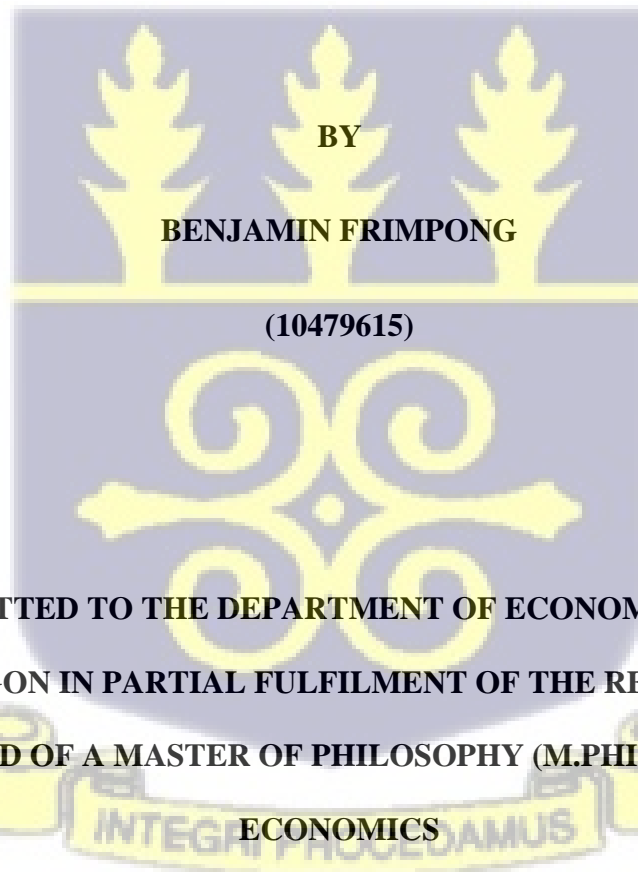


**UNIVERSITY OF GHANA, LEGON**

**DEPARTMENT OF ECONOMICS**



**EFFECTS OF PUBLIC DEBT ON PUBLIC INFRASTRUCTURE  
INVESTMENT IN GHANA**



**BY**

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**A THESIS SUBMITTED TO THE DEPARTMENT OF ECONOMICS, UNIVERSITY  
OF GHANA, LEGON IN PARTIAL FULFILMENT OF THE REQUIREMENT FOR  
THE AWARD OF A MASTER OF PHILOSOPHY (M.PHIL) DEGREE IN  
ECONOMICS**

**OCTOBER, 2022**

**DECLARATION**

I, BENJAMIN FRIMPONG, hereby declare that this thesis is an original research undertaken by me under the guidance of my supervisors; and with the exception of references to other people's work which have been duly cited, this thesis has neither in part nor in whole been submitted for another degree elsewhere.

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## DEDICATION

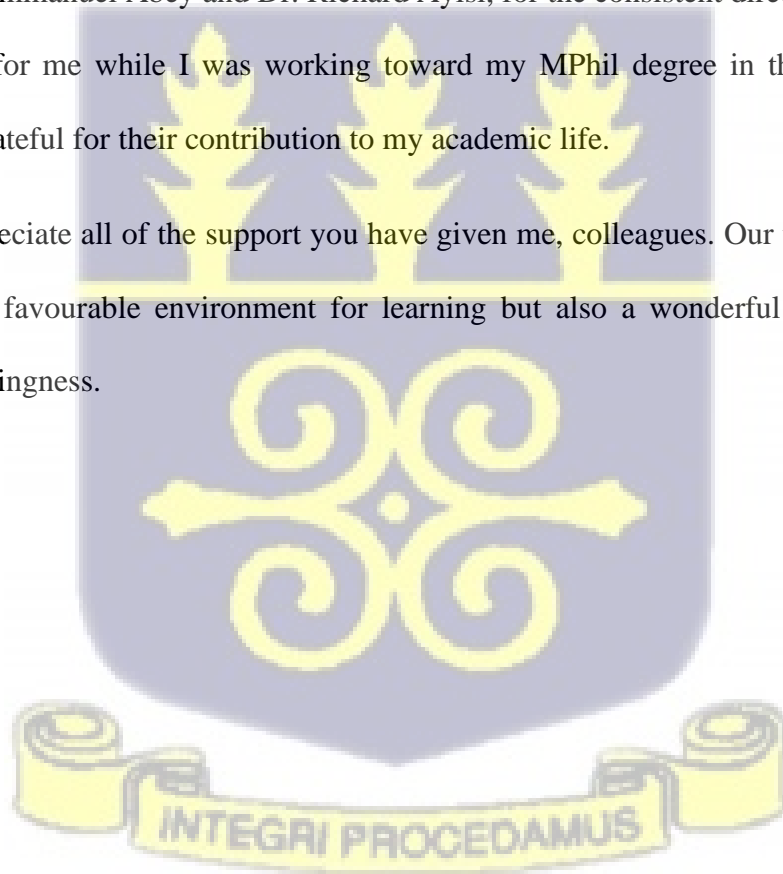
This thesis is dedicated to God Almighty, my mother, Madam Cecilia Boampong, and my father, Mr. Benjamin Kaakyire Frimpong, who have been the anchors of my educational achievements at every stage, and finally to everyone who has imparted knowledge to me through teaching and research.



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I sincerely appreciate all of the support you have given me, colleagues. Our time together not only created a favourable environment for learning but also a wonderful and exceptional sense of belongingness.

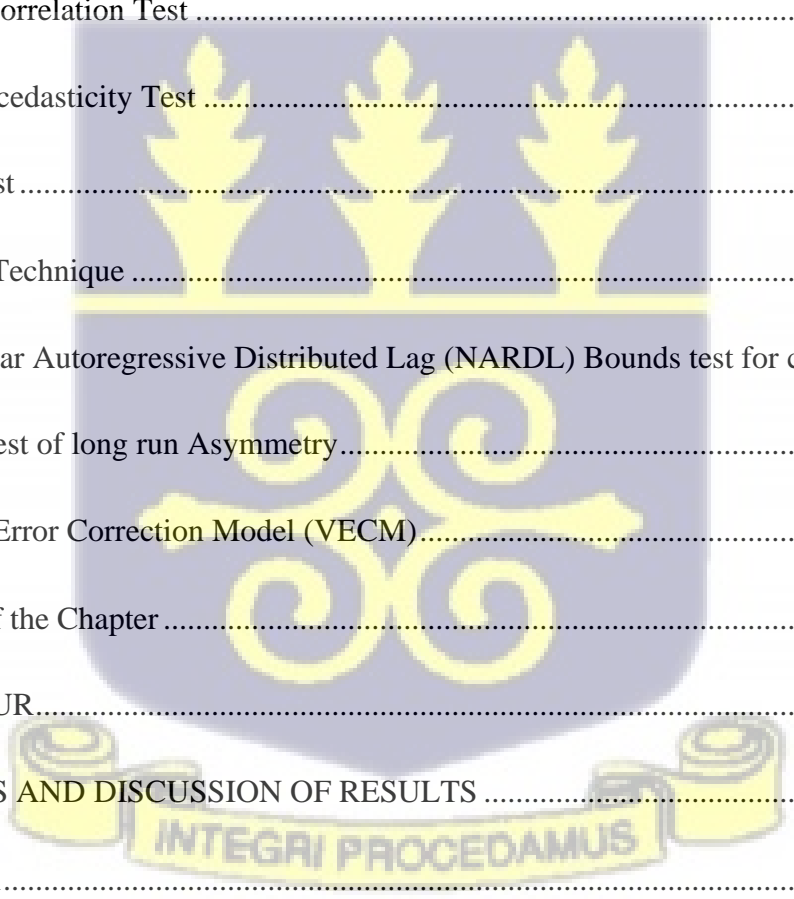


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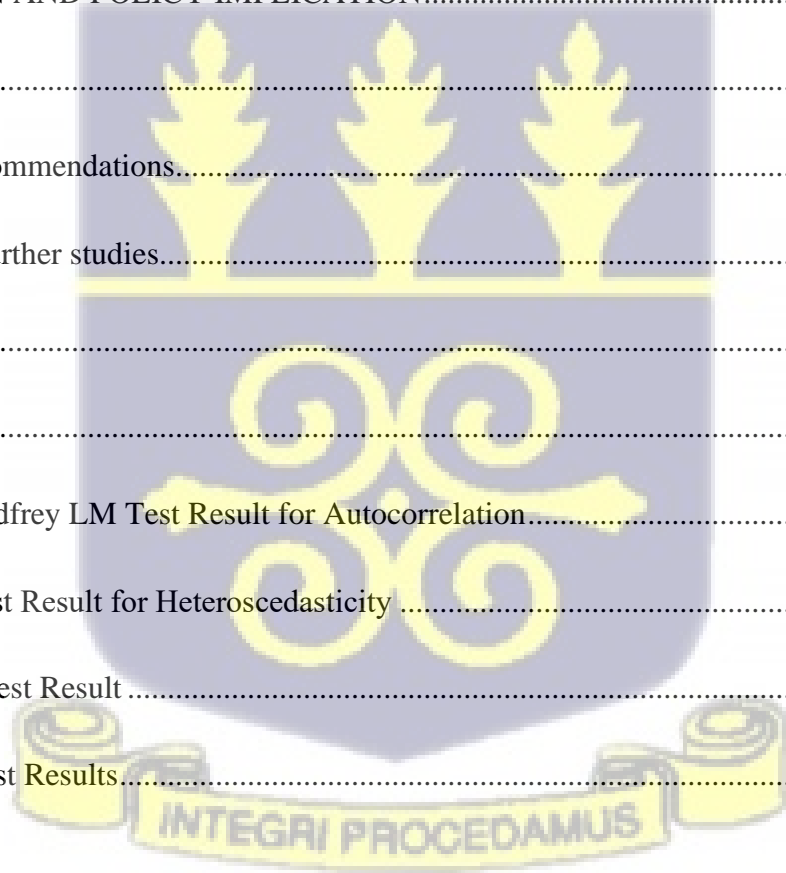
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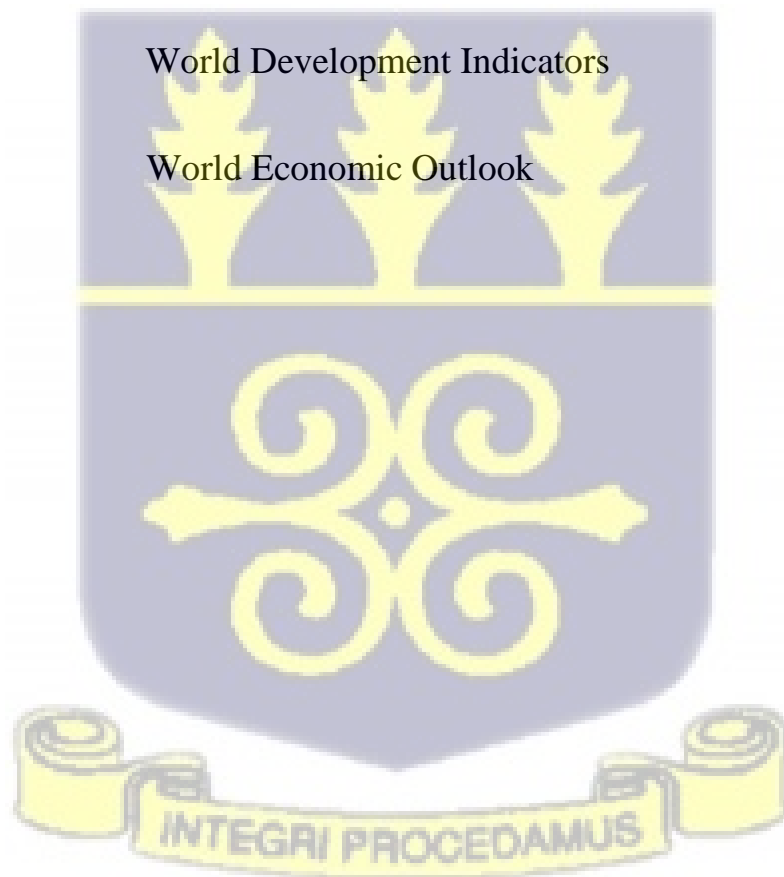
## ACRONYMS

