariates, on unconditional quantiles of the dependent variable (Firpo et al, 2009).

5.6.3 Estimation of the UQR (RIF-Regression)

The choice of UQR is When the RIF has been obtained, the UQR can be obtained using three alternative RIF regressions namely – the OLS, Logit and Nonparametric - NP (Firpo et al, 2009). Of the three methods, the RIF-OLS is easiest and yields a gives a valid estimate of the effect of variables on the unconditional mean of the dependent variable (Firpo et al, 2009; Fortin et al, 2010). Moreover, numerous comparative simulation studies for RIF-OLS, RIF-Logit and RIF-NP estimates show that their estimates are quite similar, with only a slight difference (Firpo et al, 2009).

Conversely, results of simulation studies reveal that there is a wide difference between CQR estimates and that of the UQR i.e. RIF-OLS. This of course is not that surprising since as discussed earlier, these two are different models in the sense that their dependent 'variables' are not directly comparable.

Firstly, simulation shows that while the CQR presented monotonic effects, the latter showed nonmonotonic, buttressing its ability to account for actual pattern of changes in the distribution of the variable (Firpo et al, 2009).

Additionally, UQR estimates are also known for very small approximation errors compared to the CQR, which supports its appropriateness for generalisation. These explanations informed the choice of UQR via RIF-OLS for estimation in this study.

5.7 CHAPTER SUMMARY

The methodology chapter provides in sequential order, detailed empirical procedures to be followed in the study. The study is based on the positivism and objectivism philosophical research paradigms. The chapter provided information on the data sources for variables including their measurements. This was followed by a detailed explanation of various techniques deployed for panel data analysis. Subsequently, a preliminary analysis to understand the relationship between public expenditure, institutional environment and economic growth. This was conducted using the fixed effects (FE) model. Preliminary results confirmed significant relationships between all explanatory variables and independent variables at 5% except for law and order variable which was significant at 10% level.

The rest of the chapter contains detailed explanation of further empirical tests required for a detailed study on the topic. The initial tests prescribed were to check for normality and endogeneity. Subsequently, endogeneity correction on the model using both instrument-free and instrumental variable were also listed.

Other analyses prescribed included searching for nonlinearity effects, such as interactions, in the model. For interaction effects, the study intends to apply both parametric and nonparametric methods, specifically the Random Effects Within Between (REWB) model and the smoothing spline regression method. Additionally, to account for possible heterogeneity of effects across different quantiles of the dependent variable, the study proposes to use unconditional quantile regression (UQR) for the final analysis.

CHAPTER SIX

EMPIRICAL ANALYSIS

6.1 INTRODUCTION

The previous chapter contains in sequence, an outline of various econometric procedures guiding this study. Subsequently, this chapter, contains detailed tests, results and interpretations of the methodological procedures carried out in the course of this study. This chapter, divided into sections, flows in the following order – Introduction (6.1), Descriptive Statistics (6.2), Normality Distribution Tests (6.3), and Endogeneity Testing and Correction (6.4). Then the study conducts analysis for nonlinear effects using the REWB and the Smoothing Spline (6.5). Finally, the study deployed the unconditional quantile regression method in order to capture heterogenous effects on the dependent variable (6.6). The last section of the chapter was the conclusion (6.7).

6.2 DESCRIPTIVE STATISTICS

The Descriptive Statistics for all variables including the including the data minimum, maximum, mean, and standard deviation are presented in Table 6.1 below.

Table 6.1 DESCRIPTIVE STATISTICS

Variable	Mean	Min	Max	SD
RGDP_PC	29,852.73	1,854.61	11,7221.53	19,580.19
COM_PCTEXP	0.11	1.00	6.00	0.42
HL_PCTEXP	11.25	1.00	22.00	4.15
HC	2.90	1.28	3.77	0.49
TFP	1.01	0.60	2.25	0.16
GOVTSTAB	8.05	3.17	11.50	1.60
CORR	3.37	0.50	6.00	1.32
LAWORDER	4.47	1.00	6.00	1.27

For the dependent variable, real GDP per capita, the table shows that while the average income per capita for all the 67 countries for the period of study stands at $29,852.73, the minimum and maximum income per capita of countries within the dataset are $1,854.61 and $117,221.53 respectively. The standard deviation of $19,580.19 shows a wide disparity of incomes across countries for the period covered by this study. This is not surprising since the dataset for the study covers both developed and developing countries. Thus, income disparity across countries over the period, 1984 to 2017 is expected.

A notable disparity exists between the minimum incomes of Qatar ($67,904.77) and Zambia ($1,727.36), indicating that Qatar's income is over 39 times higher than that of Zambia (Appendix I). Additionally, the standard deviations in income further underscore the economic disparity between the two countries. Qatar exhibits a standard deviation of $20,132.32, suggesting high dispersion in income levels over the years, whereas Zambia's standard deviation of 473.57 reflects a relatively uniform distribution across the years.

The statistics show that the average percentage of public expenditure on communication (COM_PCTEXP) is 0.11 percent of total expenditure. Minimum and maximum values stand at 1.00 and 6.00 respectively indicating a relatively low portion of expenditure in this sector. The standard deviation of 0.42 suggests a modest variability in communication expenditures among countries. The implication is that percentage spending on communication expenditure is relatively uniform among countries under review.

With a mean score of 11.25 among the range of 1 to 22 values over the period, public expenditure on health (HL_PCTEXP) indicates considerable variability among countries within the period. In other words, of the total expenditure, the least and highest spending countries appropriated 1% and 22% respectively in the health sector. The standard deviation of 4.15 implies that countries' expenditures varies considerably.

The average score for human capital (HC) index is 2.90. The minimum score is 1.28 while the maximum stands at 3.77. The standard deviation of 0.49 represents moderate range of variability within the dataset.

The mean score for total factor productivity (TFP) variable is 1.01. The minimum and maximum scores are 0.60 and 2.25 respectively. Standard deviation of 0.16 indicates that a relatively uniform score within the data set.

Scores also indicate moderate variability in the dataset across institutional environment variables. In the range of 3.17 to 11.50, the average score of government stability index (GOVTSTAB) stood at 8.05. This implies low variability across countries within the period under study. Similarly, the indicator of corruption rate (CORR) has standard deviation of 1.27. This shows that the indicator does not vary so much from the mean of 3.37 given that 0.50 and 6.0 are the minimum and maximum scores respectively.

Finally, law and order index (LAWORDER) has a mean score of 4.47, while the minimum and maximum scores stand at 1.00 and 6.00 respectively. This implies that there is a wide disparity among nations with the way people adhere to law and order. This is not surprising since countries vary in developmental stages, institutional factors are likely to follow similar trend.

6.3 NORMALITY DISTRIBUTION TESTS

As earlier detailed in the methodology (Chapter Five), the data for the study is tested for normality using parametric and non-parametric tests in order to understand the distribution pattern for the data. This will guide the selection of a suitable econometric technique for endogeneity tests and other analysis.

For simplicity, all variables are tested, although in principle, the study is only interested in the normality of the dependent variable and those suspected of endogeneity. Thus table 6.2 shows the results of normality tests.

Table 6.2 Normality Tests: Shapiro-Wilk (SW) and Kolmogorov-Smirnov (KS) Tests

SN	Variables	SW Statistics	p-values	KS Statistics (D)	p-values
1	RGDP_PC	0.92	0.00	1.00	0.00
2	COM_PCTEXP	0.04	0.00	0.50	0.00
3	HL_PCTEXP	0.94	0.00	0.85	0.00
4	HC	0.95	0.00	0.93	0.00
5	TFP	0.73	0.00	0.76	0.00
6	GOVTSTAB	0.99	0.00	1.00	0.00
7	CORR	0.94	0.00	0.92	0.00
8	LAWORDER	0.91	0.00	0.95	0.00

From the results, the Shapiro-Wilk (SW) test indicated that all the variables deviate significantly from normal distribution, with highly significant results at 5% level of significance. Similarly, statistics across all the variables also confirm that the sample is sufficiently non-normal with high values which is very significant i.e. very small p values (0.00). Both tests confirm that the data is sampled from a non-normal distribution data.

6.4. ENDOGENEITY TESTING AND CORRECTION

6.4.1 THE HIGHER ORDER LEAST SQUARES (HOLS) TECHNIQUE

The study applies the HOLS technique (Schultheiss et al, 2023) to check for endogeneity in the model, having been assumed functionally correct in form and specification. Table 6.3 shows the results of the HOLS test.

Table 6.3 Results of Higher Order Least Squares (HOLS) Test

Methods	COM_PCTEXP	HL_PCTEXP	HC	TFP	GOVTSTAB	CORR	LAWORDER
OLS coefficients	5614.15	526.44	25056.61	22501.23	198.53	-514.45	487.20
HOLS coefficients	5430.16	193.10	24890.02	16977.74	175.42	-352.16	402.54
Asymptotic HOLS test P-value	1.00	0.07	1.00	0.00	11.00	0.97	1.00
Simulated HOLS test P-value	1.00	0.06	1.00	0.00	1.00	0.97	1.00

These differences in the results of coefficients across in table 6.3 above highlights the existence of some hidden confounding factors, due to the omitted variables as detailed in Schultheiss et al, (2023). From this result, it is evident that the OLS is unfit to accurately estimate the true parameters in the analysis due to its inability to detect confounding variables.

The results of the HOLS tests indicate that the coefficients of two variables, public expenditure on health (HL_PCTEXP) and total factor productivity (TFP), are statistically unreliable and potentially these variables may be endogenous (Appendix II). It is important to note that a major limitation of the HOLS is that while it can identify unreliable variables, it does not suggest the reason for unreliability i.e. whether it is due to confounding bias or nonlinearities (Schultheiss et al, 2023). This underscores the need for further analysis in order to establish the nature of unreliability for both variables.

6.4.2 ENDOGENEITY CORRECTION USING THE GAUSSIAN COPULA TEST

For the Gaussian copula test, I have employed the Pstar* terms which uses the 'control function' approach. The pstar*** terms provide correction (for the correlation between the endogenous variable and the error term. If the corresponding pstar*** term is statistically significant, then the variable under question is indeed correlated with the error term and the significant correction term indicates that this variable is endogenous. This is less computing intensive alternative to full

Maximum Likelihood (ML) which also provides guidance of which variables can be considered endogenous and which are not.

Based on the recommendation of the HOLS, the model is respecified and re-estimated. In case of only one endogenous variable, the ML method, which is more efficient is applied. It allows for the selection of parameter values to optimise the log-likelihood function given a specific set of parameter values (Wooldridge, 2010; Greene, 2012). The respecified model is assessed for fitness to ensure that there is no deviation from the copula specification.

Provided that the basic assumptions of the Gaussian copula method are met, correction for endogeneity is deemed to be effective (Park and Gupta, 2012; Danaher and Smith, 2011; Eckert and Hohberger, 2023). Therefore, if another HOLS check identifies any variable as potentially unreliable, alternative methods for correcting endogeneity may be considered.

Table 6.4 Initial Copula Correction Estimates

Coefficients	Points Estimate	Boots SE	Lower Boots CI (95%)	Upper Boots CI (95%)
COM_PCTEXP	5046.51	1123.02	3296.59	7416.39
HL_PCTEXP	842.58	544.38	-232.86	1896.90
HC	25133.67	1627.25	22038.50	28440.12
TFP	4059.60	5163.79	-5534.71	15075.65
GOVTSTAB	199.55	87.63	25.47	368.91
CORR	-443.59	280.28	-974.75	117.96
LAWORDER	432.18	308.71	-180.45	1030.58
PSTAR.HL_PCTEXP	-246.72	405.44	-1003.06	561.20
PSTAR.TFP	1367.74	326.29	698.14	1991.01

The copula correction estimation confirms the recommendation of the HOLS that of the two variables, only total factor productivity – Pstar.TFP, appears endogenous with lower and upper bootstrap bounds bearing the same signs. Notice from the table that public health expenditure – Pstar.HL_PCTEXP, have different signs in the upper and lower boots and therefore cannot be considered endogenous. The model is then respecified, considering only TFP as the endogenous

variable and re-estimated with the ML method, which is more efficient (Table 6.5). The method allows for the selection of parameter values to optimise the log-likelihood function given a specific set of parameter values (Wooldridge, 2010; Greene, 2012).

Table 6.5 Model Estimation Result

	Point Estimate	Boots SE	Lower Boots CI (95%)	Upper Boots CI (95%)
COM_PCTEXP	5624.79	382.35	5621.66	6881.50
HL_PCTEXP	625.09	3.59	616.30	629.15
HC	25073.23	456.51	25070.45	26346.16
TFP	22552.91	659.87	22551.78	24432.50
GOVTSTAB	284.21	2.26	281.79	290.32
CORR	-463.20	48.50	-471.28	-458.17
LAWORDER	498.32	39.59	496.59	500.38

Using the VineCopula package in R-Statistics, the respecified model is assessed for fitness, in order to ensure there is no deviation from the copula specification. Table 6.6 presents results of Copula goodness of fit tests using 3 tests - the White test, Cramer-von Mises test and Kolmogorov-Smirnov test. With test statistics have p-values of 0.52, 0.32 and 0.51 respectively leading to rejection of null hypothesis and confirming that the copula specification is reliable.

Table 6.6 Tests for Copula Goodness of Fit

Goodness-of-Fit Test	Test Statistic	P-Value
White Test	41.12	0.52
Cramer-von Mises Test	0.69	0.32
Kolmogorov-Smirnov Test	1.88	0.51

Since the basic assumptions of the Gaussian copula method is met, it is believed that correction for endogeneity concerns has been properly handled in the model (Park and Gupta, 2012; Danaher and Smith, 2011; Eckert and Hohberger, 2023). However, another HOLS test on the respecified model shows consistency with the first, still pointing to the unreliability of the health expenditure

variable HL_PCTEXP (see Results in the Appendix II). This therefore underscores the need for consideration of other methods correction for endogeneity in order to understand the source of its unreliability. As a next step, the study uses lags of the two unreliable variables, HL_PCTEXP and TFP as instrumental variables.

6.4.3 INSTRUMENTING WITH LAGS OF ENDOGENOUS VARIABLES

In order to understand the endogeneity pattern, the study uses lags of 'unreliable' variables as instruments. This practice rests on the argument that lagged variables precede the endogenous variable in time, and that the lagged variable causes the endogenous variable (Wang and Bellemare, 2019). Provided that a lagged variable does not have any direct causal effect on either the dependent variable nor on the unobserved confounder, it reduces endogeneity problem through reduction of bias as well as root mean squared errors (Reed, 2015; Wang & Bellemare, 2019).
Based on the recommendation of HOLS and copula tests, lags of potentially endogenous variables are created and added to the dataset. The variables are also tested for weak instrumentation. The Wu-Hausman test statistic is applied to test the validity of the instrumental variables. The next step is to consider other nonlinear effects.

6.4.3.1 Instrumental Variables (IV) Testing

The variables are also tested for weak instrumentation. The study applies the Wu-Hausman test statistic to test the validity of the instrumental variables.

Table 6.7A Joint Instrumental Variable Tests

		df2	Statistic	p-value
Weak Instrument (HL_PCTEXP)	2	788	280.31	0.00
Weak instrument (TFP)	2	788	1539.83	0.00
Wu-Hausman	2	786	9.93	0.00

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Table 6.7B IV Test using lag of Total Factor Productivity (TFP)

	df1	df2	Statistic	p-value
Weak instrument (TFP)	1	788	3105.16	0.00
Wu-Hausman	1	787	16.48	0.00

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Table 6.7C IV Test for Lag of Government Health Expenditure

	df1	df2	Statistics	p-value
Weak instrument (HL_PCTEXP)	1	788	559.19	0.00
Wu-Hausman	1	787	1.74	0.19

Signif. codes: 0 '*' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1**

Altogether, three tests were conducted (Tables 6.7A, 6.7B and 6.7C) using the lag of HL_PCTEXP and lag of TFP. Joint tests were also conducted using lags of both variables. In general, results for weak instrumentation for the joint test show that p-values (p = 0.00), are significant for both instruments, which implies that the null of hypothesis of weak instruments should be rejected (see table 6.8A). For the joint result also, the Wu-Hausman test result of 9.93 with p-value of 0.00, suggests rejection of null hypothesis of exogeneity, thus confirming the presence of endogeneity in the model.

Results of individual IV tests are presented in tables 6.7B and 6.7C. The Wu-Hausman test for lag of TFP is 16.48 (p=0.00) while that of HL_PCTEXP is 1.74(p=0.19). This suggests the instrument for public health expenditure variable, HL_PCTEXP is not valid. Hence, it is either not endogenous or a better instrument is needed. Hence, it is concluded that only TFP is endogenous while HL_PCTEXP is not.

6.4.3.2 Model Estimate using Instrumental Variable

Results of model estimates using lagged values of instrumental variables are presented in table 6.8 below.

Table 6.8 Result of Model Estimation using Lagged Values

Variable	Coefficients	Standard Error	P value
COM_PCTEXP	5644.61	1688.21	0.00
HL_PCTEXP	531.32	139.42	0.00
HC	25074.06	1123.18	0.00
TFP	26259.14	1619.90	0.00
GOVTSTAB	150.77	82.41	0.07
CORR	-383.25	215.09	0.08
LAWORDER	360.35	262.05	0.17

The results of the estimation presented in table 6.8 show that all the economic variables are statistically significant - communication expenditure, health expenditure, human capital and total factor productivity are significant at 5% level of significant. On the contrary, all the 3 institutional variables government stability (GOVSTAB), corruption (CORR) as well as law and order (LAWORDER), have p-values of 0.07, 0.08 and 0.17 respectively. In comparison to earlier results in Table 6.5, it is evident that institutional variables lost their significance in the IV regression. Thus, there is a possibility that institutional expenditures interact with health expenditure, leading to loss of significance in their estimates.

It is evident from empirical findings that total factor productivity (TFP) is endogenous while public health expenditure, HL_PCTEXP is not. This is not surprising since it also aligns well with the endogenous theory, that growth is influenced by factors within the economy such as increased concentration of new technology (Easterly & Levine, 2001; Klenow & Rodríguez-Clare, 1997; Miller & Upadhyay, 2002). Recall that total factor productivity is a factor of growth that lies within the economy and reflected in the total output even though it is not captured as an input in the production process. Thus, growth is encouraged by total factor productivity, a factor that is within the economy. This explains its endogeneity.

On the other hand, empirical evidence shows that the health expenditure variable, HL_PCTEXP though unreliable as suggested by the HOLS, is not endogenous. Like mentioned earlier, a major limiting factor of the HOLS is that while it suggests that this variable can have confounding effect on the model, it may not reveal the nature of the effect (Schultheiss et al, 2023).

One possibility is the nonlinearity of the effect of the health expenditure. The second one is that the variable may be interacting with institutional environment variables – government stability, corruption, law and order, which may be responsible for their nonsignificance of their coefficients at 5%. Based on these findings, the study will consider non-linear effects of the variable and check for other possible interactions within the model.

6.5 INTERACTION EFFECTS

Applying the corrected estimator, two (2) models were analysed using the panelr package in R Statistics. The first analysis was based on the fixed effects specification (within), while the second was based on the Mundlak's specification. Table 6.9 presents both results. Both results are identical in terms of coefficients of variables, standard errors, t-values, degree of freedom and significance, a point made originally by Mundlak (1978).

Table 6.9 COMPARISON OF FE MODEL AND MUNDLAK SPECIFICATION

STANDARD FE MODEL				**MUNDLAK'S (1978) SPECIFICATION**			
	Estimate	**Std Error**	**Pr(>|t|)**	**Estimate**	**Std Error**	**t val**	**p**
intercept				27389.00	2654.06	10.32	0.00
COM_PCTEXP	6139.88	1472.02	0.00	6139.88	1528.62	4.02	0.00
HL_PCTEXP	512.41	127.12	0.00	512.41	132.01	3.88	0.00
HC	24744.97	1014.67	<0.00	24744.97	1053.69	23.48	0.00
TFP	14233.07	2571.57	0.00	14233.07	2670.46	5.33	0.00
GOVTSTAB	204.68	75.07	0.00	204.68	77.96	2.63	0.01
CORR	-505.68	199.70	0.00	-505.68	207.38	-2.44	0.01
LAWORDER	450.28	241.47	0.00	450.28	250.75	1.80	0.07
PSTAR.TFP	1270.96	339.89	0.00	1270.96	352.96	3.60	0.00

Table 6.9 demonstrates that the Mundlak's model efficiently reproduces the FE model. Note that in both results, the coefficient of HL_PCTEXP is 512.41(p=0). Similarly, coefficients of CORR and LAWORDER variables are -505.68 (p=0.01) and 450.28(p=0.07) respectively in both results. This confirms that Mundlak's specification efficiently replicates the individual-specific effects in the FE model. The specification is considered quite robust, covering both the general 'within-between model' (wbm) and Random Effects (RE) specification. It is superior to the FE model, in that it provides flexibility, i.e. enabling a specific pattern of correlation between individual effects in the model (Mundlak, 1978). The specification meets the desired multilevel modelling approach which prevents restrictions common with the FE model (Bell and Jones, 2015).

6.5.1 RANDOM EFFECTS WITHIN BETWEEN (REWB) MODEL

Having demonstrated that the Mundlak's model efficiently replicates the correct model, the study employs the more general REWB (the Mundlak specification in a specific case of it) model for the estimation of the model. Results are shown in Table 6.10.

Table 6.10 Result of Random Effects Within-Between (REWB) Model

	Estimate	Std. Error	t value
(Intercept)	-113628.83	17825.50	-6.38
COM_PCTEXP	5401.56	1498.63	3.60
HL_PCTEXP	-1607.64	451.47	-3.56
HC	25451.14	1038.88	24.50
TFP	14951.88	2618.01	5.71
GOVTSTAB	-74.82	155.41	-0.48
CORRUPT	928.68	400.20	2.32
LAWORDER	-1652.74	408.39	-4.05
PSTAR.TFP	1056.99	347.62	3.041
COM_PCTEXP_between	-3191.67	14445.47	-0.22
HL_PCTEXP_between	-1737.49	1010.84	-1.72
HC_ between	-15707.18	3896.54	-4.03
TFP_ between	40796.03	10443.05	3.91
GOVTSTAB_ between	2758.25	1487.49	1.85
CORR_ between	5112.24	1984.59	2.58
LAWORDER_ between	6610.68	2069.83	3.19
HL_PCTEXP:GOVTSTAB	68.53	30.57	2.24
HL_PCTEXP:CORR	-325.52	79.27	-4.11
HL_PCTEXP:LAWORDER	593.56	90.77	6.54

Table 6.10 indicates that the results is unreliable results when compared with the fixed effects model in table 6.9. Unlike earlier results (table 5.9), estimates of variables, differed not only in magnitude but also in direction. For instance, in table 6.10, the coefficient of health expenditure variable (HL_PCTEXP) is negative (-1607.64), while it was positive (512.41) in table 6.9, with both results being significant. Similarly, coefficient of government stability variable (GOVTSTAB) is negative and insignificant, i.e. -74.82(t=0.48), which contrasts with 204.68 (p=0.01) in table 5.9. The trend is the same with the coefficient of LAWORDER, varying in signs across the two results.

Even though the interaction terms appear significant, this result is to be considered unreliable.

The issue may not be unconnected with the lack of theoretical backing for institutional variables in the model. For instance, LAWORDER, like other institutional variables, are not captured in the economic growth theory since they are not factors of production and as such, have no direct effect on growth. In line with the theory, economic variables, for example, human capital (HC), can improve growth by adding to the stock of knowledge (technology) capital within an economy thereby boosting productive activities (Barro, 1991; Cortright, 2001; Kostov & Le Gallo, 2015). Conversely, LAWORDER measures the extent of compliance to the rule of law and only likely to 'encourage' investment through its link with property rights protection (Haggard, 2008; Barro, 1996; Keefer and Knack, 2007). Thus, the main terms of institutional variables i.e. GOVTSTAB, CORR and LAWORDER, can be excluded from the model since their inclusion is not backed up by the endogenous theory (Balli & Sørensen, 2013). Rather, the model retains only the interaction terms of the variables, since they modify the effect off the actual productive factors. This is also in tandem with the objective of this study.

Therefore, the model is re-specified, with insignificant correlation effects i.e. between economic variables, and main institutional variables excluded.