ADF	Augmented Dickey Fuller
AEO	Authorized Economic Operator
AfDB	African Development Bank
AFRODAD	Africa Forum and Network on Debt and Development
AIC	Akaike Information Criterion
ARDL	Autoregressive Distributed Lag
CUSUM	Cumulative Sum
DEDH	Direct Effect of Debt Hypothesis
ECM	Error Correction Model
ECOWAS	Economic Community of West African State
EMU	Economic and Monetary Union
ERP	Economic Recovery Programme
EU	European Union
FDI	Foreign Direct Investment
GDP	Gross Domestic Product
GEPA	Ghana Exports Promotion Authority

GIPC	Ghana Investment Promotion Centre
GLS	Generalized Least Square
GMM	Generalized Moments of Methods
GNI	Gross National Income
HIPC	Highly Indebted Poor Countries
HQIC	Hannan-Quinn Information Criterion
IDA	International Development Association
IMF	International Monetary Fund
LCH	Liquidity Constraint Hypothesis
MOF	Ministry of Finance
MPS	Marginal Propensity to Save
MTDS	Medium-Term Debt Strategy
NARDL	Nonlinear Autoregressive Distributed Lag
OLS	Ordinary Least Squares
OPEC	Organization of the Petroleum Exporting Countries
PCSE	Panel Corrected Standard Error
PP	Philip Perron

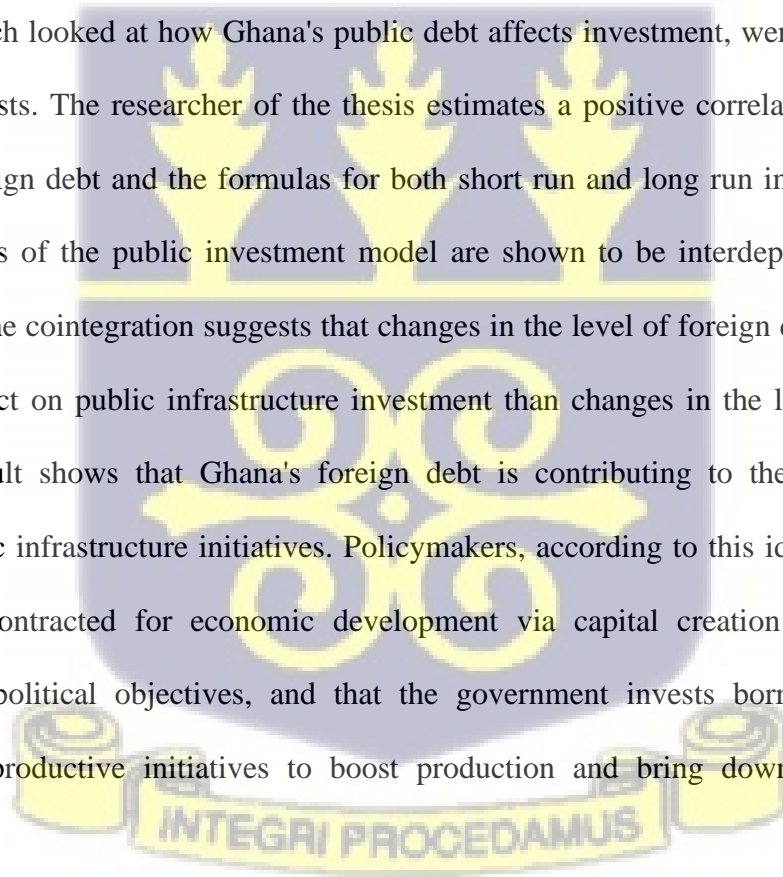
SAP	Structural Adjustment Programme
SBIC	Schwarz Bayesian Information Criterion
SOE	State-Owned Enterprise
SSA	Sub-Saharan Africa
VAR	Vector Autoregression
VECM	Vector Error Correction Model
WAMZ	West African Monetary Zone

WDI	World Development Indicators
WEO	World Economic Outlook



## ABSTRACT

As a nation, Ghana's mounting public debt has been a major issue throughout its economic history. Over the last three decades, Ghana's public debt position has deteriorated, with the government acquiring more and more debt and growing increasingly at risk of default. Ghana's national debt is so high that the country's infrastructure projects have not benefited from the government's heavy expenditure and borrowing. These two cases emphasize the need for more research on the connection between public debt and infrastructure expenditure by the government. In this study, we take a fresh look at the correlation between debt and investment in Ghana. The inputs to a second study utilizing the NARDL cointegration technique, which looked at how Ghana's public debt affects investment, were the findings of the unit root tests. The researcher of the thesis estimates a positive correlation between the amount of foreign debt and the formulas for both short run and long run investments. Long run components of the public investment model are shown to be interdependent using the Bounds test. The cointegration suggests that changes in the level of foreign debt have a more significant effect on public infrastructure investment than changes in the level of domestic debt. This result shows that Ghana's foreign debt is contributing to the funding of the country's public infrastructure initiatives. Policymakers, according to this idea, should make sure debt is contracted for economic development via capital creation rather than for egotistical or political objectives, and that the government invests borrowed money in economically productive initiatives to boost production and bring down the debt load.



## CHAPTER ONE

### INTRODUCTION

#### 1.1 Background of the study

The global debt crisis of the 1970s and 1980s was caused and maintained in large part by poor debt management practices used by middle-income countries (Marquez, 2000). The Organization of the Petroleum Exporting Countries (OPEC) was responsible for the increase in the price of oil that occurred in 1973. As a direct consequence of this event, the member nations of OPEC deposited a significant portion of their windfall with commercial banks. In order to make the most of their resources, organizations that have received help from OPEC have invested in countries that are still in the process of developing. In most cases, a number of these financial institutions will join together in order to provide assistance to a developing nation that is extremely rich as a result of an abundance of an essential primary commodity or "good" infrastructure advances (countries such as Indonesia, Mexico, Brazil, Korea, etc.).

The term "syndicated loans" refers to bank loans that are made available to a number of different borrowers. The vast majority of these loans were granted to developing countries over lengthy periods of time by commercial banks (or to SOEs with government guarantees). Because of the comparatively low extraction of oil during that time period, there were less constraints placed on banks by international organizations and donor states. A portion of the borrowed money was used for things like acquiring firearms and ammunition, as well as financing private businesses that mostly benefited government officials and a limited set of elites, among other things (Marquez, 2000).

The repayment of the enormous debts that emerging and rising countries had racked up over the previous decades became a priority for these nations as they gained access to greater amounts of short run capital. A significant portion of these nations' debt burdens may be

attributed to borrowing money on short run basis, followed by investments in assets with a longer repayment horizon (Marquez, 2000). Debtor countries continued to struggle to make interest and principal payments as a direct result of the heavy economic blow they sustained as a direct result of the oil crisis that occurred between 1973 and 1974. Despite the fact that the 1973–1974 oil crisis was a key catalyst for imbalances in balance of payments, debtor countries continued to carry over their large debt. (Stambuli, 1998).

At the beginning of the 1980s, the world economy went into a tailspin, which led to irresponsible lending practices on the part of financial institutions, ineffective debtor management, and a debt crisis. As a direct consequence of this, gross domestic product growth slowed as emerging countries took on substantial debt to finance the cost of oil imports and complete development projects that had been initiated in the preceding decade. It was not uncommon for the timeline for paying back loans to fall behind the schedule for financing government projects. As a consequence of this, the government makes significant investments in the pursuit of long run objectives while also racking up new debt. Because of this, governments are unable to charge the taxes required to fulfil the costs of their responsibilities (Krumm, 1985).

The amount of debt held by developing countries rose from \$130 billion in 1973 to \$612 billion in 1982 (IMF, 1984). Since the Mexican government defaulted on its debt and other arrangements with U.S. commercial banks in August 1982, developing nations have been plagued by debt problems (Wellons, 1987). Mexico was not alone in its predicament with regard to the balance of payments. Countless insolvent governments have been forced to make the humiliating admission that they are unable to meet their financial responsibilities. International commercial banks pulled all funding for countries that were being negatively affected by the debt crisis and began concentrating only on recouping the money they had lost.

As a response, the government of the United States collaborated closely with the World Bank and the International Monetary Fund to provide humanitarian assistance funding to nations who were badly afflicted by the crisis. The government of the affected nation was offered funding to fill the "financing gap," but this assistance was contingent on the nation taking the "necessary" measures toward adjustment. These governments were able to provide credit to their constituents because they had access to finances and loans made available to them by the richest nations on the planet. In many cases, the enormous quantities of financial assistance that were required much exceeded the sums of loan money that were made available by the International Monetary Fund and the World Bank (Wellons, 1987).

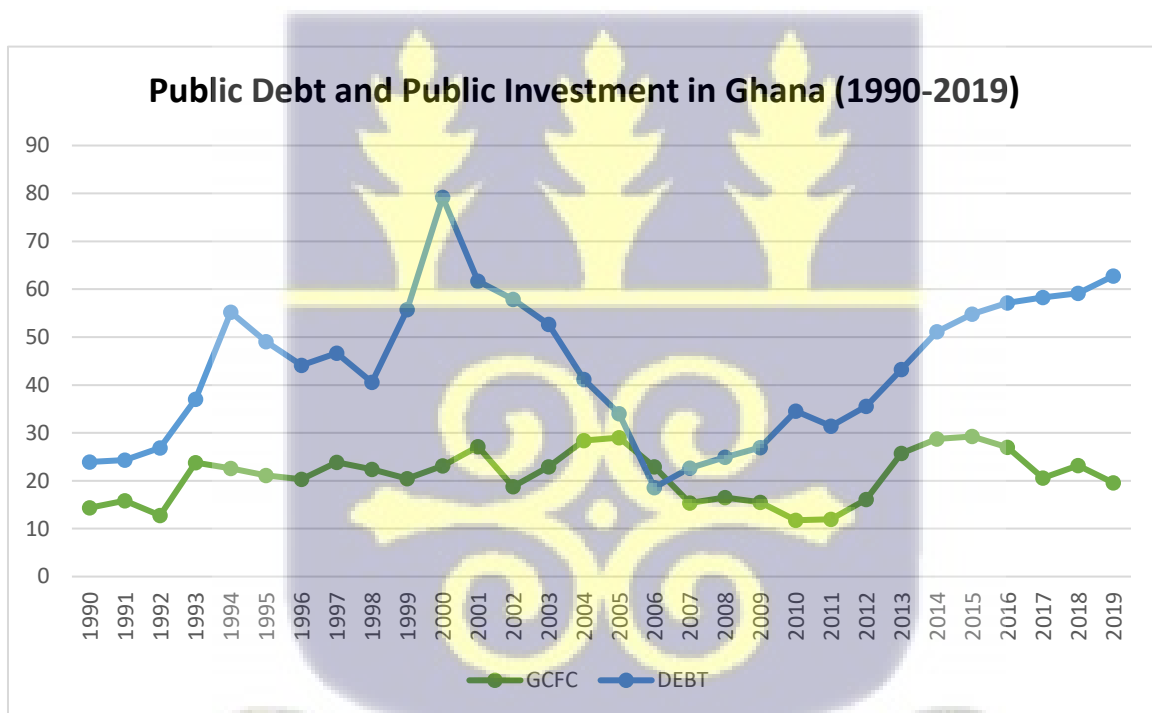
The Paris Club is an association made up of government lenders that helped several developing countries by renegotiating their debt or providing fresh funds in exchange for full repayment. The objective was to motivate individuals to take action that would be beneficial to the economy. These significant loans were guaranteed by the whole of the global society, and the Paris Club was responsible for making their availability possible. It would not have been possible to restructure the Paris Club's debts in the absence of an agreement with the IMF (or for fresh funds to be provided). Official bilateral lenders would only consider providing rescue loans if a new adjustment program agreed upon between the IMF and the target nation has been fully implemented (a loan with requirements from the IMF). In addition, commercial bank lenders sought the advice of the London Club in order to renegotiate the terms of their loan. In contrast to the Paris Club, which maintained a single location for all of its get-togethers, the London Club, often referred to as the British MOF, held its events in various cities and towns all around the United Kingdom on a regular basis.