Table 6.11 Estimates of Interaction Effects

	Estimate	Std. Error	t value
(Intercept)	-392.93	477.49	-0.82
COM_PCTEXP_within	5738.11	1467.15	3.91
HL_PCTEXP_within	393.40	137.81	2.86
HC_within	24203.98	925.59	26.15
TFP_within	14783.11	2559.84	5.78
CORR_between	571.33	189.73	3.01
LAWORDER_between	-401.52	170.32	-2.36
HL_PCTEXP:GOVTSTAB	17.89	11.28	1.59
HL_PCTEXP:CORR	-137.84	32.50	-4.24
HL_PCTEXP:LAWORDER	89.08	30.01	2.97
PSTAR.TFP	1186.71	339.91	3.49

From the results presented in table 6.11, all the 'between' and 'within' variables are significant in this model. The results also show significant interaction effects between HL_PCTEXP and institutional variables, except GOVTSTAB. Thus, it can be concluded that corruption significantly reduces the growth effect of total health spending. Similarly, the interaction term, HL_PCTEXP:LAWORDER, (t=2.97) implies that increased compliance with law and order, strengthens the growth effect of health spending. On the interaction between HL_PCTEXP and GOVTSTAB, it can be inferred that government stability does not alter the nature or magnitude of effect of health expenditure on the real GDP per capita. It is possible that government's unity, legislative strength and popular support may not impact on total health expenditure, if it does not impact property rights and private investment (Barro, 1990).

6.5.2 THE SMOOTHING SPLINE NONPARAMETRIC REGRESSION MODEL VIA THE GENERALISED ADDITIVE MODEL (GAM)

For estimation, the Generalised Additive Model (GAM) is employed from the mgcv package in R statistics. The GAM was selected because it efficiently combines multiple terms, fixed, random and smooth terms in order to capture nonlinearity in regression models (Wood, 2017). It also allows for simultaneous estimation of the model parameters and the penalty of the smoothing term, thus avoiding computationally intensive methods for selecting a smoothing penalty (which controls the degree of smoothing of the spline terms) such as backfitting. Thence the model is estimated in a single step, which increases efficiency in its estimation.

Additionally, in GAM, random effects can be treated as smooths to produce parametric interaction of the predictors (Wood, 2023).

Table 6.12 Estimates of Interaction Effects using the GAM Model

Parametric coefficients:

	Estimate	**Std. Error**	**Pr(>|t|)**
(Intercept)	-62962.80	5613.60	< 0.00
COM_PCTEXP	4740.10	1491.10	0.00
HC	24663.00	1030.60	<0.00
TFP	15826.00	2645.20	0.00
PSTAR.TFP	1034.40	349.40	0.00

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Approximate significance of smooth terms:

	edf	Ref.df	F	p-value
s(HL_PCTEXP):CORR	8.19	8.88	6.33	<0.00
s(HL_PCTEXP):LAWORDER	2.00	2.00	13.64	0.00
s(HL_PCTEXP):GOVTSTAB	6.32	7.27	4.65	0.00
s(isocode)	65.83	66.00	214.37	<0.00

*Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1*

From the results, estimates of all the parametric coefficients are statistically significant at 1% and 5% level of significance. Based on F-statistic and p-values, all the smooth terms are statistically significant. The smooth term s(HL_PCTEXP):CORR reflects the interaction effects between HL_PCTEXP and CORR variables. The effective degrees of freedom (edf) of 8.19, is quite small and may imply that the smooth term does not have sufficient wiggle room. Similarly, the F-statistic of 6.33 ($p<0.00$) also indicates a positive relationship of the interaction effects with economic growth. Low levels of corruption and health spending, produces an upward effect on economic growth. Understandably, an earlier study has found that low levels of corruption leads to lower spending in the healthcare sector (Lichand et al, 2016). At low level of corruption, over-bloated spending gives way to lower, and possibly more efficient spending in the economy including in the health sector. This in turn, encourage more efficient allocation into productive investment to boost growth.

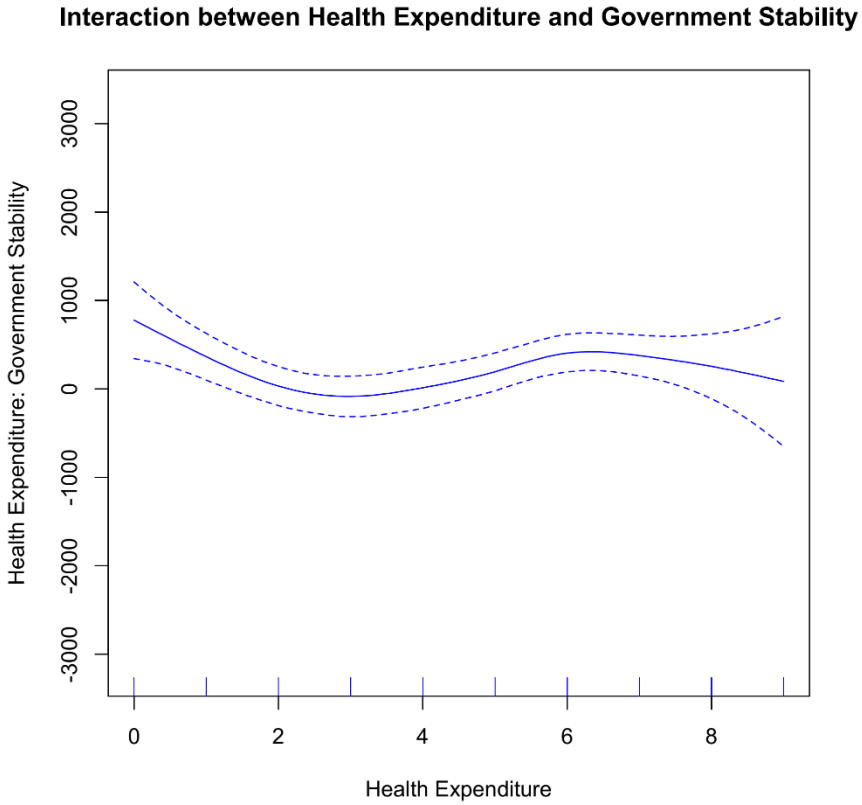

Figure 1 ***Interaction between Health Expenditure and Government Stability***

The interaction effect for health expenditure and government stability is barely significant though the effects are mostly positive except at very low levels (figure 1). This implies that government stability has little or no effect on the effect of health expenditure on growth and vice versa. In general, it can be inferred that institutional variables significantly impact economic growth via its effect on health expenditure in the model.

Similarly, the smooth term s(HL_PCTEXP):CORR reflects the interaction effects between HL_PCTEXP and CORR variables. The edf of 8.19, is quite small and may imply that the smooth term does not have sufficient wiggle room. This implies that there is insufficient data for reliable estimation of all effects. The F-statistic of 6.33 ($p<0.00$) also indicates a positive relationship of the interaction effects with economic growth. From the diagnostic plot in figure 2, low levels of corruption and health spending, produce an upward effect on economic growth. Understandably, an earlier study has found that low levels of corruption lead to lower spending in the healthcare sector (Lichand et al, 2016). At low levels of corruption, over-bloated spending gives way to lower, and possibly more efficient spending in the economy including in the health sector. This in turn, encourages more efficient allocation into productive investment which ultimately boosts growth.

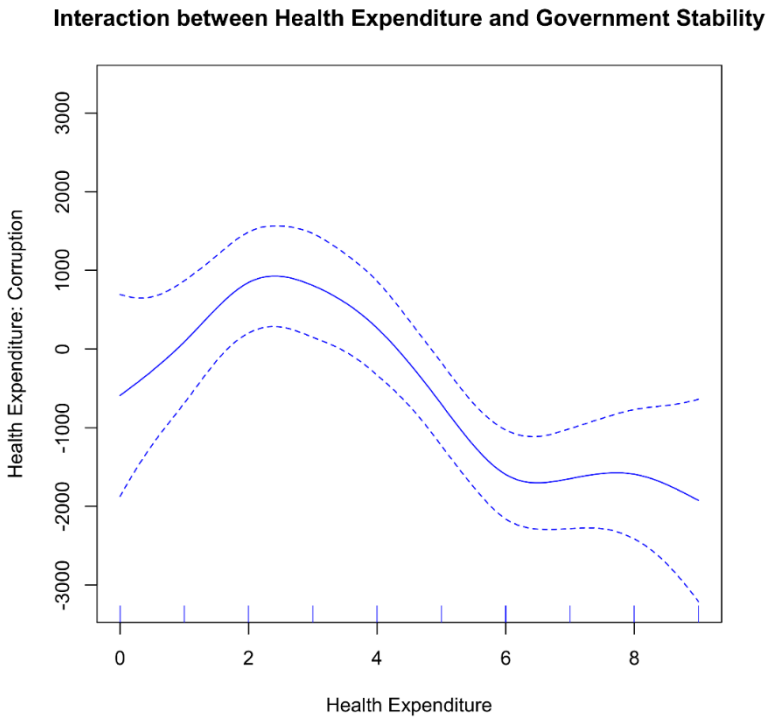

Figure 2 Interaction between Health Expenditure and Corruption

Lastly, the result of interacting health expenditure with law and order variable produced a smooth term showing that the interaction is positive and almost linear and statistically significant. The smooth term is statistically significant with (p=0.00). The diagnostic plot in figure 3 below indicates that the interaction effect is upward, portraying a positive effect on economic growth. A positive link has been previously established between health spending and the rule of law (Pinzon-Rondon et al, 2015). This result indicates that the interaction effect did not alter the individual effects of both variables on growth within the model.

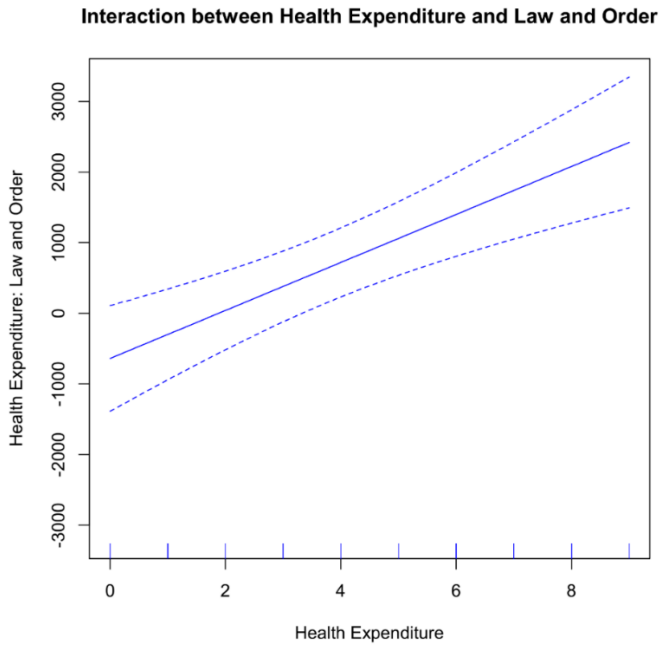

Fig. 3 Interactions between Health Expenditure and Law and Order

The results of the interaction effects between HL_PCTEXP and LAWORDER variables is (almost) linear and positive. The smooth term is statistically significant i.e. F-Statistic = 13.64 and p-value of 2.07e-06. The diagnostic plot, indicates that the interaction effect is upward, portraying a positive effect on economic growth. A positive link has been previously established between health spending and the rule of law (Pinzon-Rondon et al, 2015). This result indicates that the interaction effect did not alter the individual effects of both variables on growth within the model.

Overall, adjusted R-squared of 0.98 indicates that the model explains 98% of the variability in economic growth. However, the relatively low values of effective degrees of freedom (edf) across the smooth terms (edf), indicate the smooth function has very little wiggle room. This implies that

the data available for the study is insufficient for proper analysis to understand non-linear effects using the GAM model. Thus, in the following section, the study looks at more suitable econometric method for the interpretation of heterogeneity of effects across sample countries.

6.6 CAPTURING HETEROGENOUS EFFECTS

From the foregoing, there appears to be variability of effects on the dependent variable. The study seeks to understand the nature and magnitude of these effects on the quantiles of the dependent variable using the unconditional quantile regression (UQR) method.

6.6.1 UNCONDITIONAL QUANTILE REGRESSION

Analysis was done using the uqr package in R statistics, data is analysed using the RIF-OLS and results presented in table 6.13 for five selected quantiles: 0.10, 0.25, 0.50, 0.75 and 0.90.