During the international financial crisis that occurred in 1982, it became plainly evident that a nation's public debt is a problem for all nations, regardless of their size or degree of income. Many people in the industrialized world are concerned about their debt, but the debt

difficulties that are affecting the poor nations are far more severe. It is feasible for developing nations to borrow money to invest in their economies from both local and international financial markets. The money borrowed may be used for either short run or long run investments. Because of this, the total debt of the government will continue to grow. It is necessary to make consistent payments, both toward the principal and the interest, on a significant debt. There goes a cash that may have been invested elsewhere for the sake of expansion. The resources of developing countries are depleted when the cost of debt repayment increases as a consequence of excessive borrowing to cover deficits. This is because excessive borrowing is done in order to cover deficits.

Since the beginning of time that anybody can remember, Ghana's national debt has been a significant obstacle for the economy of the country. Over the last three decades, Ghana's national debt has steadily increased, eventually reaching levels that are insurmountable (Ministry of Finance, 2020). This was reinforced by the Ghana Financial Sustainability Report for 2017, which found that the country is very susceptible to a financial catastrophe owing to the enormous quantity of foreign debt it carries (IMF, 2017). According to the findings of the research, the primary factors contributing to the country's current economic predicament are fiscal leakages. These include excessive levels of foreign debt, inefficient debt, and insufficient cash management. The Ghanaian Ministry of Finance's Annual Public Debt Report for 2020 reveals that the country's public debt reached 76.1% of GDP in 2020, up from 62.4% in 2019 and 57.6% in 2018. Because the minimum requirement for participation in ECOWAS is 70.06 percent, this is more than that. The cost of servicing the government's debt has surged in recent years and has reached a level that cannot be maintained as a percentage of total tax revenue (Aimola & Odhiambo, 2021). Due to the fact that a significant portion of national income is used to pay off debt, the nation is vulnerable to shocks and is suffering from an infrastructure deficit that is becoming worse.

Ghana has been weighed down by an enormous amount of national debt ever since the country's debt was written off in the year 2004. The government of Ghana has amassed a considerable amount of debt but has not put any of that money into improving the country's infrastructure. In contrast to the situation in the majority of other African nations, the public debt in Ghana is far higher than the country's investment in infrastructure. The government of Ghana took out loans and spent the proceeds in various public works projects beginning in 1990 and continuing through 2019. The ratio of the national debt to GDP is the most reliable measure of the extent to which the government borrows money, while the ratio of gross fixed capital production to GDP is an adequate proxy for the extent to which the government spends money on infrastructure.



**Figure 1.1: Public Debt and Public Investment in Ghana**

Source: IMF (2021) and World Bank (2021)

Over the last three decades, Ghana's national debt stock has seen considerable shifts. Debt as a percentage of GDP in Ghana climbed from 23.9% in 1990 to 79.2% in 2000, as reported by the International Monetary Fund (IMF), highlighting the country's urgent need to address its

mounting debt. During the debt reduction phase, the federal government's debt ratio dropped from 61.7% in 2001 to 34% in 2005. As a result, Ghana's national debt has risen from 18.6% in 2006 to 34.6% in 2010 to 62.7% in 2019. This means that despite gains in public debt due to debt reduction, the debt stock remains expanding with inputs from both international and local debt.

Generally speaking, domestic debt and international debt make up the two main categories that make up Ghana's total debt. Due to the high level of government borrowing in Ghana, a large amount of the country's public debt was made up of foreign debt prior to the debt reduction in 2004 (Fosu, 2001). As a proportion of overall debt, external debt has been declining in recent years. Over fifty percent of the public debt stock was made up of domestic debt as of the end of December 2020. As a result, in 2020, domestic debt will be 51.4%, up from 48.0% in 2019, while foreign debt will be 48.6%, down from 51.7% (Ministry of Finance, 2020).

The infrastructure project (public investment) is very small compared to Ghana's massive national debt. Public investment as a share of GDP in Ghana increased from 14.4% in 1990 to 23.1% in 2000. Nonetheless, government spending decreased from 22% in 2000 to 16% in 2019. According to the World Bank's Development Indicators, 2021. Figure 1 depicts an increase in Ghana's state debt over the same time period.

There is a widespread agreement that public investments in infrastructure are a vital and efficient approach to spur economic growth. An increase in public infrastructure spending boosts the fiscal multiplier in the near run, which in turn boosts aggregate demand. The extent to which this works depends on the state of the economy (Auerbach and Gorodnichenko, 2013). Debt-to-GDP ratios change as a direct consequence of this, with the direction dependent on the magnitude of the fiscal multiplier and the income-to-output

elasticity. In the same way that domestic savings are insufficient in many other debtor countries, they are also inadequate in Ghana to fund infrastructure development projects like constructing roads, installing electricity, and installing piped water.

Because of limited tax receipts, the government must borrow money to pay infrastructure projects, but Ogunmuyiwa (2010) asserts that politicians are afraid to take this risk by printing more money. Based on their research, Erickson and Owusu-Nantwi conclude that Ghana's tax system is inefficient, and as a result, the country's government is unable to raise sufficient revenue to close its budget deficits (Erickson, Owusu-Nantwi, 2016). This is due to the fact that taxes are not sufficient to sustain Ghana's economy on its own. The logical conclusion is that taxes is a poor choice for funding government operations and programs. Ghana's economy is highly dependent on physical infrastructure (public investment). Nonetheless, public infrastructure projects often use debt financing due to their massive size, asymmetrical form, and extended lifespan. Ghana has a history of fiscal crises and is very vulnerable to both regional and global economic uncertainty, making the issue of public debt limits a recurrent one. It might lead to a decline in the quality and quantity of public infrastructure spending. According to Al-Dughme (2019), public infrastructure investment helps the economy thrive by creating jobs and decreasing poverty. Ghana's large public debt is a necessary evil for the country's much-desired economic growth and prosperity. Not enough infrastructure has been built despite extensive use of credit and debt for growth (International Labour Office, 2017).

Inadequate funding for the expansion of Ghana's power grid has severely hampered the country's industrial sector, resulting in decreased production and fewer jobs. Given this setting, this study's overarching objective is to evaluate how borrowing policies have affected the growth of Ghana's public utilities from 1991 to 2020.

## 1.2 Statement of the problem

Infrastructure in Ghana is notably inferior to that in other developing and middle-income nations worldwide, particularly in Africa. The African Infrastructure Country Diagnostic reveals as much (2010). Therefore, when compared to the finest countries in Africa, Ghana has poor infrastructure (African Development Bank, 2012). To maintain its present rate of economic growth, Ghana must make huge investments in economic and social infrastructure, but the country's high level of public debt hinders this. With a growing population and economy, the country's deteriorating infrastructure is feeling the strain (International Labour Office, 2017).

The Economic Recovery Program (ERP) and the Structural Adjustment Programs (SAPs) implemented in Ghana in the 1980s laid the groundwork for the country's economic growth and development. These suggestions aim to boost investment and exports via a variety of fiscal and monetary policies. The investment was a crucial factor in the economy's recovery. Liberating the financial sector and taming inflation via a surplus of liquidity were the primary goals of the Bank of Ghana's monetary policy. The demand for increased liberalization in the financial industry has made it easier and cheaper for businesses to get credit from commercial banks. To that end, it was decided to look for support from the business sector. More money should be invested in the country if taxes and levies on machinery and tools were eliminated as a consequence of these measures (Baffour, 1995). The country of Ghana's economy has grown, thanks to these efforts. Since 1984, the average investment rate as a share of GDP has been 27.57 percent, and this rate is expected to remain stable in the years ahead (World Bank, 2021; IMF, 2021). Fast increases in investment and GDP per capital have typically relied heavily on public debt due to dependence on foreign loans and assistance to fuel economic expansion and consumption (Attefah and Enning, 2016).

To maintain sustainable levels of national debt, the West African Monetary Zone (WAMZ) proposes a debt-to-GDP sustainability ratio of 60% for all countries in the West African sub-region. Ghana's debt to GDP ratio was lower than this during 1990 to 1999. Over this time period, debt was quite modest, accounting for just 39.52 percent of GDP on average. Ghana's debt peaked at an alarming 80.2% of GDP in the year 2000. A multitude of issues, such as poor budget management, a shrinking tax base, and rising interest rates, contributed to this. As a result of having its foreign debt forgiven as part of the HIPC programme in 2000, the country's debt to GDP ratio was below the WAMZ 60% sustainability criteria from 2002 to 2017. Debt as a percentage of GDP has increased annually from 2011 to 2019. In 2018 and 2019, the level of debt to GDP ratio exceeded the threshold level. The levels recorded for 2018 and 2019 were 63.2 and 63.9 percent respectively (IMF, 2021; AFRODAD, 2013; Aimola and Odhiambo, 2018).

The connection between debt and infrastructure investment has been investigated by certain developing market economists (Chukwu et al., 2021; Anyanwu, 2020; Ncanywa, Masoga, 2018; Al-Dughme, 2019; Lora, Olivera, 2007; Sanchez-Juarez, Garcia-Almada, 2016). All of these studies show that public debt negatively affects public investment, with the exception of one study by Chukwu et al. (2021) who used the Autoregressive Distributed Lag (ARDL) model and the co-integration test on time series data and found no significant effect of public debt on the public investment in Nigeria. Methods such as panel fixed effect regression, multiple linear regression, and the Autoregressive Distributed Lag (ARDL) model were utilized in combination to get estimates for the relationship between debt and investment. This study used a nonlinear autoregressive distributed delay model to examine the connection between the national debt and public infrastructure spending (NARDL). With positive and negative partial sum decompositions of the relevant variables, Shin et al. (2014) demonstrate

nonlinearities over the short and long run. Once the bounds are established, this model will provide reliable predictions for the foreseeable future.

Using the Generalized Method of Moments, Picarelli et al. (2019) examined the stifling effect of public debt on public investment in 26 European countries (GMM). Adding weight to the debt overhang hypothesis, a study found that a one percentage point rise in EU public debt was linked to a three percentage point drop in EU public investment. Investment seems to be declining as a direct result of the present level of national debt. Ncanywa and Masoga (2018) looked examined South Africa's GDP growth, investment, and state debt from 1995 to 2016. Granger causality, impulse response analysis, and variance decomposition were some of the methods used. The figures show that both debt and spending were falling. Public debt, public investment, and growth in state governments throughout Mexico from 1993 to 2012 were analysed by Sanchez-Juarez and Garcia-Almada (2016) using dynamic panel data models and the generalized method of moments. (GMM). The authors maintain that all investment types involve some kind of government borrowing. Al-Dughme (2019) examined the development of Jordan's economy, government debt, and investment from 1990 to 2017. Multiple linear regression may be used to check whether your hypothesis is sound. This research demonstrates that when debt levels rise, governments reduce their discretionary spending, which includes infrastructure investment. Between 1985 and 2018, researchers Chukwu et al. 2021 analysed how Nigeria's national debt affected the country's public investments. Time series data was analysed using cointegration and autoregressive distributed lag (ARDL) models. It was concluded that the findings did not indicate any impact of Nigeria's public debt on the country's monetary policy (Chukwu et al., 2021).

In order to fully grasp the impact of government accountability on infrastructure investment in Ghana, further in-depth empirical research is required, especially taking into consideration distinct contexts and macroeconomic activity that have occurred since the aforementioned

studies were conducted. The study predicts that between 1991 and 2020, public infrastructure investment in Ghana would decline steadily as a consequence of the country's rising debt. The major goal of this study is to ascertain whether increased debt burdens in Ghana have diminished public infrastructure spending. This research aims to contribute to the current corpus of empirical studies on individual countries by utilizing a nonlinear autoregressive distributed lag (NARDL) technique to investigate the relationship between public debt and public infrastructure investment. We won't be gauging success in this area by using a simplistic metric like the ratio of debt to expenditure on public works. Decomposing the explanatory variables into partial sums of positive and negative values may lead to both short- and long run nonlinearities. Understanding the strength of the correlations between the two variables may be improved by knowing whether the calculated coefficients are positive or negative.