Table 6.13 Results of Unconditional Quantiles Regression

	QUANTILES				
VARIABLES	0.10th	0.25th	0.50th	0.75th	0.90th
RGDP_PC (Actual in $)	8373.79	15054.88	25532.39	41378.49	52878.78
COM_PCTEXP	-1895.25	-6663.60	6602.29	9875.86	14898.48
	(0.46)	*(0.14)*	*(0.00)*	*(0.00)*	*(0.00)*
HL_PCTEXP	102.94	-6.74	873.25	1755.80	1929.19
	(0.47)	*(0.96)*	*(0.00)*	*(0.00)*	*(0.24)*
HC	-453.564	17210.83	16002.20	34263.74	40267.30
	(0.71)	*(0.00)*	*(0.00)*	*(0.00)*	*(0.04)*
TFP	-13181.48	48341.42	50202.33	46668.00	68218.65
	(0.00)	*(0.00)*	*(0.00)*	*(0.00)*	*(0.00)*
GOVTSTAB	35.81	-77.87	-700.73	485.85	2086.82
	(0.67)	*(0.35)*	*(0.00)*	*(0.00)*	*(0.01*
CORR	542.32	-1157.16	204.49	-1715.71	-5437.85
	(0.00)	*(0.00)*	*(0.70)*	*(0.00)*	*(0.00)*
LAWORDER	-1408.62	-1423.49	-1621.49	2058.79	6977.18
	(0.05)	*(0.00)*	*(0.00)*	*(0.00)*	*(0.00)*
Constant	*-75939.15*	*-103502.59*	*-85929.09*	*-90086.66*	*-236018.50*
	(0.00)	*(0.00)*	*(0.00)*	*(0.00)*	*(0.03)*

Based on the UQR estimates across the selected quantiles, it is evident that effects across the distribution of real per capita GDP from one country to the other, varies among sample countries, depending on the level of the country's income. In other words, across the 5 chosen quantiles, the effect on the value of real per capita GDP may likely differ depending on the economic prosperity of nations, i.e. whether they are poor or rich country.

6.6.2 DISCUSSION OF RESULTS

Estimation is taken initially over a limited range of quantiles (the quantiles plus the upper and lower 10% quantiles). These results in table 6.13, demonstrate that the effects do differ substantially between richer (upper quantiles) and poorer (lower quantiles) countries. In order to obtain a better overview of these effects, the model is estimated over a finer grid of quantiles (from 0.1th to 0.9^{th}, at 0.05 increments). To give a clearer picture of the income distribution, the actual values of real GDP per capita in USD($) is included. Actual values corresponding to each quantile are 8373.79, 15,054.88, 25,532.39, 41,378.49 and 52,878.78 respectively.

6.6.2.1 Public Expenditure on Communication

The effect of communication expenditure variable is insignificant in the two lowest quantiles i.e. -1895.25 (0.46) and 6663.60 (0.14). However, in the upper quantiles (50^{th} to 90^{th}), these effects are positive and significant, with steady increase in magnitude. This implies that the marginal effects of communication spending though not significant in poor countries, contributes to growth in richer countries. Furthermore, this effect increases with income level. Taking a closer look at figure 4 below, one would observe the decline in effects within the lower quantiles and the subsequent steady rise afterwards from median to upper quantiles.

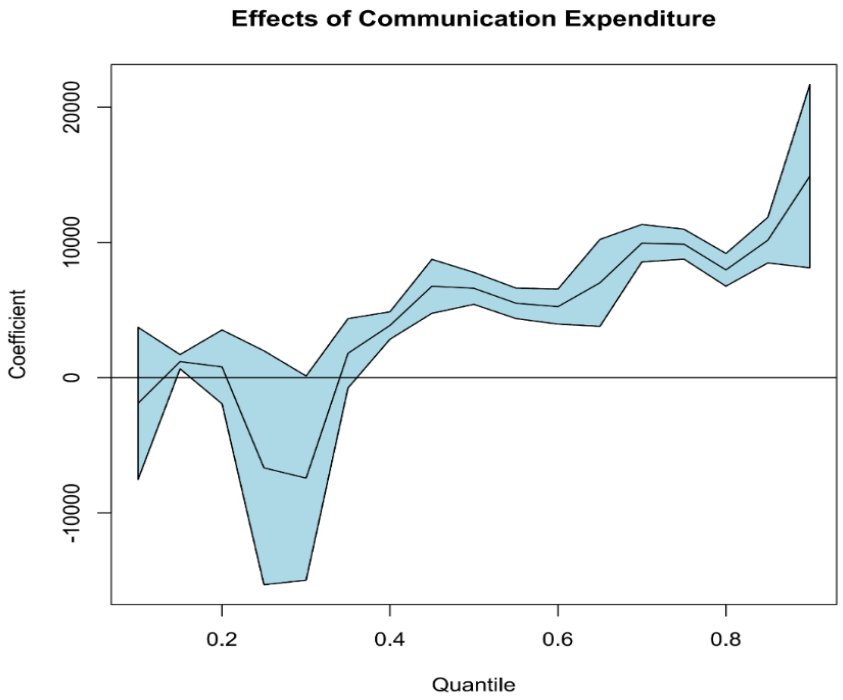

Figure 4 Effects of Communication Expenditure on Growth

The results indicate that in countries with higher income per capita, increasing public expenditure on communication will promote growth while it may not have any effect in poorer countries. The results for low income economies are not very surprising in the light of the findings of Dzhumashev (2014), that in low-income economies government expenditure reduces growth in poor economies since it increases rent-seeking behaviour leading to government inefficiency. Another empirical evidence of insignificant relationship between communications expenditure in developing countries is found in Bose et al. (2007) and Okoli et al. (2023). On the other hand, there are also ample empirical literature in line with the findings for middle to high income countries (De Long & Summers, 1991a; Easterly & Levine, 1997; Easterly & Rebelo, 1993; Esfahani & Ramirez, 1999; Gemmell et al., 2016).

Results from higher-income countries conform with the endogenous growth literatures on knowledge spillovers, entrepreneurship and innovation (Lucas, 1988; Romer, 1990). Thus, as a major infrastructure expenditure, it is considered as an input to private production, which has the potential of boosting growth (Barro, 1990). Little wonder it is often classified as productive expenditure (Kneller et al., 1999; Kutasi & Marton, 2020; Chu et al, 2020). On the contrary however, results from low-income countries are in contrast with the endogenous growth theory

since communications expenditure shows no significant relationship with economic growth in these countries.

6.6.2.2 Public Expenditure on Health

Looking at the values of coefficients for health expenditure, the effects seems to follow the same trend as that of communications expenditure i.e. increasing upwards from upper quantiles. There seems to be no significant effects of health expenditure on growth among poorer with coefficients from 102.94(0.47) in the 10th quantile to -6.74 (0.96) in the 25th quantile. At the lowest quantile, though the result initially shows that the effects on growth are positive, it still dropped to negative at the 25th quantile, with none statistically significant. For richer countries however, the coefficients increased from 873.25 to 1929.185, between the median and 75th quantile, with both statistically significant. From the graph in figure 5, steady increase in magnitude of effect is clearly observable. Thus, it can be interpreted that health expenditures shares no significant relationship with growth in poor countries but positively influences growth in richer countries, though the effect is not significant at the 90th quantile, something that could be due to the sample used since the insignificance is due to largely inflated standard errors.

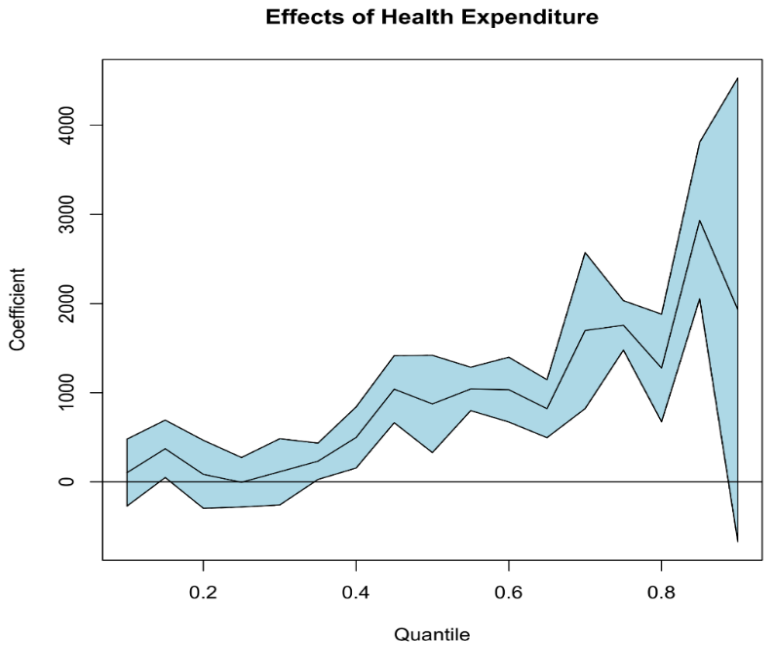

Figure 5 Effects of Health Expenditure on Economic Growth

The insignificant relationship between health expenditure and economic growth recorded in the low income countries finds support in Devarajan et al. (1996), Kelly (1997) and Churchill et al (2015). Another reason for insignificant results between health expenditures and income especially in developing economies is increasing the percentage of expenditures on curative expenditures, which is more costly and does not improve health indicators such as mortality rates and life expectancy (Kelly, 1997; Devarajan, 1996). When disaggregated, results showed that health research and preventive care contributes positively to growth (Devarajan et al, 1996). In a similar vein, there are also evidences that health expenditure encourages growth (Beraldo et al., 2009; Cooray, 2009; Pradhan, 2010; Acosta-Ormaechea & Morozumi, 2013; Qehaja et al., 2023; Hu & Wang, 2024). Contrary to the negative evidence revealed by the meta-analysis conducted by Churchill et al. (2015), more recent studies classified health spending as productive (Chu et al., 2020; Kutasi & Marton, 2020).

Results from high-income countries are is consistent with endogenous growth theory. Earnings is significantly related to emotional and physical health (Becker & Tomes, 1986), while a person's stock of health determines the total time period of earnings (Grossman, 1972). The association between health outcomes and economic growth is mainly explained through improvement in productivity of labour force. First, government spending on health improves the productivity of the working population thereby improving economic growth (Strauss & Thomas, 1998; Jack, 1999). Secondly, improved health outcomes such as low mortality and fertility rates, translates to increased working population (Bloom & Canning, 2000). Thirdly, increased health outcomes bring about incentives for further investment in education and skills acquisition (Barro, 1996; Bloom & Canning, 2000).

6.6.2.3 Human Capital

The coefficient of the 10^{th} percentile, -453.56 (0.71) suggests that human capital may not have any significant association with growth in very low-income level economies. From that quantile, the study recorded a positive significant effect, which increased to 17210.82 in the 0.25^{th} percentile with a little decline at the median. This is well depicted in figure 6. From the 50th quantiles upwards, there is a steady rise in the magnitude of effects with the largest spike recorded between 0.50^{th} and 0.75^{th}, i.e. from 16002.20 to 34263.74. The magnitude of effects increased steadily. Across the chosen quantiles, results indicate that while human capital fosters growth in middle

income and richer economies, the variable may not matter to growth in very lower income countries.

Except for very poor countries, the effect of human capital variable is aligns with the endogenous growth models (Barro, 1990; Becker, 1994; Cortright, 2001; Grossman & Helpman, 1991; Lucas, 1988; Romer, 1990). As an input into the R&D, human capital supports generation of new products and ideas that trigger invention of technological products (Romer, 1990) and enhances productivity of both labour and capital (Lucas, 1988). Abundant empirical evidence supporting this relationship can be found in the literature including Barro (1991), Mankiw et al. (1992), Glaeser et al. (2004), Bose et al. (2007), Hanushek, 2013 and Kostov & Gallo, 2018). Likewise, Becker (1994) provided a comprehensive explanation of how investing in education and skill acquisition contributes to the accumulation of human capital. Consistent with this, numerous disaggregated studies exploring the impact of education expenditure on economic growth have identified a positive and significant relationship between these variables (Nijkamp & Poot, 2004). Even, Acosta-Ormaechea & Morozumi, (2013) argues that reallocation funds in favour of education sector is likely to lead to long term growth, although their findings are at odds with those of Barro (2003).

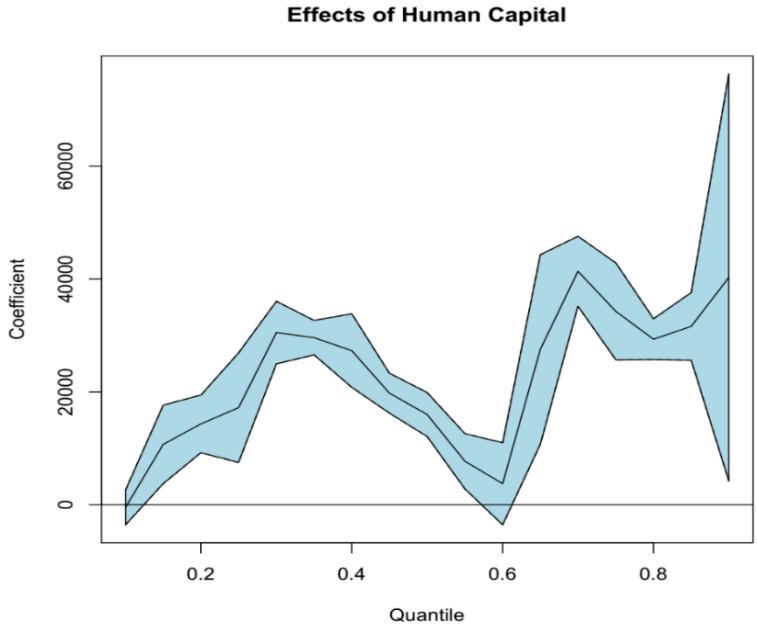

Figure 6 Effects of Human Capital on Economic Growth

The graph in figure 6 depicts a nonmonotonic effects of human capital variable across the quantiles of the growth variable. Initial increase of its effects is followed by a drop and then another increase. Empirical studies show that measures of human capital can yield varying effects, thus the need to employ measures that fully capture the stock (Kostov & Gallo, 2018). While noting that development countries have closed the human capital gaps as measured by standard measures, focus should be directed towards quality as may be captured by performance in international examinations to ensure that human capital accumulation is not relegated to mere schooling (Hanushek, 2013). Reducing education to mere schooling or mismatching same with skills acquisition, may yield negative effect on economic growth (Benhabib & Spiegel, 1994; Pritchett, 2001). Unfortunately, quality schooling, which entails both provision of the necessary infrastructure and access to resources may be lacking in poorer countries.

6.6.2.4 Total Factor Productivity

Across all quantiles, results show that total factor productivity have significant effects on growth though the change in effects across quantiles is nonmonotonic as depicted in figure 7. However, the effects are generally positive across quantiles of growth except in the 0.10^{th} quantile with coefficient of -13181.47. Between 0.25^{th} quantile and the median, the coefficients increased from 48341.42 to 50202.33. From that value, there was a further decline to 46668.00 in the 0.75^{th} before another rise to 68218.65 in the 0.90^{th} quantile. Also worthy of note is that the highest magnitude of effects is in the uppermost quantile followed by the median quantile. Generally, results here show that except in very poor countries, i.e. lowest quantiles, increasing total factor productivity enhances economic growth. This finding tends to conform with Easterly & Levine (2001) that rich countries sustain their wealth over time by increasing the rate of concentration of technological innovation.

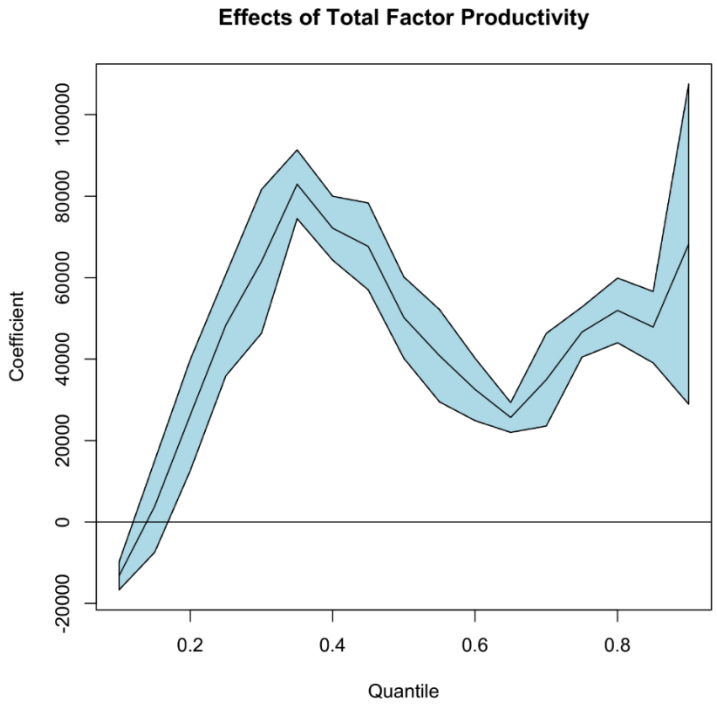

Figure 7 Effects of Total Factor Productivity on Economic Growth

Except for very poor countries, this finding tend to the laud the growth-enhancing effects of total factor productivity as described by Easterly & Levine (2001). This also aligns with endogenous growth models proposed by Schumpeter, formalised by Aghion & Howitt (1992), and further elaborated by Grossman & Helpman (1993). These models emphasise how innovation and entrepreneurship drive long term growth by creating new products and technologies. The finding of this study corroborate many empirical evidences which highlight the increasing returns to growth associated with technological innovation and diffusion (Barro & Sala-i-Martin, 1995; Benhabib & Spiegel, 1994; Easterly & Levine, 2001; Klenow & Rodríguez-Clare, 1997; Miller & Upadhyay, 2002; Yalçınkaya et al., 2017; Haq et al, 2022).

6.6.2.5 Government Stability

Results of the UQR shows that government stability has no significant relationship with growth in the lowest quantiles. i.e. 35.81(0.67) and -77.87(0.35) for 0.10^{th} and 0.25^{th} quantiles respectively. Figure 8 captures this effect in a graph showing the steady fall from the 0.10^{th} to the median before it increased. Surprisingly, the median with coefficient of -700.73 shows that government stability is inversely related to growth. However, results from upper quantiles indicates a strong positive

significant relationship between growth and government stability with coefficients rising from 485.85 to 2086.82 from 0.75^{th} to 0.90^{th} quantiles. These findings indicate that while the effects of government stability may not influence growth in low income countries, it is negatively related to growth in medium income countries. In the two uppermost quantiles, 0.75^{th} and 0.90^{th}, results indicate a significant positive association between government stability and growth.

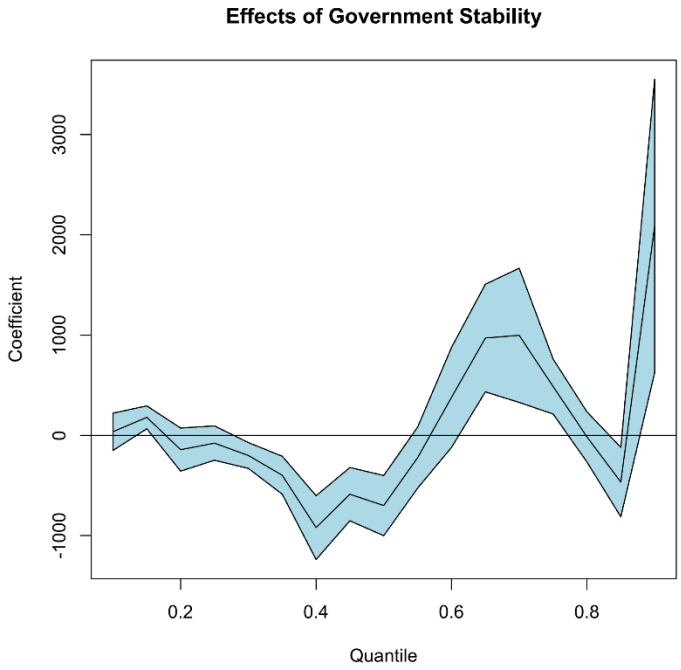

Figure 8 Effects of Government Stability on Economic Growth

As results for upper quantile suggests, for high income countries to sustain growth, it is important to maintain government stability (Londregan & Poole, 1990; Barro, 1991; Alesina et al., 1996) The variability of effects across sample countries, indicates that there may be other factors influencing these relationship across these countries such as development level suggested in Sidek & Asutay (2020). In a like manner, the insignificance of the result recorded among low income countries may be connected to the need for categorisation of changes in government (Feng, 1997). There are other findings which are suggestive of insignificant relationship between these variables (Easterly & Rebelo, 1993; Glaeser et al., 2004).

6.6.2.6 Corruption

On the effects of corruption on economic growth, the coefficient of CORR in the 0.10th quantile (542.32) indicates a significant positive effect on growth. This is followed by a massive decline to -1157.16 in the 0.25th quantile and another rise to 204.49 in the 0.50th quantile (though insignificant). Coefficients of corruption at the upper quantiles (0.75 and 0.9), bear negative coefficients of -1715.71 and -5437.85 respectively. Figure 9 captures the steady downward direction of the effects from 0.50th to 0.90th quantile

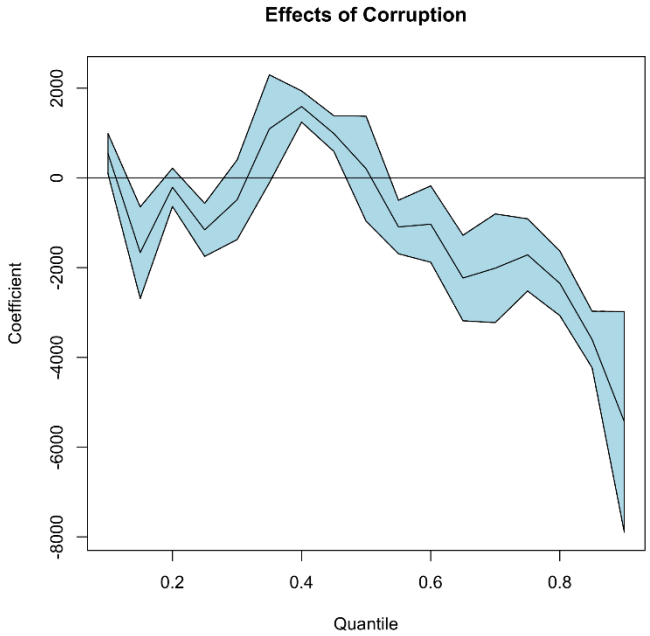

Figure 9 Effects of Corruption on Economic Growth

Amidst many evidences of the inverse relationship between corruption and growth (Aidt, 2009; Easterly & Levine, 1997; Mauro, 1995, 1998) which explain the effects of 0.25th, 0.75th and 0.90th quantiles, there is a possibility that corruption above or below the optimal level results to unpopular effects on growth (Trabelsi, 2023). Hence corruption should be controlled in order to promote the effectiveness and efficiency of public spending (Okunlola et al, 2024). Similarly, the strong positive effect of corruption on growth in the 10th quantile finds support in Spyromitros & Panagiotidis (2022). The authors conducted a panel data study and found a positive relationship between corruption and growth in Latin America. Similar to the result of this study in the 50th quantile, their findings reveal that corruption shares no significant relationship with growth in the MENA region. Thus, they concluded that when data is disaggregated into regions, there is a possibility for emergence of a different evidence which may appear unpopular.

6.6.2.7 Law and Order

The effects of law and order (LAWORDER) variable is well captured in figure 10 with all effects statistically significant. With coefficients of -1408.62, -1423.49 and -1621.49 at 0.10^{th}, 0.25^{th} and 0.50^{th} quantiles respectively, the variable shares an inverse relationship with growth. This trend however changed in the upper quantiles with coefficients increasing from 2058.79 to 6977.18 between 0.75^{th} and 0.90^{th}. It can be inferred from this result that law and order shares negative relationship with growth in low to medium income countries but positive relationship in high income economies. Another point notable is that difference in magnitude of effects between the uppermost quantiles. This indicates that the higher the income level of a country, the more the effects on growth. This can also be interpreted in the light of the fact that comparatively, higher income countries tend to have good institutions which has fostered trust in law enforcement authorities over time (Barro, 1996; Butkiewicz & Yanıkkaya, 2011; Keefer & Knack, 1997; Nedanovski & Kocevska, 2023).

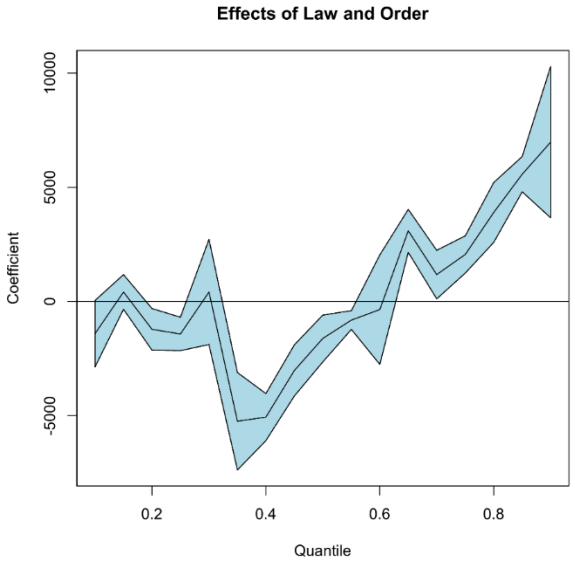

Figure 10 Effects of Law and Order on Economic Growth

Generally, observations show that the growth effects of variables in the model are either insignificant or sometimes even counterintuitive for poorer countries, while they conform to expectations for richer countries. The variability in the effects is a key reason for the choice of the

unconditional quantile regressions since the mean-based models assume homogeneity of effects across dependent variables and thus unsuitable for this type of analysis.
Secondly, the process of generating national income (GDP) appears to be much better explained in richer that in poorer countries, where the impediments to growth do not appear to be captured by our explanatory framework. Therefore, more detailed investigation into the possible engine for growth in poorer countries may be necessary.