### **1.3 Research questions**

In the light of the above problems, the study addresses the following research questions:

1. Do levels of public debt impact public infrastructure investment?
2. What is the effect of public debt on public infrastructure investment in both the short run and the long run?
3. What are the determinants of public infrastructure investment in Ghana?

### **1.4 Research objectives**

The primary purpose of this research is to analyse the effect of public debt on infrastructure investment in Ghana from 1991 to 2020. Therefore, the following objectives have been established for the study:

1. To analyse the effect of the level of public debt on public infrastructure investment in Ghana.
2. To determine the long run and the short run effects of public debt and public infrastructure investment.
3. To examine the main determinants of public infrastructure investment.

### **1.5 Significance of the study**

This study fills a need in the literature by examining the relationship between debt and infrastructure investment in developing and emerging economies. Policymakers in the Ghanaian government and related parties might benefit from considering the results of this study. Policy conversations concerning the sustainability of public debt and investment may benefit from considering the study's findings.

The findings of this study might aid in reducing the country's infrastructure deficit, which in turn would facilitate economic change and the creation of new jobs. Upgrades would be especially helpful for infrastructure including roads, railways, water systems, and sewage treatment plants.

Furthermore, the study's findings would supplement the current understanding of the most important determinants affecting public investment in Ghana. Some examples of such variables are debt levels, levels of expenditure and investment, income levels, population size, and ease of access to foreign markets. The study results would expand the corpus of information on this tactic. In this study, the coefficient of variation was estimated using NARDL.

At last, the study's conclusions would help educate politicians and other key parties on how to effectively conduct infrastructure projects using borrowed monies. If government officials had this information, they might utilize it to devise strategies to restore the country's

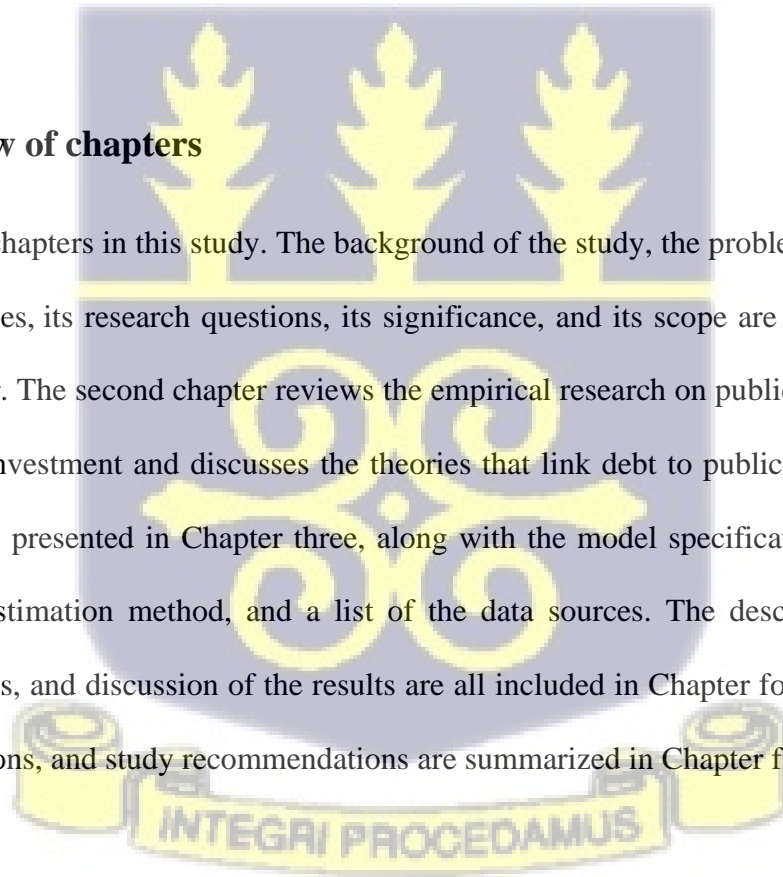
crumbling infrastructure. This study is predicated on the assumption that Ghana, like many other developing nations, is severely indebted. With so much debt, Ghana's administration is struggling to keep the country afloat.

### **1.6 Scope of the study**

This thesis analyses one country using time series data from 1983 through 2020. Research findings should not be extrapolated to the debt crises of other countries in Sub-Saharan Africa (SSA). Due to data limitations, this study was unable to fully account for all of the variables that affect public infrastructure spending. Despite these caveats, this study's variables are in line with the theoretical and empirical literature on public debt and public investment.

### **1.7 Overview of chapters**

There are five chapters in this study. The background of the study, the problem statement, the study's objectives, its research questions, its significance, and its scope are all introduced in the first chapter. The second chapter reviews the empirical research on public debt and public infrastructure investment and discusses the theories that link debt to public investment. The methodology is presented in Chapter three, along with the model specification, a list of the variables, an estimation method, and a list of the data sources. The descriptive statistics, empirical results, and discussion of the results are all included in Chapter four. The findings, study implications, and study recommendations are summarized in Chapter five.



## CHAPTER TWO

### LITERATURE REVIEW

#### 2.1 Introduction

The theoretical and empirical literature on the connections between public debt and public infrastructure investment is examined in this chapter. The theories that link public debt to investments in public infrastructure are covered in the first section, and some empirical evidence is then taken into consideration.

#### 2.2 Theoretical Literature Review

Several indicators may be used to demonstrate the degree to which a country's public debt load is felt in the economy (Baaziz, 2015). The author contends that domestic savings and public investment might be affected by the level of public debt. There are several ways of looking at the connection between public debt and infrastructure spending in the existing research. Debt overhang, liquidity constraints, debt, and the dual-gap are only a few instances of such concepts (Fagbemi & Adeosun, 2020). In this part, we theoretically examine the current connections between governmental debt and investment. However, in this paper we examine the effect of public debt on infrastructure development in Ghana, with a primary emphasis on the neoclassical growth model. The theory predicts that the effect of debt on growth can be ambiguous since it is dependent on the relative growth in output and interest rates. In this theory, private investment is constantly degraded while public investment grows in the presence of high interest rates caused by persistent increases in debt levels. As a result, the impact of public debt on overall investment is also ambiguous. Based on this theory, this study will investigate the potential effects of public debt on investment in Ghana.

### 2.2.1 Debt Overhang Theory

When an organization's existing debt load is too high, it is said to be in a situation of debt overhang (Sach, 1989). Public infrastructure investment and economic productivity, Krugman (1988) argues, are hampered by an ever-increasing debt load (unsustainable debt accumulation). While investigating the factors that determine corporate borrowing, especially the influence of excessive debt on investment choices at the company level, Myers (1977) first developed the debt overhang theory. The primary idea behind the debt overhang hypothesis is that, at some point, a country's level of debt gets so high that it prevents further investment in public infrastructure, stunting the country's economic development. According to Udeh et al. (2016), the burden becomes so great that the majority of the country's income is spent on debt repayment rather than on investments in things like new infrastructure (Udeh et al., 2016). In addition, sovereign governments are affected by debt (Kagan, 2021). In this context, the term refers to a state in which a country's debt levels surpass its projected income. This might be due to the economy's inability to fill available jobs or a continual demand for more credit to address a production deficit. A large debt burden may stifle economic growth and lower standards of life by diverting resources away from essentials like healthcare, education, and infrastructure. There are several ways in which burdens of debt may lead to emotional discomfort. They might make nations and companies halt future expenditure and investment. As a result, investments may be cut down. Overhanging debt may hinder development, making recovery that much more difficult. This study applies the debt overhang theory to analyse how government debt affects spending on public infrastructure in Ghana.

### **2.2.2 liquidity Constraints Hypothesis (LCH)**

Capital market imperfections, such as liquidity limitations, limit the amount of money an individual may borrow or the interest they must pay. The idea of liquidity restrictions suggests that debt repayment may diminish resources that may otherwise be invested in economically beneficial projects (LCH). Poor investment in high-debt emerging nations is due to liquidity constraints, not debt overhang, argue Hoffman and Reisen (1991). This paper argues that a debt liquidity limit should be legally enforced since interest and principal payments reduce the amount of money available for investment (Fosu, 1999). Without access to international financial markets, nations have a liquidity constraint that makes it difficult to make up for shortfalls in private budgetary financing and foreign currency revenues, as stated by Serieux and Yiagadeseen (2001). Given that the vast majority of African countries' loans come from foreign governments, gauging the effectiveness of their public debt (especially external debt) is often their biggest challenge.

### **2.2.3 Debt Hypothesis**

The debt hypothesis posits that external debt's impact on productive variables and the investment mix may reduce productivity even if it plays only a little role in the saving-investment ratio (Fosu, 1996). A subsequent analysis by the same author (Fosu, 1999) suggests that high amounts of foreign debt might stunt economic development and undermine long run stability. In a similar vein, Pattillo et al. (2003) contend that although some governmental debt may not be harmful to the economy, excessive debt build-up is undesirable since it might lead to uncertainty. As a result, investors will no longer consider long run investments to be worthwhile owing to the elevated level of risk and uncertainty they provide. In conclusion, investments with a shorter time horizon are preferred.

#### 2.2.4 Dual-gap Theory

The dual-gap economic theory suggests that a developing country may expect to achieve its economic growth objective with a predetermined amount of borrowing. Thus, the model is centered on the question of how economically weaker states might benefit from international help and financial borrowing the most. The dual-gap hypothesis, according to Presbitero and Panizza (2012), views investment as a function of savings ( $I = f[S]$ ). Putting money aside is a crucial part of any investing strategy. This means that the capital-output ratio and the savings rate are both important factors in economic growth. However, help from outside and domestic savings cannot be substituted for one another. As a result, even if savings are raised in order to make the intended investment, it will still be necessary to import the necessary but now absent capital goods. Therefore, the deficit of foreign currency to buy capital goods cannot be remedied by increasing savings. This indicates there will be a gap in foreign exchange and savings in order to reach the target growth rate. Developing nations are particularly hard hit by this shortage since they are unable to boost exports. The two-gap concept explains why savings and foreign currency are not interchangeable. A lack of local savings or access to foreign cash is a major problem for developing countries. External sources of financing are vital to finance the infrastructure needed to drive growth and to make up for the insufficient level of local savings.

#### 2.2.5 The Classical view on Public Debt and Investment

The impact of public debt on investment, according to classical economists, is ambiguous, depending on the level and activities into which these funds are channelled. Public debt has the possibility to be used for consumption, which would divert resources away from an investment that could be productive to an unproductive activity (consumption). The effect is more pronounced in countries with smaller capital stock levels. Since they can levy taxes and

even borrow money to pay off prior debt, governments are better able and more willing to repay borrowed money than private individuals. The market price (interest rates) of loanable funds rises because of rising demand without corresponding increases in supply, making it very expensive for people to obtain these funds for productive purposes. If the level of public debt is sustainably accepted and the money is used for a productive venture like investment, public debt can support growth. In this situation, borrowing is a legitimate way to raise money for these kinds of activities (Say, 1880).

The source of the fund, according to Mill (2004), determines the impact it will have on investment. It is anticipated that money from outside sources will not have any impact on domestic interest rates. This is because, most of the time, governments and private individuals do not compete for outside funding. Increases in demand will not affect domestic interest rates because external funds could simply be excess funds from the global market. This guarantees that investment does not change. In domestic loanable fund markets, both governments and private parties compete for available funds. Market competition raises interest rates, which in turn discourages private investment and ultimately causes output to decline.

### **2.2.6 Neoclassical View on Public Debt and Investment**

The overall impact of public debt on growth is determined by the relativity of changes in both economic growth and interest rates. The accumulation of sufficient capital to cover a proportionately lower level of investment that will be crowded out by increases in domestic interest rates is ensured if the economy expands more quickly than interest rate increases. The welfare of both the present and future generations is enhanced by this. When interest rate growth exceeds economic growth, the level of crowded investment exceeds accumulated capital. Due to this circumstance, public debt will become an unfavourable option for

financing budget deficits (Saint-Paul, 1992). Most often, tax increases on individuals are used to pay for public debt. This lowers future savings, consumption, and disposable income. Reducing savings lowers the capital stock, which slows the expansion of capital formation. This results in a slowing of economic growth. Increases in taxes to raise the money required to pay for both interest and principal components of both domestic and external debt have the same effect of decreasing utility. When the government depends on domestic debt, the crowding out effect is more common. This is so that government debt can be used in place of actual capital in an individual holder's portfolio. This substitution of "promissory notes" for physical capital deters investment, which lowers output (Diamond, 1965).

### **2.2.7 Keynesian View on Public debt and Investment**

According to the Keynesian perspective, high levels of public debt tend to stifle investment. Two main effects result from financing public expenditures with public debt. The first effect implies that government borrowing is used to fund spending, which raises output. On the other hand, rising public debt will almost certainly result in higher taxes overall. Consumption declines as a result, and the cost of capital rises, making the investment relatively expensive. Both consumption and investment levels fall, which slows the nation's growth rate. The latter effect is essentially insignificant when public debt is at a moderate level. This emphasizes the fact that there will be a favourable effect of public debt on economic growth. Since the level of tax revenue increases in direct proportion to economic growth, an increase in national output will result in higher tax collections without a corresponding rise in tax rates. Debt servicing obligations will be made possible by the increases in tax revenue (Varughese, 1999; Ferreira, 2009).

### **2.2.8 Modigliani's Theory on Public Debt and Investment**

Modigliani (1961) asserted that depending on the direction of change, the impact of changes in the level of public debt can be felt by either the current or following generations. The burden or benefit from a change in the public debt is represented by the interest rate in this theory. Depending on how the money obtained through borrowing is used, this effect may also be offset. The present generation is not responsible for the burden of rising public debt. By lowering the private capital stock, this is transferred to the future generation. If the debt is used to pay for government spending that could boost real income in the future, this decline in private capital stock can be offset. However, when the government lowers the level of public debt, less public money is available for productive public investments that will spur economic growth. This causes a generational divide that generally benefits the current generation. The interest rate is lowered when the amount of public debt is reduced, making it relatively less expensive to increase private capital stock and investment. Future investment and growth are boosted by interest rate reduction.

### **2.2.9 Ricardian Equivalence**

According to this idea, the burden of government spending on society results from inefficiency and waste rather than from inadequate funding sources. This suggests that government will waste money, whether it is obtained domestically through taxation or externally through borrowing. If the government uses debt instruments to borrow money to cover its budget deficit, it will eventually pass the cost to the people in the form of higher taxes, which will raise enough money to cover the debt obligations. In order to boost consumption and delay the burden of debt into the future, the current generation benefits from tax reductions. As a result of this awareness, people will increase their savings and investments rather than their consumption (which would otherwise increase due to a tax

reduction). This sum of investments and savings is assumed to equal the lower tax rate. If taxes are raised in the future, savings and investment will be reduced by the same amount, but consumption will stay the same. In practice, government debt has no impact on investment or consumption levels. This suggests that changes in public debt levels have no impact on either investment or economic growth (Elmendorf and Mankiw, 1999; Roberts, 1942).

### **2.2.10 Crowding out Effect of Public Debt**

According to this theory, increased debt causes higher debt servicing costs, which lowers the desired level of investment into profitable businesses. This suggests that current investment is stimulated by a decrease in debt servicing obligations. The government will invest the money it receives from taxation and export receipts in profitable investment ventures in this case. On the other hand, if debt servicing costs rise, public investment will fall. When private investment is combined with public investment, the level of output will be lower (Diaz-Alejandro, 1981).

## **2.3 Empirical Literature Review**

Citizens have always been interested in how much their government spends and how much debt it has. Studies in recent years have examined the correlation between government borrowing and expenditure, and the results have been all over the map. The amount of money available for public investments may increase or decrease depending on whether or not the government incurs debt. There has been mixed research on the correlation between public debt and investment, with some studies finding a strong positive correlation and others finding none. Savings rates are often low in developing countries, leading to inadequate investment and a budget imbalance. In order to close the savings and investment imbalance, economic downturns will occur in many countries, according to Omoruyi (2005). As Chenery predicted in 1996, this would be accomplished using funds from outside the country. Many

economists feel it is necessary to assess how much public debt hinders economic growth and public investment because of the government's outsized influence on most economies. This is due to the fact that the government plays a pivotal part in the economic well-being of any country (Chenery, 1996).

As a result, experts have noted the significance of public debt in influencing broad macroeconomic trends (Al-zeaud, 2014; Kasidi, Said, 2013; Kumar, Woo, 2015; Sichula, 2015; Sichula, 2012; Herndon et al., 2014). Although most previous works on public debt and investment have focused on the relationship between debt and economic growth, these studies provide the framework for future empirical research on public debt and public infrastructure investment (Vergara, 2004; Alesina et al., 2002; Forni et al., 2009). Almost all respondents thought government policy had a substantial part in deciding whether or not a country would invest, and many thought that high debt service costs would discourage people from taking advantage of investment possibilities. However, this statement applies more to economies that are just getting started or to nations that are all by themselves. These findings highlight the critical need for more investigation into the complex relationship between governments and investors.

Chukwu et al. (2021), beginning with country-specific studies and concentrating on Nigeria from 1985 to 2018, looked into Nigeria's public debt on public investments using the Auto-regressive Distributed Lag (ARDL) model and the co-integration test on time series data. In Nigeria, public debt had no significant impact on public investment, according to the study.

Thilanka and Ranjith (2018) analyse the relationship between public borrowing and investment in Sri Lanka's economy from 1978 to 2015. The model employed in this research only included a small number of free variables. Relevant examples include investment, foreign debt, domestic debt, and real GDP. The authors examined the short- and long run

connections between public debt and investment at home and abroad using the Johansen co-integration approach and the Vector Error Correction Model (VECM). It seems from the statistics that there is a positive correlation between government debt (both domestic and foreign) and investment. A cross-national research by Clements et al. (2003) indicated that nations with high levels of foreign debt, like Sri Lanka, are less inclined to invest. As shown by Thilanka and Ranjith (2018), Sri Lanka benefited from both domestic and international borrowing.

Al-Dughme (2019) analysed data from 1990 to 2017 to determine how government borrowing and spending affected the economy of Jordan. Multiple linear regression analysis was used to check the study's hypotheses. The data analysis demonstrated an inverse relationship between government debt and expenditures.

Public debt, public investment, and economic development in Mexican state governments were studied by Sanchez-Juárez and Garcia-Almada (2016), who used dynamic panel data models and the generalized method of moments (GMM) to examine these three variables over the years 1993 to 2012. Total population, Gross Domestic Product (GDP), GDP per capita, public investment, debt, government spending, foreign direct investment (FDI), and educational attainment were all considered important indicators. The use of data from all 32 states necessitates a robust panel regression analysis. Methods like dynamic models and GMM estimate techniques allowed researchers to make educated guesses about the nature of these linkages. There was evidence that a larger national debt was associated with more government expenditure, greater tax revenue, and economic growth. This shows that Mexico's public debt is being used to promote growth and investment.

Ncanywa and Masoga (2018) looked at whether South Africa's public debt could affect public investment, which would then affect economic growth, from 1995 to 2016. The

autoregressive distributive lag, Granger causality, impulse response function, and variance decomposition were employed to achieve their objectives. It turned out that there is a long run inverse relationship between public debt and investment.

By using multiple linear regression analysis, Oke and Sulaiman (2012) examined the relationship between Nigeria's foreign debt and investment and GDP growth from 1980 to 2008. The model developed by Elbadawi et al. (1997) provided as inspiration for this one. Debt-Cum. Important factors were gross domestic product, private investment, government investment, exchange rate, debt service, and reserve to foreign debt. Increases in government expenditure were shown to contribute significantly to both economic growth and the rapid growth of the national debt. Though it was found that private investment was more likely when both external debt and trade openness were higher, the reverse was also true.

Kamundia (2015) investigated how Kenya's public external debt affects private investment and GDP growth. The endogenous growth model described by Ghura and Hadjimichael (1993) was used to create the empirical model. This economic theory postulates that the actions of governments, such as the issuance of debt, contribute to a rise in GDP. This study evaluated economic growth, trade openness, real interest rate, inflation, public debt, debt service, investment, human capital, and population growth from 1980 to 2013 to draw conclusions on the nature and direction of the link between public debt and investment. It is shown that public debt has a substantial impact on GDP growth but a less impact on private investment. Numerous studies show that private investment and GDP growth are influenced by debt in both direct and indirect ways.

With the ARDL technique, Ogunjimi (2019) examines the long- and short run effects of the various components of Nigeria's state debt on investment behavior between 1981 and 2016. In our analysis, we take into account both domestic and international investments. This

means that private capital, public capital, and FDI all need distinct procedures due to their varying natures. Two more factors are taken into account: GDP and interest rate. Long run impacts were estimated and confirmed using the VEC model and the ARDL limits test for cointegration. Despite its positive effects on public and private investment, domestic debt was shown to have a negative effect on FDI. The author draws the conclusion that any kind of governmental debt (long or short term) is harmful to investment.

Using data from 50 countries between 1985 and 2003, Lora and Olivera (2007) perform a panel research study on the impact of total public debt on social expenditure. We discovered that when debt levels rose, so did cuts to social care budgets. A rise in interest rates has a ripple effect on a country's budget, reducing spending on things like public services and charitable organizations. Researchers have shown a negative causal relationship between public debt and investment in recent years.

Clements et al. (2003) found a link between external debt, government spending, and GDP growth across 55 developing nations. People travelled from as far as Accra, India, and as far as Skopje, Macedonia, Nigeria, Pakistan, and Sri Lanka to attend. Growth in per capita income, population, GDP, total debt payment, foreign debt, trade openness, and the government's fiscal balance were among the many economic indicators studied by academics from 1970 to 1999. The standard Barro growth model served as our econometric starting point, and we used fixed effect and system Generalized Method of Moments (GMM) estimation techniques to complete our study. These researchers evaluate the potential for convergence between these countries using the Barro growth model. If these countries reduced their foreign debt, public investment and GDP growth were predicted to increase. This conclusion is consistent with the growing body of evidence, suggesting that the convergence across these countries predicted by the debt overhang hypothesis may not happen after all.

The crowding-out effect of public debt on public investment in 26 European countries was evaluated by Picarelli et al. (2019) using the Generalized Method of Moments (GMM). The authors gave weight to the debt overhang hypothesis by showing that a 1% rise in EU public debt was associated with a 3% decline in public investment. There are now many perspectives on the optimal way to handle public debt and investment. Using a linear regression model to estimate the panel data set's standard deviation System Fagbemi and Olatunde (2019) used GMM dynamic panel data to examine the impact of public debt on domestic investment in 33 SSA nations between 2000 and 2017. In the modern era, this is the first research of its sort. They concluded that a high level of national debt makes investors wary.

Using data for 47 nations between 1972 and 2001, Mahdavi (2004) investigates whether or not a country's total amount of foreign debt impacts the amount the central government spends on each sector of the economy. According to Mahdavi's research, debt is a hindrance to investment.

Turrini (2004) examined empirically the relationship between the introduction of the EU fiscal framework and public investment in 14 EU countries. According to the findings of panel data analysis, the impact of EU fiscal discipline rules is not clear. On the one hand, public investment is found to be more negatively affected by debt levels after phase II of EMU.

As these cases show, further in-depth empirical research on the relationship between public debt and capital investment is required. The present literature identifies two key issues. A number of studies have examined the impact of public debt on economic growth throughout Africa, but it does not seem that any have examined the relationship between public debt and investments in public infrastructure on either the continent as a whole or in Ghana

specifically. Another piece of proof that the European Union's (EU) ballooning debt is causing countries like Ghana to cut down on public investment is provided by this research. As a result, we will analyse how Ghana's mounting debt threatens the country's current and future capacity to fund public works projects.



## CHAPTER THREE

### METHODOLOGY

#### 3.1 Introduction

The theoretical framework and empirical models used in this study are covered in detail in this chapter. The report also includes information on where the data came from, what it was measured against, and how it was defined. This chapter will look at some diagnostic tests for a time series study and the appropriate econometric techniques for calculating both short and long run effects. The chapter concludes with a summary of the points raised.