6.7 CONCLUSION

Public expenditures on communications and health sectors are not significantly related to economic growth in poorer countries with RGDP_PC less than $15,054.88. However, in richer countries with higher incomes, these expenditures are strongly and positively related to economic growth.

The effects of human capital are insignificant in very low-income countries with income per capita of $8,373.79, but they become significant in high-income countries. This may be due to the inadequate stock of human capital in low-income countries, which hampers economic activities and subsequently growth.

Similarly, total factor productivity (TFP) is significant throughout but shows a negative relationship in the poorest countries. This is expected since poorer countries are unlikely to have the concentration of advanced technology necessary to boost productivity, which limits growth (Easterly and Levine, 2001).

The estimated effects of corruption show that it shares positive and significant relationship to growth in very poor and medium-income but negatively related to growth in high-income countries. Richer countries are characterised by stronger institutions, hence high corruption rate retards growth. However, in lower income countries, the positive effect of corruption may be connected to weak institutions and inappropriate governance structures. This finding also aligns with previous finding that in suboptimal institutions, corruption control beyond a certain threshold may not be healthy for growth (Kato & Sato, 2015; Huang, 2016; Nguyen & Bui, 2022). This creates opportunities for corruption to 'grease the wheel' via the provision of informal mechanisms for service delivery (Kaufmann and Vicente, 2005). Another possible reason is that corruption can

induce political stability by inappropriately allocating resources to stakeholders to maintain social order (Meon and Weill, 2010).

As expected, government stability also showed positive highly significant effects in richer countries. Contrarily however, the variable is insignificantly related to growth in poorer countries. The explanation for this is found in high ethnic polarisation associated with countries in this category which may distort expected effects (Mauro, 1995; Easterly and Levine, 1991; Acemoglu, 2005).

Finally, results of study show that law and order is negatively related to growth in poor countries, while it is significantly related to growth in medium to high-income countries. This implies that good institutions build and promotes the rule of law as people repose more confidence on institutions to enforce rules. On the contrary, the likelihood of compliance with rules are lower in the presence of weak or substandard institutions for its enforcement (Barro, 1996; Butkiewicz & Yanıkkaya, 2011; Keefer & Knack, 1997; Nedanovski & Kocevska, 2023)

As earlier proposed, the study was initiated with two main objectives in mind. The first is to examine the effects of public expenditure on economic growth while the second is to investigate whether institutional environment has any effect on the relationship between public expenditure and economic growth.

Preliminary studies indicated that public expenditure and institutional environment share significant positive relationship with economic growth. Further analysis and test for endogeneity revealed that Total factor productivity (TFP) variable is endogenous. Subsequent findings after handling endogeneity concerns suggest that effects are not reliable. Thus, the study traced the possible source of nonlinearities to interaction effects between public health expenditure and institutional factors. This is considered since the endogeneity tests considers health expenditure unreliable while the estimates of government stability, corruption and law and order variable suddenly appeared insignificant in the IV regression.

Analysis for interaction effects confirmed earlier suspicion that the interaction of health expenditure with institutional variables are significant except for government stability. The study finds that corruption significantly reduces the growth effect of health expenditure. In a similar

vein, the study also finds that improved law and order, increases the growth effects of health expenditure. However, government stability appears to have no significant on the health expenditure effect.

Results strongly suggests that public expenditure enhances growth depending on the income level of the country. The study concludes that public expenditure in communication and health sectors is positively and significantly related to economic growth in richer countries but largely negative or insignificant in poorer countries. Secondly, the study concludes that institutional environment matter for growth. However, income level may also be a determinant factor, since it may determine the strength and adequacy of institutions in the growth process.

On one hand, results of the study explain the previous finding of possible issues with the stability of estimated effects. On the other hand, it provides further insights into the growth process while raising questions about the growth theories applicability to all countries. In particular in lower income countries, the process appears to be quite different, and we may need additional explanations.

CHAPTER SEVEN

7.0 SUMMARY AND CONCLUSION

7.1 INTRODUCTION

Based on the endogenous growth theory, this study delved into the relationship between public expenditure, institutional environment and economic growth using a sample of 67 countries. The objectives of the study were to examine the effects of public expenditure on economic growth and to investigate whether institutional environment has effect on relationship between public expenditure and economic growth. Reviewed literature suggests that many previous inquiries into the relationship has produced varying evidences. Variations in findings are mainly due to certain factors such as different measures for variables, availability and coverage of data, the nature and type of data, model estimation methods, as well as unobserved heterogeneity among sample countries.

Top among the reasons for varied findings in this relationship among empirical studies is variety of measures for variables. Depending on data availability or choice, authors generally use different measures in their research which may result to varying effects. Sometimes, insufficient or inaccurate measures produce the effects which are contrary to theoretical expectations (Pritchett, 2001; Kostov & Gallo, 2018). Although this is generally due to data availability, some measures may produce unreliable results that negate theoretical expectations, and this may lead to unreliable findings (Psacharopoulus, 1994).

Another reason for variation of findings across studies is unobserved heterogeneity. There is need to be conscious of countries' unobserved heterogeneity when classifying expenditure into broad categories such as productive and unproductive. For instance, while capital and recurrent expenditures are considered productive and unproductive respectively (Barro, 1990), economic realities vary from one country to another and this may lead to variation in findings which are inconsistent with economic theories (Devarajan et al, 1996). It is important to note that irrespective of the property rights argument, countries vary in terms of their economic development, productive capacity and comparative advantage. This implies that irrespective of theoretical positions supported by empirical evidences, expenditures may produce different effects on growth in

different countries. Thus, unobserved heterogeneities among sample countries contribute to variations in findings across different studies. Whilst various expenditure types are considered either productive or unproductive, existing empirical evidences show that this does not always hold true. Moreover, in a case of unavailability of an appropriate measure, such omission potentially creates loops, thereby constituting endogeneity in the model if not properly handled.

Data availability significantly influences the scope and robustness of research. Inadequate data can lead to biased results and inconsistent findings. The scope of most research is based on data availability and the present research is no exception. Dearth or inadequacy of data may limit robustness of research leading to inconsistent findings across the same subject area. Unavailability of data can also result to biased outcomes if effects within a model are not fully captured. Also, 'type' of data, either aggregated or disaggregated is also an important factor in determining findings (Kelly, 1997). Whereas his study found that health expenditures is insignificant to economic growth, when data is disaggregated, the author found that the health expenditure data is mainly from curative expenditures, which is more costly compared to preventive expenditures. In the present study, we also found that insufficiency of data limited the use splines modelling in the Generalised Additive Model.

Generally, the above-mentioned factors signaled that effects may not be uniform, but rather nonlinear. For instance, the study found a significant interaction effects between health expenditure and institutional environment variables – corruption and law and order. This may lead to biased estimates and endogeneity similar to the bidirectional causality findings between health and growth in Pradhan (2010). This underscored the need for selection of suitable method in order to capture these heterogenous effects.

In order to ensure reliable results, the study employed a robust endogeneity correction method. The potential endogeneity was not simply controlled for, but it was consistently tested for. The reliability of the endogeneity correction was robustly tested for in the linear models, but it was also implicitly checked in all subsequent modelling specifications. Subsequently, the study employed the Unconditional Quantile Regression (UQR) method (Rodriguez-Caro, et al., 2016; Borgen et al, 2022). In comparison to the conditional quantile regression (CQR), the UQR is chosen for the underlisted reasons:

(i) The method captures the effects of independent variables on the entire distribution of the dependent variable across different quantiles, making interpretation straightforward and generalisable. This also allows for easier comparison of individual populations in the sample since the population are directly observable (Firpo et al., 2009).

(ii) It provides accurate population distribution estimate since it is computed from using the mean, i.e. the OLS. This is unlike the CQR which is generated from the median (Fortin et al., 2010).

(iii) Lastly, it has been proven to better capture nonlinearity effects when compared to the CQR (Firpo et al, 2009).

Thus, the study chose five quantiles of the response variable (RGDP_PC) with each representing income levels of countries. A larger number of quantiles were used to produce informative graphical representation of the heterogeneous effects. Poorer countries tend towards the lowest quantile (0.1) while richer countries tend towards higher quantile (0.9).

7.2 KEY FINDINGS OF THE STUDY

In line with the first objective, the study found that the effects of public expenditure on economic growth is largely determined by the economic prosperity of countries as measured by income per capita. This is in contrast with the findings of Chu et al (2020) that income level does not matter in this relationship. Findings reveal that over the five chosen quantiles, the variables mostly yield expected effects in richer countries compared to the poorer ones. Specifically, key results are as follows.

Public expenditure on Communication is positively related to economic growth in rich countries while it is insignificant to growth in poor countries. This finding aligns with the earlier research by Bose et al. (2007), which also concluded that communication expenditure is not a significant factor in the economic growth of developing countries.

For middle-income to high-income countries, numerous empirical studies have documented a significant positive relationship between communication expenditure and economic growth (De Long & Summers, 1991; Easterly & Rebelo, 1993; Easterly & Levine, 1997; Esfahani & Ramirez,

1999; Gemmel et al, 2016). These results from higher-income countries support the endogenous growth theories, which highlight the growth-stimulating effects of knowledge spillovers, entrepreneurship, and innovation (Lucas, 1988; Romer, 1990).

Public expenditure on health shares positive relationship with economic growth in rich countries while it has insignificant effect on growth in poor countries. Existing research has published both positive effects (Beraldo et al., 2009; Cooray, 2009; Pradhan, 2010; Chu et al, 2020; Kutasi and Marton, 2020; Qeheja et al, 2023; Hu and Wang, 2024) and negative effects (Devarajan et al., 1996; Kelly, 1997).

Human capital shares significant positive effect with growth in rich countries but insignificant effect on growth in very poor countries. There is also sufficient empirical evidence in support of the present finding (Barro, 1991; Mankiw et al, 1992; Glaeser et al, 2004; Hanushek, 2013, Kostov & Gallo, 2018). For poor countries however, the insignificance relationship between human capital and growth may be due to low quality schooling due to inadequate provision of the requisite infrastructure and inaccessibility of resources (Hanushek, 2013).

Total Factor Productivity (TFP) shares a significant positive relationship with growth in countries with high income level, while it is negatively related to growth in very poor countries. This finding for high income countries aligns with Easterly & Levine (2001) that rich countries sustain their wealth over time by increasing the rate of concentration of technological innovation. Additionally, this lends support to other earlier empirical evidences highlighting the increasing returns to growth generated by technological innovation and diffusion (Barro & Sala-i-Martin, 1995; Benhabib & Spiegel, 1994; Easterly & Levine, 2001; Klenow & Rodríguez-Clare, 1997; Miller & Upadhyay, 2002; Haq et al, 2022). However, findings on the negative relationship between TFP and growth in poor countries is supported by the findings of Baier et al., (2002) that overall, TFP may be negatively related to growth.

Government Stability is positively related to growth in rich countries while it shares no significant relationship to growth in poor countries. By implication, it is essential for high income countries to maintain a stable polity in order to sustain growth (Londregan & Poole, 1990; Barro, 1991; Alesina et al., 1996), while it may not matter for growth in poorer countries. Asides,

in support of the findings on poorer countries, there are earlier empirical evidence that government stability has no significant effect on growth (Easterly & Rebelo, 1993; Glaeser et al., 2004).

Corruption has significant negative effect on growth in richer countries while it promotes growth in poor countries. Rich countries are characterised by stronger institutions and hence corruption will likely 'sand the wheels' of growth (Cooray & Schneider, 2018). Surprisingly, it is also negative to growth in the second lowest income group (with average annual income of $15,054.88).

In very poor countries however, corruption shares a significant positive relationship with growth. This is not surprising in the light of previous studies that in developing countries with weak and poor governance structures, corruption may 'grease the wheel' of economic activities by providing informal mechanisms for service delivery (Kaufmann & Vicente, 2005; Kato & Sato, 2015; Huang, 2016; Nguyen & Bui, 2022). However, even for developing economies, a substantial level of corruption control is needed to improve the effectiveness and efficiency of government expenditures (Okunlola et al., 2024).