#### 3.2 Theoretical Framework

The neoclassical growth model provides the primary theoretical grounding. This model explains why governments have to borrow money, as well as how that debt affects investment and overall economic development. The neoclassical growth model is a school of economic thought that explains how the interplay of labour, capital, and technology may produce a sustained expansion of the economy. This model was developed during the neoclassical period of economics. Moreover, the model argues that technical progress has a substantial effect on an economy and that economic development cannot be sustained in the absence of such progress. This is a fundamental assumption of the model. This concept of economic development places a premium on both the creation of new wealth within an economy and the ways in which existing money is put to use. Furthermore, this is true for the ways in which individuals spend their money. It's also worth noting that the relationship between capital and labour in a given sector has an impact on the economy's production.

### 3.2.1 The Neoclassical Growth Model

We use this model to show how government borrowing and investment contribute to GDP growth. Here, we construct a simple macroeconomic model to analyse how debt and investment affect GDP growth. Finding the link between spending and debt is the primary goal of this investigation. Owusu-Nantwi and Erickson's (2016) revised neoclassical model has an output function of:

$$Y_t = F ( K_t, Z_t, L_t, S_t) \quad (1)$$

where  $Y_t$  (aggregate output) is a function of  $K_t$  (private capital),  $Z_t$  (public capital),  $L_t$  (labour unit), and  $S_t$  (vector of other variables that determine output). The subscript  $t$  indicates the time period.

The production function has the following characteristics:

$F_x > 0$  and  $F_{xx} < 0$  where  $x = \{K_t, Z_t, L_t, S_t\}$  This denotes the conventional assumptions for diminishing marginal returns.

From Solow (1957), savings is a fixed fraction of income, therefore:

$$S_t = sY_t \quad (2)$$

where  $S_t$  and  $s$  denote savings and Marginal Propensity to save (MPS) respectively.

The model assumes that savings are used to pay taxes or to finance both private and public investments.

Therefore, we have the expression:

$$sY_t = I_{K,t} + p_z I_{Z,t} + T_t \quad (3)$$

where  $I_{K,t}$  represents an investment in private capital,  $I_{Z,t}$  is the investment in public capital,  $T_t$  is taxes. Taxes  $T_t$  in this model is assumed to be a lump sum. The variable  $p_z$  denotes the

relative efficiency of public investment in terms of national output, as defined by institutional variables. A higher  $p_z$  value suggests inefficient public investment and vice versa.

The movement equation of these variables can be stated as follows when the level of both public and private investment changes:

$$\Delta K_{t+1} = I_{K,t} - \delta_K K_t \quad (4)$$

$$\Delta Z_{t+1} = I_{Z,t} - \delta_Z Z_t \quad (5)$$

where  $\delta_K$  and  $\delta_Z$  denote the depreciation rates of private and public capital respectively, and  $0 < \delta_K, \delta_Z < 1$ .

Assuming that the initial levels of both public and private investments are zero (at  $t = 0$ ), we get:

$$K_{t+1} = \sum_{s=0}^t (I_{K,s} - \delta_K K_s) \quad (6)$$

$$Z_{t+1} = \sum_{s=0}^t (I_{Z,s} - \delta_Z Z_s) \quad (7)$$

Solving for  $I_{K,t}$  from equation (3) and substituting it into equation (6) gives:

$$K_{t+1} = \sum_{s=0}^t (sY_t - p_z I_{Z,t} - T_t - \delta_K K_s) \quad (8)$$

Forwarding the output equation by  $t = 1$ , we have:

$$Y_{t+1} = F(K_{t+1}, Z_{t+1}, L_{t+1}, S_{t+1}) \quad (9)$$

Substituting both equation (7) and (8) into equation (9) gives:

$$Y_{t+1} = F\left(\sum_{s=0}^t (sY_t - p_z I_{Z,t} - T_t - \delta_K K_s), \sum_{s=0}^t (I_{Z,s} - \delta_Z Z_s), L_{t+1}, S_{t+1}\right) \quad (10)$$

Given that the government is subject to the following fiscal constraints:

$$G_t + I_{Z,t} = \Delta D_t + T_t \quad (11)$$

$$\Delta D_t = G_t + I_{Z,t} - T_t \quad (12)$$

where  $G_t$  denotes government spending and  $\Delta D_t$  denotes the change in public debt.

Substituting this into equation (10), we have:

$$Y_{t+1} = F\left(\sum_{s=0}^t (sY_s - T_s - G_s - \delta_K K_s) - p_z \Delta D_t, \sum_{s=0}^t (T_s - G_s - \delta_Z Z_s), L_{t+1}, S_{t+1}\right) \quad (13)$$

Taking derivatives with respect to  $D_t$  gives:

$$\frac{dY_{t+1}}{dDt} = \frac{\partial F}{\partial Z} - p_z \frac{\partial F}{\partial K_p} \quad (14)$$

$$\frac{dI_{Z,t}}{dDT} = \frac{\partial F}{\partial Z} > 0 \quad (15)$$

$$\frac{dI_{K,t}}{dDt} = -p_z \frac{\partial F}{\partial K_p} < 0 \quad (16)$$

Equation (14) denotes the effect of public debt on investment. The model suggests that increased public debt leads to increased public investment. Equation (15) represents the effect of public debt on private investment. The model predicts a negative link between public debt and private investment.

From equations (14) and (15), the effect of public debt on output equation (13) is ambiguous, with the direction of change determined by the magnitude of both  $\frac{\partial F}{\partial Z}$  and  $p_z \frac{\partial F}{\partial K_p}$ . This renders

equation (13) unclear, indicating that, according to empirical studies, public debt might have a positive, negative, or no effect on investment.

### 3.3 Empirical Model Specification

To assess the effect of public debt on investment, the study employs the models proposed by Owusu-Nantwi and Erickson (2016). From equation (12) we have:

$$Y_{t+1} = F \left( \sum_{s=0}^t (sY_s - T_s - G_s - \delta_K K_s) - p_z \Delta D_t, D_t \sum_{s=0}^t (T_s - G_s - \delta_Z K_s), L_{t+1}, S_{t+1} \right)$$

This can be represented as:

$$Y_{t+1} = f(K_{t+1}, Z_{t+1}, L_{t+1}, S_{t+1}, T_s, G_s, D_{it}) \quad (17)$$

Where  $Y_{t+1}$  is output at time  $t+1$ .

$K_{t+1}$  is private investment.

$Z_{t+1}$  is public investment.

$L_{t+1}$  is labour at time  $t+1$ .

$S_{t+1}$  is a vector of variables that determine output.

$T_s$  and  $G_s$  are taxes and government expenditure respectively.

$D_{it}$  represents a vector of debt indicators.

For this thesis, the functional form of the investment model is represented as:

$$GFCF_t = f(ED_t, EXP_t, INV_t, INF_t, EXR_t, TRADE_t, POP_t) \quad (18)$$

Where  $INF_t$  = Inflation rate,  $ED_t$  = External Debt as a share of GNI,  $TRADE_t$  = Trade Openness,  $EXP_t$  = Public Expenditure per GDP,  $GFCF_t$  = Public Investment as a share of GDP,  $EXR_t$  = Exchange rate,  $INV_t$  = Private Investment as a share of GDP, and  $POP_t$  = Population growth rate.

The equation from the investment model is represented as:

$$GFCF_t = \beta_0 + \beta_1 ED_t + \beta_2 EXP_t + \beta_3 INV_t + \beta_4 INF_t + \beta_5 EXR_t + \beta_6 TRADE_t + \beta_7 POP_t + \varepsilon_t \quad (19)$$

Where  $\beta$ 's are parameters to be estimated,  $\varepsilon_t$  is the random error term (white noise) and  $t$  denotes time period.

### 3.4 Data Sources and Scope

This study examines statistics for a single country (Ghana) from 1983 until 2020. These annual figures originate from the International Monetary Fund's World Economic Outlook 2021 and the World Bank's World Development Indicators and International Financial Statistics online databases. Research will span 38 years, from 1983 to 2020, to account for the far-reaching effects of both the 2008 financial crisis and the global debt crisis of 1982. This is also representative of the time when SAPs and ERPs were no longer needed. Since information was scarce before the development of SAP and ERP systems, this time period was selected. On the other hand, this span of time includes both the pre- and post-HIPC periods and is thus seen to give enough background for academics to adequately account for the effects of the country's worst debt situation in its history.

### **3.5 Definition and Measurement of Variables**

The primary data used for the empirical study on how public debt affects investments in public infrastructure are described in this chapter's sub-section. It also provides justifications for using the selected variables, as well as their predicted signs.

#### **3.5.1 Public Investment (GFCF)**

Total government gross fixed capital formation (i.e., GFCF) is used as a stand-in for public infrastructure investment in this research since public investment is the independent variable of interest. The research looks at this variable in the context of a country's GDP to see how it reacts to changing standards of living. Improvements to land, the installation of new machinery and equipment, the construction or renovation of buildings like schools, trains, offices, hospitals, private residences, industrial and commercial structures, and so on are all examples of this. Both the net purchase of assets and the fluctuation in stock levels are included in (WDI 2021). Investment is explicitly included as a factor in the basic Keynesian aggregate spending model, which helps explain why investment is associated with higher production. New plant and equipment investments boost manufacturing efficiency and quantity.

#### **3.5.2 External Debt (ED)**

External debt is the total amount owed by a nation to non-residents (individuals and/or organizations) that must be repaid in goods, services, or monetary terms. According to WDI (2021), this is the sum of IMF credit, short run debt, publicly guaranteed debt, and long run debts that are privately non-guaranteed. According to the literature review and theoretical model, external debt has an ambiguous impact on investment and economic growth. This is mostly determined by the type of activity (productive or not) into which these funds are

directed. If the funds are directed toward productive and efficient sectors, they will increase investment and create future returns, offering the country with surplus output after debt service. This suggests that there is uncertainty regarding how external debt affects investment. The two main proxies for this variable are the external debt to GDP ratio and the external debt to GNI. The study's decision to use external debt per GNI as a stand-in for public debt was affected by the data's availability.

### **3.5.3 Public Expenditure (EXP)**

The primary measure of public expenditure is the government's total expenditures as a share of GDP. Chart showing government spending as a share of GDP (WEO, 2021). Total government spending is taken into account to see whether it has any influence on how that money is doled out. Investments may be put on hold or even eliminated if budget cutbacks become necessary. Cutting public investment is "politically easier" than cutting other sectors of spending, such government employee salaries. In addition, academics have studied public budgets. Cooray (2009), Ranjan & Sharma (2008), Al-Yousif (2000), and Abdullah (2000) all argue that public spending should be used to guarantee and provide certain public goods to citizens in order to stimulate economic expansion. It follows that this study assessing the impact of government expenditure on investment is likely to provide contradictory findings.

### **3.5.4 Private Investment (INV)**

The share of GDP spent on the acquisition of private capital assets is a surrogate for private investment. When calculating the potential effect of a relocation on public gross fixed capital production, this element must be taken into account. Therefore, increased private sector investment may replace or lure equivalent levels of government investment. This helps us to see whether public and private spending are counteracting or complementing one another. This raises questions about the reliability of government and private sector investments.

### **3.5.5 Inflation rate (INF)**

The annual percentage change in the average consumer's purchases of a basket of goods and services is what is measured by inflation. The estimation period may be constant or subject to modification at predetermined intervals, typically annually (WDI, 2021). Most empirical research on how inflation affects economic growth has yielded contradictory findings. Numerous researchers have looked into the connection between inflation and growth. Tobin (1965) confirms that lower levels of inflation help to propel economic growth while higher levels retard economic growth. Fabayo and Ajilore (2006) estimated a 6 percent inflation rate for the Nigerian economy. Inflationary pressures above this level stifle economic growth. This study assumes that because inflation is typically higher than 6 percent, it has a detrimental effect on investment. The consumer price index will be used as a gauge of inflation in this study.

### **3.5.6 Exchange rate (EXR)**

A visual depiction of the relative worth of several currencies, the WDI chart (2021). New capital expenditures and economic hopes may be dampened by a depreciation of the national currency because of the potential rise in the cost of repaying the government's foreign currency debt. Economic growth may be unaffected by foreign debt if external shocks and currency volatility help even things out (Asiama et al., 2014; Baharumshah et al., 2017). This shows the widespread skepticism over the role the exchange rate plays in economic activity and investment. The most frequent currency rate in Ghana is the cedi to USD. If you want to use the actual effective exchange rate, you need to deflate the nominal effective exchange rate by some measure of inflation. Use of price deflators allows for inflation to be included in.

### 3.5.7 Trade Openness (TRADE)

The level of trade openness is determined by comparing the difference between imports and exports of goods and services to GDP. This study measures a country's degree of openness to international trade by looking at its trade-to-GDP ratio. Public investment in "more open to trade" countries is claimed to help them maintain their competitive edge in global markets (by, for instance, building the required infrastructure) (Sturm, 2001). Ricardo highlights comparative advantage, which enables nations to produce locally at a productive rate and cheap prices (Ricardo, 1817). Saving money on imports and expanding output are both benefits of exporting these products and services. Husain (1996) believes that nations that engage in international trade reap benefits including increased productivity of limited goods and resources, increased savings, increased investment, and new jobs. The findings show a strong connection between freer trade and economic growth.

### 3.5.8 Population Growth (POP)

This variable is used to describe the population's exponential growth from one year to the next, or, in this case, from period (t) to period (t+1). Based on the de facto definition, all residents, regardless of their citizenship or legal status, must be counted for this assessment (WDI, 2021). The annual population increase was used to compute the reported percentage of population growth. According to Chang et al. (2014) and Lartey et al. (2018), population increase is a major driver of expansion in the labour force, consumer spending, business investment, and manufacturing. These studies claim that population growth and investment are positively correlated. The findings of Chang et al. (2014) and Lartey et al. (2016) will be used as the foundation for the anticipated impact of population growth on investment.

**Table 3.1: Summary of model variables, anticipated coefficient signs, and data sources.**

Variable	Measure used	Expected sign	Source
Public Investment (GFCF)	Government Gross Fixed Capital Formation (%GDP)		WDI (World Bank)
External Debt (ED)	Central Government Debt (%GDP)	Uncertain	WDI (World Bank)
Public Expenditure (EXP)	Government Total Expenditure (%GDP)	Uncertain	WEO (IMF)
Private Investment (INV)	Private Gross Fixed Capital Formation (%GDP)	Uncertain	WDI (World Bank)
Inflation Rate (INF)	Consumer Price Index (%)	(-)	WDI (World Bank)
Exchange Rate (EXR)	Real Effective Exchange Rate (adjusted for inflation)	Uncertain	WDI (World Bank)
Trade Openness (TRADE)	Sum of exports and imports as share of GDP	(+)	WDI (World Bank)
Population Growth (POP)	Annual population growth rate (%)	(+)	WDI (World Bank)

**Source: Author's compilation**

### 3.6 Diagnostic Test

To verify that indeed estimation does not suffer from estimation biases and spurious regression, certain pre-estimation and post-estimation diagnostic tests are required. This section explains the diagnostic tests that were performed prior to and after the estimation of the time series regression analysis. These tests include the unit root test, serial correlation, heteroscedasticity, and endogeneity tests. This ensures that the estimated outcomes for forecasts are accurate and not skewed.

#### 3.6.1 Unit Root Test

To be considered stationary, a stochastic process must maintain a constant mean and variance throughout time, and the covariance value between two time periods must rely solely on the gap between the two time periods rather than on the moment at which the covariance is determined (Gujarati, 2003). So, it doesn't matter when you estimate the covariance between two periods. The stability of the variables under investigation may be verified, and any false regression can be eliminated, with the use of the unit root test. It is crucial to keep all other variables constant while doing a time series analysis. The estimates are likely to be very predictive if the R-squared or modified R-squared of the regression result is substantial. When the error terms in an equation are not treated separately, they might lead to erroneous regressions (low values of Durbin-Watson statistic). The  $R^2$  values, raw and corrected, are rather large. This issue has repercussions beyond the estimated coefficients, impacting the results of significance tests and the model's predictions (Granger and Newbold, 1974).

This investigation into the potential existence of a unit root will make use of the Augmented Dickey Fuller (ADF) and Phillips-Perron (PP) tests. It has been shown that the model's error components are not associated using two different autocorrelation tests: the Autocorrelation

Detection Function and the Pearson Product Moment test. The Augmented Dickey Fuller (ADF) test regression can be expressed as follows:

$$\Delta x_t = \beta' \mathbf{D}_t + \boldsymbol{\pi} \mathbf{X}_{t-1} + \sum_{i=1}^p \psi_i \Delta x_{t-i} + \varepsilon_t \quad (20)$$

Where  $x_t$  is the variable at time  $t$

$\mathbf{D}_t$  is a vector of predictable terms that comprises a constant, trend, and so on.

$P$  is the number of lagged differences in the model.

$\boldsymbol{\pi}$  and  $\psi_i$  are the coefficients to be estimated.

$\varepsilon_t$  is the random error (disturbance) term.

The tests' null and alternative hypotheses are as follows:

$H_0 : \pi = 0$  (series has a unit root)

$H_0 : \pi \neq 0$  (series has no unit root)

The Augmented Dickey Fuller (ADF) and Phillip-Perron (PP) tests employ distinct strategies to adjust for serial correlation. To adjust for serial correlation, the ADF regression specification employs lagged differences in the variables, whereas the PP technique uses semi-parametric statistical methods.

### 3.6.2 Serial Correlation Test

The breach of Assumption 4 (observations of the disturbance terms are uncorrelated with each other) is the serial correlation (or autocorrelation). The anticipation of uncorrelated disturbance terms is a key assumption of the traditional linear regression model, that is:

$$\text{Cov} [u_i, u_j] = 0, \quad \text{for } i \neq j \quad (21)$$

This means that the error at one moment should not correlate to the error at another. When the random error terms are correlated, it creates a situation known as autocorrelation or serial correlation. This occurs because of model misspecification, inertia, omitted variable bias,

inappropriate functional forms, data translation, lag application, and other factors - (Gujarati, 2004).

In equation (16), the model specification may be represented as an autoregression with a lagged variable of the dependent variable  $Y_t$ :

$$Y_t = \alpha + \beta Y_{t-1} + \sum_{j=1}^k \delta_j X_{tj} + \sum_{m=1}^p \pi_m DEBT_{tm} + \varepsilon_t \quad (22)$$

Where  $X_{tj}$  is a collection of exogenous variables that influence output,  $DEBT_{tm}$  is a vector of debt signals,  $\alpha$  and  $\beta$  are constants,  $\delta_j$  and  $\pi_m$  are estimated coefficients, and  $\varepsilon_t$  is the error term.

Applying the lag of  $Y_t$ , which again is  $Y_{t+1}$ , we have:

$$Y_{t-1} = \alpha + \beta Y_{t-2} + \sum_{j=1}^k \delta_j X_{t-1j} + \sum_{m=1}^p \pi_m DEBT_{t-1m} + \varepsilon_{t-1} \quad (23)$$

When we replace  $Y_{t+1}$  with  $Y_t$ , we get:

$$Y_t = \alpha + \beta [\alpha + \beta Y_{t-2} + \sum_{j=1}^k \delta_j X_{t-1j} + \sum_{m=1}^p \pi_m DEBT_{t-1m} + \varepsilon_{t-1}] + \sum_{j=1}^k \delta_j X_{tj} + \sum_{m=1}^p \pi_m DEBT_{tm} + \varepsilon_t \quad (24)$$

$$Y_t = \alpha + \alpha\beta + \beta^2 Y_{t-2} + \sum_{j=1}^k \beta \delta_j X_{t-1j} + \sum_{m=1}^p \beta \pi_m DEBT_{t-1m} + \beta \varepsilon_{t-1} + \sum_{j=1}^k \delta_j X_{tj} + \sum_{m=1}^p \pi_m DEBT_{tm} + \varepsilon_t \quad (25)$$

This means that  $Y_t$ , which will be calculated using the random error term  $\varepsilon_t$ , has another error term that is  $\beta \varepsilon_{t-1}$ . This will result in a correlation between the random error terms  $\varepsilon_t$  and  $\varepsilon_{t-1}$ , i.e.,  $Cov[\varepsilon_t, \varepsilon_{t-1}] \neq 0$ . The estimation of regression coefficients is not skewed by the presence of a serial correlation. Only that OLS ceases to be a minimum variance estimator as a result. The predicted variances of the regression coefficients are skewed by serial correlation, making hypothesis testing unreliable. It will appear that the t-statistics are more significant than they actually are.

To resolve the issue of serial correlation in autoregressive regression analysis, it will be prudent to use the difference of variables whose lags are included in the model, the use of robust standard errors, and the use of Generalized Least Square (GLS) estimators will be required (Gujarati, 2004; Wooldridge, 2015). The study will use both differencing such

parameters (noting the results from the unit root test) and robust standard errors. A Durbin-Watson  $d$  test for autocorrelation problems will also be performed as part of the investigation.

### 3.6.3 Heteroscedasticity Test

The terminology "heteroscedasticity" is used to describe a consistent and continuous variation in the residuals' distribution throughout the whole range of observed values. Because ordinary least squares regression demands that all residuals come from a population with constant variance, heteroscedasticity is a reason for alarm (homoscedasticity). Homoscedasticity is the assumption that all of the observations have the same variance. Homoscedasticity fails when the distribution of the unobserved term  $u_i$  fluctuates with variations in the given independent variable, say  $x$ . This may be caused by the existence of outliers, skewness in the distribution, using an error correction model (ECM), or a variety of other factors. The error terms of the regression analysis are considered to be heteroscedastic in this scenario (Gujarati, 2004).

We have the following in a homoscedastic regression model:

$$\text{Var} [\varepsilon_i | x_i] = \sigma_i^2 \quad i = 1, \dots, n$$

Similarly, when we consider that the random error terms are uncorrelated then:

$$E [\varepsilon \varepsilon' | x] = \sigma^2 \Omega$$

Where  $\Omega$  is a normalized diagonal vector of weights.

We have the following in a heteroscedastic regression model:

$$\text{Var} [\varepsilon_i | x_i] \neq \sigma_i^2 \quad i = 1, \dots, n$$

In both circumstances (homoscedastic and heteroscedastic regression models), the regression errors have no effect on the bias or efficiency of the estimated parameters. The ordinary least squares (OLS) estimator will remain unbiased, consistent, and asymmetrically normal in the event of a regression with heteroscedastic errors. Regardless, the study must account for the occurrence of homoscedastic errors in the estimation by employing robust standard errors. Furthermore, this study will conduct a heteroscedasticity test utilizing the Breusch-Pagan / Cook-Weisberg approach.

### **3.7 Stability Test**

In addition to the more common diagnostic methods, the researchers also used a test called the Cumulative Sum (CUSUM) of squares. The CUSUM-of-squares test will help you make sure your model is reliable. It is essential to use the CUSUM-of-squares test to identify outliers in conditional model parameters, particularly as the sample nears its conclusion, regardless of whether or not the variance of the regression error is included in the set of variables changing. The test may identify changes to the model's parameters without the inclusion of the variance of the regression error in the list of shifted variables (Caporale & Pittis, 2004).

### **3.8 Estimation Technique**

To predict the intermediate and long run effects of government debt on infrastructure spending in Ghana, an appropriate cointegration method is required. To evaluate current and future impacts of public debt on public infrastructure projects, this thesis uses the Non-linear Autoregressive Distributed Lag (NARDL) model. Even if the variables are stationary, the NARDL method shines when working with tiny samples. With the NARDL method, we can evaluate the sensitivity of the asymmetric dynamic multipliers to both positive and negative

shocks separately from the regressors. NARDL cointegration techniques seem to be relevant given the unit root test's findings of a mix of variables having I(0)s and I(1)s. The NARDL limits test for cointegration is the most appropriate cointegration method to use when the unit root test reveals that two or more variables contain both I(0)s and I(1)s. NARDL was proposed by Shin et al. (2014) as a framework in which to study asymmetric cointegration and dynamic multipliers. Decompositions of the independent variable into positive and negative partial sums allow for the introduction of both short run and long run nonlinearities.