Law and order shares a strong positive effect with growth in richer countries, while it is negatively related to growth across the poorest to middle income countries. This implies that for rich countries, popular observance of law promotes economic growth as people are more familiar with expectations and penalties for noncompliance with laws. There is also increased confidence in institutions when rules are enforced. Clarity about property rights protection encourages entrepreneurship, investment, innovation and ultimately, growth. This may explain the reason that rich countries sustain their wealth over the years. Contrarily, in the presence of weak institutions with associated poor enforcement of rules, there is decreased likelihood of compliance with law and order (Barro, 1996; Butkiewicz & Yanıkkaya, 2011; Keefer & Knack, 1997; Nedanovski & Kocevska, 2023).

7.3 CONCLUSION

As earlier proposed, the study was initiated with two main objectives in mind. The first is to examine the effects of public expenditure on economic growth while the second is to investigate whether institutional environment has any effect on the relationship between public expenditure and economic growth.

Results strongly suggests that public expenditure enhances growth depending on the income level of the country. The study concludes that public expenditure in communication and health sectors is positively and significantly related to economic growth in richer countries but largely negative or insignificant in poorer countries. Secondly, the study also concludes that institutional environment matter for growth depending also on the income level of the country. Stability of government promotes growth in rich countries while it will not matter for growth in their poorer counterparts. While corruption deters growth in rich countries, it promotes growth in poorer countries. The study also found that increased law and order supports growth in richer countries, while it hinders growth in poorer countries.

Therefore, the study concludes that income level of countries is a key determinant to whether or not they can achieve growth through provision of public goods and services.

7.4 THE IMPLICATIONS OF FINDINGS

The findings of this research hold profound implications for government policymakers, particularly in the realm of budgetary allocations and public expenditure decisions. By providing a nuanced understanding of how sectoral expenditures affect overall economic growth, the study highlights the critical mediating role of institutional factors in this relationship. Through the lens of endogenous growth theory, the research tested its applicability across countries at varying income levels and revealed differentiated effects of sectoral expenditures on growth.

One of the key implications is the need for government policymakers and budgetary advisers to tailor public expenditure strategies to the developmental stage of each country. The findings indicate that public spending in different sectors must be adapted to a country's income level in order to effectively drive economic growth. For low-income countries, the structure of public expenditure may need to prioritize sectors that yield the highest marginal returns to growth, which

may differ substantially from the spending priorities of higher-income nations. Moreover, the percentage of national income allocated to specific sectors must also be contextually adjusted, as poor countries may face limitations in their capacity to finance expenditures at the levels necessary to stimulate growth. This implies that the total value or percentage of sectoral expenditure in lower-income countries may be insufficient to generate the desired growth outcomes, constrained by fiscal capacity.

A significant insight derived from this study concerns the need for disaggregated data in analyzing sectoral expenditures. For example, in the health sector, it is important to distinguish between expenditures that enhance health outcomes and those that are merely curative. As highlighted in previous literature, including Kelly (1997), the efficacy of health spending depends on targeting interventions that yield long-term improvements in public health rather than short-term curative measures.

The findings also have implications for the role of human capital in growth. The measure of human capital employed in this study—based on years of schooling and returns to education—was found to be non-significant in lower-income countries. This may be attributed to inadequate infrastructure and limited access to essential educational resources, which diminish the effectiveness of schooling in these contexts. Thus, years of schooling in such settings may not translate into meaningful human capital accumulation, relegating education to a formality rather than a substantive driver of growth.

Similarly, the study's exploration of total factor productivity (TFP) underscores its limited relevance in low-income countries, where growth is often more reliant on factor accumulation than technological advancement. In such contexts, the residual contribution of TFP to growth is minimal, as technological spillovers between countries at the same income level are unlikely. This reinforces the need for alternative growth strategies in poorer nations that do not rely solely on technological progress.

The research also points to a critical institutional challenge in low-income countries: the prevalence of weak institutions. The evidence suggests that such institutions are often inadequate to foster sustained economic growth. A particular issue identified is high ethnic fragmentation,

which impedes consensus on the appropriate allocation of public goods and limits institutional efficacy. In this regard, the study lends support to both the "greasing the wheels" hypothesis, which suggests that corruption can sometimes enhance efficiency in developing economies, and the "sanding the wheels" hypothesis, which posits that corruption hinders growth in more developed economies.

In conclusion, the implications of this research underscore the importance of context-specific policymaking. Government decision-makers must consider a country's income level, institutional quality, and other contextual factors when formulating sectoral budgetary allocations aimed at promoting growth. The findings challenge the notion that economic theories, such as the endogenous growth model, can be universally applied without adaptation. Policymakers should, therefore, approach the implementation of economic theories with a critical awareness of each country's unique circumstances.

7.5 STUDY'S LIMITATION AND SUGGESTIONS FOR FURTHER STUDY

Although this study has made considerable effort in order to meet the study's objective as well as provide answers to the research questions, it still has some limitations, which presents opportunities for future research.

One of the main limitations is the lack of sufficient data for institutional environment. Construction of the study's database from a combination of three datasets greatly impacted the data sample. While PWT 10.01 and SPEED databases provided data dating back to 1970 and 1980 respectively, the ICRG data provided data only from 1984 to 2017. This shrunk the sample size to 67 countries covering only 33 years. The insufficiency of the available data limited the study's estimation of non-linear effects using the GAM model, a nonparametric analysis.

Secondly, the study combined countries at various income levels in the present research. In line with its findings, it is recommended that future research should explore the growth nexus of public expenditures, institutional environment and economic growth using samples from countries within the low-income bracket. This is crucial in order to understand which sectoral expenditures are most effective in driving economic growth in poorer countries. The outcome of such study will help governments of low-income countries to understand the dynamics of applying fiscal policies to

foster the desired growth. In such investigations a closer attention needs to be paid to both the measures employed in empirical specification, as well as the finer detail of potential differences amongst these lower income countries themselves.

Thirdly, the present study applied longitudinal modelling approaches to the problem. Although panel type of data allows for better modelling some types of heterogeneity, it has two considerable shortcomings. First it aggregates and averages certain effects, something that can be somewhat overcome via quantile methods. Yet allowing for a more varied time dynamics would be beneficial in better understanding the underlying effects. While this is, in principle, possible in longitudinal settings, it implies higher model complexities, which as demonstrated in the spline modelling example, needs much larger data sample. Therefore, time-series approaches (for example on a single country) which allow one to isolate time variability without the need to account for cross country variations, could be potentially useful in getting valuable insights in the growth relationships. Although such single country studies will be more difficult to generalise, they would offer possibilities to better represent and finetune investigations that rely of cross-country data and give further insights into the best ways to construct useful measures for the variables that affect the growth relationship.

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APPENDICES

Appendix I - SUMMARY OF LITERATURE

Years	Title	Title/objective	Method	Data	Result
1991	Barro	Economic Growth in Cross Section of Countries	Cross-Sectional Regression	98 countries (1960 – 1985) Developed and developing	Government consumption share of income has significant negative association with growth since it is considered unproductive and may hinder growth. Ratio of private investment to GDP shares negative association with government consumption expenditure. Political instability is negatively related to growth and investment since it is presumed to distort property rights. *Consumption expenditure may cause distortions if it increases tax as this may reduce private investment.*
1991	De Long and Summers	Equipment Investment and Economic Growth	OLS in two samples (Large sample of 61 countries and higher productivity of 25 countries)	1960 to 1985 (25 years) Developed and developing	Machinery and equipment investment is strongly and positively associated with growth. There is a strong association positive between machinery and equipment Investment with economic growth. Compared to its private return, government's investment in equipment has relatively high social return.
1992	Mankiw et al	A contribution to the empirics of economic growth.	OLS Regression	i. Non-oil – 98 countries ii. INTER – 75 countries iii. OECD – 22 countries Developed and developing	1. Increased income is a factor of savings level, population and education. 2. Increased savings rate increases the level of human capital at the steady state which in turn raises total factor productivity. 3. Population growth rate negatively affects income per capita since the available capital and human capital becomes insufficient to improve total factor productivity.

Years	Title	Title/objective	Method	Data	Result
1993	Easterly and Rebelo	Fiscal Policy and Economic Growth	Cross country Regressions	Developed and developing Historical data (1870 – 1988) for 28 countries Cross Country data (1970 – 1988) for 100 countries	Public expenditure in transport and communication strongly enhance growth. Budget surplus encourages private investment and growth. equitable income distribution boosts growth more than political system.
1996	Devarajan et al	The Composition of Public Expenditure and Economic Growth.	OLS	43 developing countries (1970 – 1990) 20 years	Capital expenditure is negatively associated to per capita GDP growth. Current expenditure is positively related to economic growth. Spending on health and education is insignificant and negatively related to growth Transport and communication expenditure is negatively correlated with growth Total current expenditure is positive. Total capital expenditure is negative. Spending on defence and economic infrastructure is positive.
1997	Keefer and Knack	Why Don't Poor countries Catch up?	Cross country regressions	Developed and developing countries 196 – 1989	Institutions play a key role in determining economic growth of countries. Business risk has the most effect as countries tend to diverge as it increases. The interactions with institutional variables are positive and significant for all results.
1997	Miller and Russek	Fiscal Structures and Economic Growth: International Evidence	Fixed and Random-effects model and OLS method	44 countries 1975 – 1984 Developed and developing	Revenue-financed increase in spending improves growth in developing countries but reduced growth in developed countries. Debt-financed defence spending is negative to growth in developing countries but positive in developed countries. Health and social security expenditures increases through debt reduces economic growth in developing country but has no significant effect on growth developed countries.

Years	Title	Title/objective	Method	Data	Result
1997	Kelly	Public expenditures and Growth	OLS	1970 – 1989 73 developing countries	Private investment increases growth. Aggregate education expenditure reduces growth For developing nations, expenditure in high tertiary education retards growth while it promotes growth in developed nations. Aggregate health expenditure is negative and not significant for growth. Expenditure on social security promotes economic growth.
1997	Easterly and Levine	Africa's Growth Tragedy: Policies and Ethnic Divisions	Growth Regressions using SUR	1960s – 1980s Over 30 years 47 Sub-Saharan African Countries including dummies for Latin America and Caribbean Countries	Ethnic diversity is responsible for slow growth in Africa since it promotes growth-reducing policies. Telephone per worker is positively related to growth. Percentage of paved roads is positively related to growth. Low income causes low convergence. Political instability deters growth. Educational attainment promotes growth.
1997	Feng	Democracy, Political Stability and Economic Growth	3 Stage Least Squares Method	96 Countries; 1960 – 1980	Irregular government change has a significant negative effect on economic growth while regular change has significant positive effect on economic growth. Democracy has positive effect on growth.
1999	Kneller et al	Fiscal Policy and Growth: Evidence from OECD Countries	Panel data (Fixed Effects)	22 developed countries (1970 to 1995)	Productive expenditures promote growth while non-productive expenditures are not significant to growth. Taxation produces distortionary effects except that of domestic goods and services.
1999	Esfahani and Ramirez	Institutions, Infrastructure and Economic Growth	2 stage least squares method (2SLS)	78 countries from 1965 – 1995 (Developed and developing) Africa, South Asia and China, MENA, Latin America, East Asia and OECD and others	There is a significant positive relationship between average infrastructure investment and per capita GDP growth. Investment in infrastructure play a very crucial and significant role in driving growth. Credible institutions foster infrastructure-led growth.

Years	Title	Title/objective	Method	Data	Result
2000	Ahmed and Miller	Crowding-Out and Crowding-In Effects of Components of Government Expenditure	Fixed Effects	39 countries (23 developed and 16 developing) 1975 – 1984	Spending on transport and communication crowds-in investment. Aggregate government spending boosts investment in developing countries but reduces same in developed countries. Trade crowds in investment in developing countries. Social security and welfare spending is negative to investment regardless of financing method. Tax-financed public spending crowds-out investment more than debt-financed.
2002	Scarpetta and Bassanini	The Driving Forces of Economic Growth: Panel Data Evidence for the OECD Countries	Pooled Mean Group Panel Data	21 OECD Countries (1971 – 1998)	Physical capital accumulation, human capital and R&D drives economic growth. Technological innovation should be incorporated into new capital to maximise growth effects.
2003	Barro	Determinants of Economic Growth in a Panel of Countries	3 Stage Least Squares Method	113 countries (1965 – 1995) Developed and developing countries	Initial human capital promotes convergence. Good health indices promotes growth. Consumption is detrimental to growth.
2003	Esfahani and Ramirez	Institutions, Infrastructure and Economic Growth	Instrumental Variables and 2 Stage Least Squares (2SLS)	1965 to 1975 75 countries	Infrastructure has a substantial positive effect on growth. institutional reforms improves economic outcomes. Ethnolinguistic heterogeneity (ELH) is negative to growth. Population density is negative to growth
2004	Nijkamp and Poot	Meta-Analysis of the effect of Fiscal Policies on Long run growth	Meta-Analysis using Rough Set Analysis	Publications from 1983 – 1998	Share of investments in GDP is positively correlated to growth. Education expenditure is positively related to growth. Studies on growth effects of education and infrastructure should be scaled down to microlevel in order to generate results for policymaking

Years	Title	Title/objective	Method	Data	Result
2005	Loizides and Vamvoukas	Government Expenditure and Economic Growth: Evidence from Trivariate Causality Testing	Bivariate and Trivariate Causality Testing	1948 – 1995 3 countries (Greece, UK and Ireland)	Economic growth causes increased in government size for Greece and UK if inflation is controlled. Increase in expenditure increases growth of national income. Increase in output causes increased growth in Greece.
2006	Drury et al	Corruption, Democracy and Economic Growth	Time series Cross Sectional Analysis	1982 – 1997 Over 100 countries	Corruption has no significant effect in democratic economies but negatively affects growth in non-democracies.
2008	Mo	Government Expenditure and Economic Growth: the Supply and Demand Sides	OLS	1970 – 1985 146 countries (Barro and Lee, 1994 dataset)	Human capital is positively related to growth but education expenditure is negative. Government consumption is negatively related to real GDP per growth rate. Public investment is positively related to productivity growth. Resource reallocation from other sectors to investment yields higher growth rate of GDP and productivity
2007	Bose et al	Public Expenditure and Economic Growth: A Disaggregated Analysis for Developing Countries	Ordinary Least Squares Method	30 developing countries (1970 – 1980)	Total capital spending is positively related to growth. Defence, transport and communication expenditure have no effect on growth.
2010	Afonso and Fuceri	Government size, composition, volatility and economic growth	Combined Cross Section Time Series Regression	28 Countries (15 EU and 13 OECD) (1970 – 2004)	Government size is detrimental to growth. Government investment is not significant to growth.
2010	Wu et al	The impact of government expenditure on economic growth: How sensitive to the level of development?	Panel unit root tests and causality tests	182 countries 1950 - 2004	Government expenditure shares positive relationship with economic growth. Government expenditure shares no significant relationship with growth in low income countries.

Years	Title	Title/objective	Method	Data	Result
2011	Butkiewicz and Yanikkaya (2011)	Institutions and the Impact of Government Spending on Growth	Seemingly-Unrelated Regression (SUR)	100 countries using 2 sets of data 1970 – 1999 and 1990 to 2004	Consumption expenditures has negative effect in developing nations with poor institutions Capital expenditures have positive effect in developing nations with poor institutions Infrastructure expenditures have positive effect in developing nations Rule of law is significantly related to growth in all sample and positive in developing countries which maintain rule of law.
2013	Aisen and Veiga	How does Political Instability affect Economic Growth?	GMM Technique	169 countries (1960 – 2004)	i. Political instability negatively affects investment. ii. Leads to or create uncertainty about future. iii. Inefficient resource allocation creates reduce R&D efforts of government. Misallocation of resources. iv. Negatively affect human capital accumulation.
2016	Connoly and Li	Government spending and economic growth in the OECD countries .	GMM Technique	34 OECD countries (1995 – 2011)	Public social spending is negative and significant to growth. Consumption spending – not significant Public investment spending – not significant.
2016	Gemmell et al	Does the Composition of Government Expenditure Matter for Long-Run GDP Levels?	Pooled Mean Group (PMG)	17 OECD countries (1970 – 2007)	Means of expenditure financing matters for economic growth. Reallocating total expenditure in favour of infrastructure and education is positively related to long-run output levels. While reallocation of expenditure in favour of recurrent expenditure is negatively related to long run output levels.
2020	Sidek and Asutay	Do government expenditures and institutions drive growth? Evidence from developed and developing economies	Two Step GMM Estimator	121 Countries (91 Developing; 30 Developed) 1984 to 2017	Consumption expenditure is detrimental to growth. Development (investment) expenditure promotes growth. Good institutions promotes economic growth

2020	Chu et al	The Impact of Productive and Non-Productive Government Expenditure on Economic Growth Empirical Analysis in high-income versus low-to-middle income economies	OLS Fixed Effects and GMM Techniques	59 countries (37 High Income and 22 low to middle income countries) 1993 - 2012	Income is not a major factor. Productive expenditure promotes growth while non-productive expenditures retards growth.
2020	Kutasi & Marton	Long Term Impact of Public Expenditures on GDP-Growth	First Differences GMM, FE panel and OLS models	25 EU Countries 1996 – 2017	Recurrent expenditures have significant negative relationship on GDP growth. Education and health spending has positive impact on GDP growth.
2021	Arvin et al	Are there links between institutional quality, government expenditure, tax revenue and economic growth? Evidence from low-income and lower middle-income countries	Panel Vector Error correction model	51 LICs and LMIC (2005 – 2019)	Institutional quality, government expenditure, tax revenue propels economic growth in LICs & LMICs in the long run
2021	Afonso et al 2021	The impact of institutions on economic growth in OECD countries	2SLS and IV method	1995 – 2021 36 OECD countries	Institutional quality is a key determinant of growth in highly indebted developed economies. The interaction of institutional variable and debt produces significant positive effect.
2022	Nguyen and Bui	Government Expenditure and Economic Growth: Does the Role of Corruption Control Matter?	GMM and Threshold Model	16 countries in Asia 2002 – 2019	Consumption expenditure and corruption control are negatively related to growth. The interaction of government expenditure and corruption control reduces the impact on growth.
2022	Afonso	The Impact of Institutions on Economic Growth in OECD Countries	Panel data analysis with 2 stage least squares	28 OECD Countries 2011 – 2017	Index of freedom (IDF) contributes significantly to efficiency of labour and thus to growth.

2023	Nedanovski & Kocevska	Rule of Law and Economic Growth: Evidences from South East Europe	Fixed Effects; OLS	10 countries (1996 – 2020)	Abiding by the rule of law promotes contract enforcement and property rights protection. It also encourages trust in law enforcement and judicial system
2023	Qehaja et al	The Relationship Between Government Health Expenditure and Economic Growth: Evidence from Western Balkan Countries	OLS FE RE	2000 - 2020 7 countries	Public expenditure in healthcare has positive relationship with human capital and thus enhances productivity and overall economic performance.
2024	Hu & Wang	Economic growth effects of public health expenditure in OECD countries: An empirical study using the dynamic panel threshold model	Dynamic Panel Threshold Model	33 OECD countries (2001 – 2017)	Public health spending has positive effect on economic growth.

APPENDIX II – DESCRIPTIVE STATISTICS OF REEAL GDP PER CAPITA ACROSS 67 COUNTRIES

	Country	Mean	Min	Max	SD
1	Angola	6372.252	3914.905	8699.621	1451.321
2	Argentina	18803.08	13716.78	24249.54	3274.459
3	Armenia	7102.853	2695.644	12129.14	3437.99
4	Austria	42634.53	30531.34	51157.91	6945.791
5	Bahrain	47174.77	40503.51	51593.87	3027.612
6	Belgium	37149.13	27132.87	44691.29	5732.826
7	Bolivia (Plurinational State of)	5494.49	4223.39	7962.2	1068.834
8	Brazil	12228.11	10011.48	15544.06	1724.195
9	Bulgaria	12426.78	9064.621	18785.55	3110.471
10	Chile	14934.3	7134.004	22919.82	5115.015
11	China, Hong Kong SAR	32518.89	17655.37	48520.36	9313.485
12	Colombia	9474.848	6914.988	13448.73	1911.384
13	Costa Rica	12032.02	8251.221	17634.35	2914.065
14	Croatia	19729.86	12482.88	25227.56	3983.841
15	Cyprus	25308.51	15126.4	33187.23	5465.021
16	Czech Republic	25940.99	19053.69	33901.3	4987.658
17	Denmark	42838.63	32587.83	50437.68	5560.229
18	Dominican Republic	9280.06	5664.604	15994.3	3092.265
19	Egypt	8460.564	5358.764	11771.24	2091.08
20	Estonia	20119.96	10993.37	29430.93	6479.348
21	Finland	35289.63	25231.54	44917.57	6668.513
22	France	36494.6	27958.42	41981.26	4623.342
23	Greece	25800.31	20680.26	34146.12	4180.531
24	Guatemala	6064.963	4909.499	7433.484	783.2166
25	Hungary	19137.87	14390.63	25734.2	3586.948
26	Iceland	35924.56	26526.39	47990.8	6731.62
27	Indonesia	6159.17	3335.855	10247.09	1980.266
28	Iran (Islamic Republic of)	10379.39	7111.34	13721.29	1990.873
29	Ireland	47621.48	22636.25	80520.55	17313.23
30	Israel	29008.24	19799.21	38259.65	5462.798
31	Italy	38433.26	29492.57	43669.28	3998.584
32	Jamaica	7977.436	6280.939	8758.467	667.5687
33	Jordan	10189.71	8076.541	12335.5	1286.381
34	Kazakhstan	16313.68	8976.571	25579.73	6002.339
35	Kenya	3136.383	2837.624	3951.465	293.6475
36	Kuwait	59888.1	20219.29	83629.14	15431.45
37	Latvia	16812.38	8726.422	25998.47	5858.521
38	Lithuania	17356.5	9107.047	28170.61	6055.571
39	Luxembourg	70610.87	38356.1	92975.35	16966.67
40	Malaysia	14455.06	7690.306	23144.52	4594.865

	Country	Mean	Min	Max	SD
41	Malta	20133.45	10611.27	33142.67	6034.928
42	Mongolia	5549.158	3541.462	10123.86	2077.831
43	Namibia	7329.106	5777.137	10353.42	1471.083
44	Netherlands	43302.67	30538.74	52823.72	7465.598
45	Norway	58520.32	41034.03	69721.13	9773.675
46	Peru	7362.481	4903.132	11858.31	2138.437
47	Philippines	4846.033	3764.961	7473.81	1035.249
48	Poland	16754.03	10181.35	27682.99	5531.928
49	Portugal	25229.26	16095.9	29613.36	4188.513
50	Qatar	96400.36	67904.77	120747.9	20132.32
51	Republic of Korea	23076.06	7497.522	39711.06	10098.97
52	Republic of Moldova	6237.904	3952.582	11232.64	1880.017
53	Russian Federation	20065.1	12726.62	26933.79	5082.499
54	Serbia	10902.49	5388.886	15668.67	3437.48
55	Slovakia	17166.08	10251.65	25713.26	5174.463
56	Slovenia	24463.02	16439.78	31351.55	4876.988
57	South Africa	11034.98	9396.513	12918.65	1232.996
58	Spain	31759.2	21455.62	38792.3	5409.707
59	Sweden	39753.09	30060.82	51085.26	6967.237
60	Switzerland	63347.13	52606.01	73132.7	6179.025
61	Thailand	10155.97	4351.56	16076.09	3499.162
62	Trinidad and Tobago	19149.56	11034.2	29259.37	7366.485
63	Tunisia	7764.91	5201.223	10827.38	2042.842
64	Turkey	15744.76	9850.401	25153.71	4441.552
65	Ukraine	11556.29	7436.042	17592.26	2790.885
66	United Kingdom	35685.25	24369.23	43620.47	6144.939
67	Zambia	2241.163	1727.359	3148.112	473.5677

APPENDIX III

Higher Order Least Squares (HOLS) Test

```
> unlist(dimnames(x) [2]) [which(mytest$pval <0.05)]
[1] "hl_pctgdp" "rtfpna"
> unlist(dimnames(x) [2]) [which(mytest$pval.corr <0.05)]
[1] "rtfpna"
> unlist(dimnames(x) [2]) [which(mytest$pval.sim <0.05)]
```

Coefficients	Points Estimate	Boots SE	Lower Boots CI(95%)	Upper Boots CI(95%)
com_pctgdp	5046.51	1125.74	3324.13	7647.80
hl_pctgdp	842.58	575.54	-357.23	1905.37
hc	25133.67	1641.08	22028.53	28376.77
rtfpna	4059.60	4859.14	-5212.66	13993.98
govtstab	199.55	87.08	26.95	364.59
corrupt	-443.59	279.84	-975.25	146.79
laworder	432.18	291.30	-122.24	1031.88
Pstar.hl_pctgdp	-246.72	425.07	-1035.19	610.44
PStar.rtfpna	1367.74	310.17	737.18	1938.34

Number of bootstraps: 1000

Continuous endogenous variables: hl_pctgdp, rtfpna