### **3.8.1 Nonlinear Autoregressive Distributed Lag (NARDL) Bounds test for cointegration**

Non-linear Autoregressive Distributed Lag (NARDL) limits test of the cointegration approach was suggested and developed by Shin, Yu, and Greenwood-Nimmo (2014) to estimate both short run and long run associations. The adopted bounds testing methodology may be used on stationary, non-stationary, or mixed time series vectors. This is doable if the variables are all I(0)s, all I(1)s, or a mix of the two, but it is impossible if the variables are all I(2)s. In this study's limited sample size, the NARDL model proved to be an effective econometric technique for dealing with endogeneity issues. The NARDL distinguishes between how the dependent variable ( $Y_t$ ) responds to changes in the independent variables ( $x_t$ ), both positive and negative. NARDL divides the independent variable ( $x_t$ ) into two components in order to account for the effect of asymmetry:

- 1) Partial sum of positive change in  $x_t$ , denoted by  $x_t^+$ .
- 2) Partial sum of negative change in  $x_t$ , denoted by  $x_t^-$ .

Both  $x_t^+$  and  $x_t^-$  are included as separate regressors in the NARDL model.

The approach may be used to precisely determine the number of cointegration vectors in the presence of multiple cointegration vectors.

A NARDL ( $p, q$ ) – two variables ( $x$  and  $y$ ) bounds test for cointegration can be performed using the regression equation:

$$\Delta y_t = \beta_0 + \sum_{i=1}^{p-1} \lambda_i \Delta y_{t-i} + \sum_{i=0}^q \delta_i^+ \Delta x_{t-i}^+ + \sum_{i=0}^q \delta_i^- \Delta x_{t-i}^- + \rho y_{t-1} + \Phi^+ x_{t-1}^+ + \Phi^- x_{t-1}^- + \mu_t \quad (26)$$

Where  $\Delta y_t$  represents the first difference of  $y$  at time  $t$ .

$\Delta y_{t-i}$  denotes some lags of the first difference of  $y$ .

$\Delta x_{t-i}^+$  represents current plus some lags of the first difference of  $x^+$ .

$\Delta x_{t-i}^-$  represents current plus some lags of the first difference of  $x^-$ .

$y_{t-1}$  represents the first lag of  $y$ .

$x_{t-1}^+$  represents the first lag of the partial sum of positive change in  $x$ .

$x_{t-1}^-$  represents the first lag of partial sum of negative change in  $x$ .

NARDL short run coefficients:  $\lambda_i, \delta^+, \delta^-$

NARDL long run coefficients with asymmetric terms:  $\rho, \Phi^+, \Phi^-$

Disturbance term (white noise):  $\mu_t$

NARDL bounds test for asymmetric long run cointegration is similar to ARDL bounds test, it's a joint test of all lagged one-period levels of  $x^+, x^+$ , and  $y$ .

- F-test of Pesaran et. al (2001) or Narayan (2004), if using small  $n$ :

$$H_0: \rho = \Phi^+ = \Phi^- = 0$$

- t-test of Banerjee et. al (1998)

$$H_0: \Phi = 0$$

$$H_A: \Phi < 0$$

Therefore, if we reject  $H_0$  (of no cointegration), we conclude that the variables are cointegrated in the presence of asymmetry.

We calculate the NARDL long run levels asymmetric coefficient by dividing the negative of the coefficient of  $x_t^+$  (i.e,  $\Phi^+$ ) by the coefficient of  $y_{t-1}$  (i.e,  $\rho$ ):  $\frac{-\Phi^+}{\rho}$  and also by dividing the

negative of coefficient of  $x_t^-$  (i.e,  $\Phi^-$ ) by the coefficient of  $y_{t-1}$  (i.e,  $\rho$ ):  $\frac{-\Phi^-}{\rho}$ .

### 3.8.2 Wald Test of long run Asymmetry

If a long run relationship exists (bounds test), the study proceeds to test if the difference in the asymmetric coefficients are statistically significant:

$$H_0 : \frac{-\phi^+}{\rho} = \frac{-\phi^-}{\rho}$$

$$H_A : \frac{-\phi^+}{\rho} \neq \frac{-\phi^-}{\rho}$$

Therefore, if we reject  $H_0$ , it means we have long run asymmetry. In other words, the magnitude of the change in  $y$  when  $x$  increase is not the same as when  $x$  decrease.

### 3.8.4 Vector Error Correction Model (VECM)

The Johansen cointegration model and the Non-linear Autoregressive Distributed Lag (NARDL) model's regression models can both be combined to create this model, which is used to assess short run effects. Through the inclusion of an error correction term, this transformation ensures that long run information is also recorded in short run analysis (Granger and Engel, 1969).

A VEC model can be defined using equation (25) as follows:

$$\Delta Y_t = \sum_{i=1}^p \beta_i \Delta Y_{t-i} + \sum_{j=0}^k \gamma_j \Delta X_{t-j} + \lambda ECT_t + \varepsilon_t \quad (27)$$

where  $ECT_t$  is an error correction term that records long run information.

## 3.9 Summary of the Chapter

The chapter's Neoclassical model shows that the relationship between government debt and investments in public infrastructure is complex. Empirical studies may use data provided by the International Monetary Fund (World Economic Outlook) and the World Bank (World Development Indicators). The research includes diagnostic procedures including the testing

for unit root, serial correlation, and heteroscedasticity. This keeps the estimates from being biased and prevents the analysis from producing misleading regression. The results of the unit root test will indicate which econometric technique will be utilized most often. The Non-linear Autoregressive Distributed Lag (NARDL) cointegration method is acceptable to utilize if the unit root results produced a mix of variables,  $I(0)$ s and  $I(1)$ s.



## CHAPTER FOUR

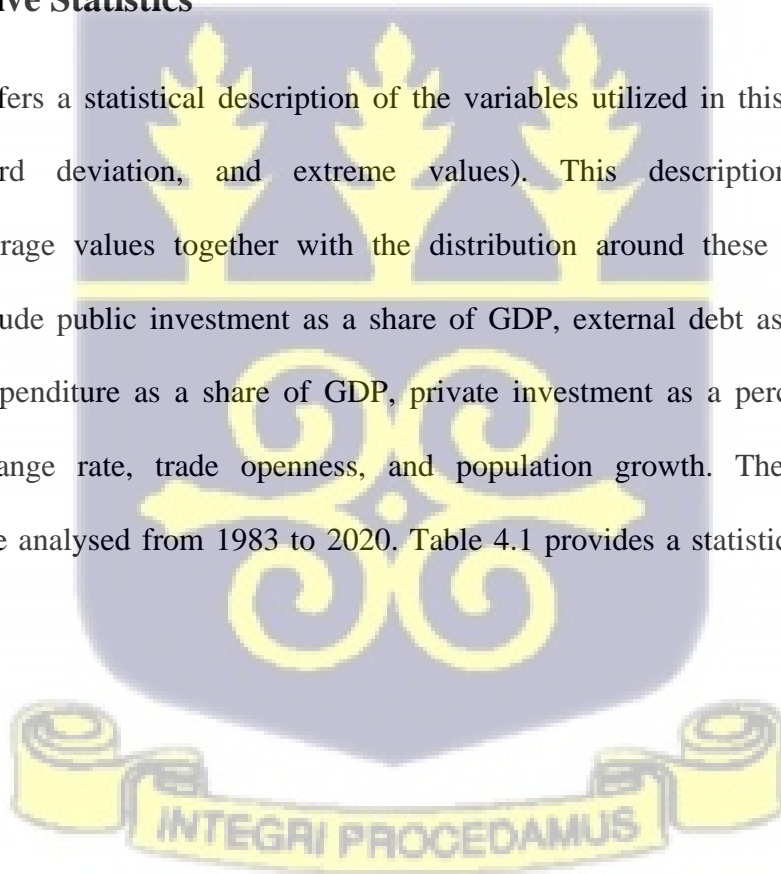
### ESTIMATIONS AND DISCUSSION OF RESULTS

#### 4.1 Introduction

The descriptive data estimates, diagnostic tests, and regression results are all included in this chapter. The statistical description of the variables used for empirical estimation is provided in the first section of the chapter. This is accompanied by several time series pre-estimation diagnostic test and the predicted model findings. The chapter concludes with summary of the main findings.

#### 4.2 Descriptive Statistics

This section offers a statistical description of the variables utilized in this empirical study (mean, standard deviation, and extreme values). This description includes the parameters' average values together with the distribution around these averages. These parameters include public investment as a share of GDP, external debt as a percentage of GNI, public expenditure as a share of GDP, private investment as a percentage of GDP, inflation, exchange rate, trade openness, and population growth. The data on these parameters were analysed from 1983 to 2020. Table 4.1 provides a statistical description of the parameters.



**Table 4.1: Descriptive Statistics of Variables**

<b>Variable</b>	<b>Mean</b>	<b>Std. Dev.</b>	<b>Min</b>	<b>Max</b>
<b>GFCF</b>	18.39881	6.36340	3.76118	29.00214
<b>ED</b>	62.87924	34.09136	16.52009	139.4387
<b>EXP</b>	14.29018	5.669996	3.635000	28.96200
<b>INV</b>	12.06017	6.105173	2.013324	24.30000
<b>EXR</b>	224.0343	557.1654	64.62934	3520.534
<b>INF</b>	23.16433	20.53006	7.126350	122.8745
<b>TRADE</b>	67.00098	24.41219	11.54490	116.0484
<b>POP</b>	2.577710	0.268885	2.130763	3.080960

*Source:* Author's compilation using Eviews 10.

Public investment (government gross fixed capital formation) as a share of GDP for Ghana for the period 1983-2020 averaged 18.40 percent with a maximum of 29 percent and a minimum of 3.76 percent in 2005 and 1983 respectively. The variable also has a standard deviation of 6.36 percent. This represents a great performance following the country's adoption of ERP and SAPs in 1983. A standard deviation of 6.36 percent around a mean of 18.40 percent suggests a strong level of investment to GDP in Ghana.

External debt as a share of GNI for the period under study has an average of 62.88 percent, with a minimum of 16.52 percent in 2008 and a maximum of 139.44 percent in 2000. Following then, the country was declared as HIPC. The mean value of 62.88 percent exceeds the West African Monetary Zone's 60 percent threshold (WAMZ). These figures demonstrate the country's reliance on external debt as a source of fund to finance the government's budget deficit. The capacity of a country to make future debt payments is evaluated by investors using government debt as a percentage of GNI, which affects borrowing costs and

government bond yields. Because of falling gold and cocoa prices and rising crude oil prices, as well as poor domestic economic performance during that time, the highest debt ever recorded was incurred in that year. This imbalance in financial gains led to a sharp increase in monetary growth, which in turn caused significant reductions in consumption and production (African Economic Outlook, 2002).

Public expenditure as a share of GDP for this period recorded an average of 14.29 percent with a minimum of 3.64 percent in 1983 and a maximum of 28.96 percent in 2020. The 1983 economic crisis had a wide-ranging impact on key components of the economy, including government spending and inflation. Inflation averaged 23.16 percent during this period, with a standard deviation of 20.53 percent. In 2012, the lowest inflation rate of 7.13 percent was recorded. One of the major goals of the Bank of Ghana is to achieve a single-digit inflation rate. The mean value of 23.16 percent denotes a poor performance in meeting the set goal of inflation in the single digits.

Furthermore, the average private investment in Ghana for the period 1983 – 2020 was 12.06 percent with a 6.11 percent deviation. The minimum and maximum values recorded are 2.01 percent in 1986 and 24.30 percent in 2012 respectively. However, between 1983 and 2020, the average exchange rate was 224.03, with a standard deviation of 557.17. In 1983, a maximum value of 3520.53 was recorded; in 2015, a minimum value of 64.63 was also recorded.

Trade openness for the period 1983 – 2020 averaged 67.00 percent with a standard deviation of 24.41 percent indicating a large variation of import and export distribution as a ratio of Ghana's GDP. The minimum and maximum values recorded are 11.54 percent in 1983 and 116.05 percent in 2000 respectively. This indicates that goods and services move freely

within and outside the nation. Trade has long been a significant element in the country's growth and development (Darko, 2015).

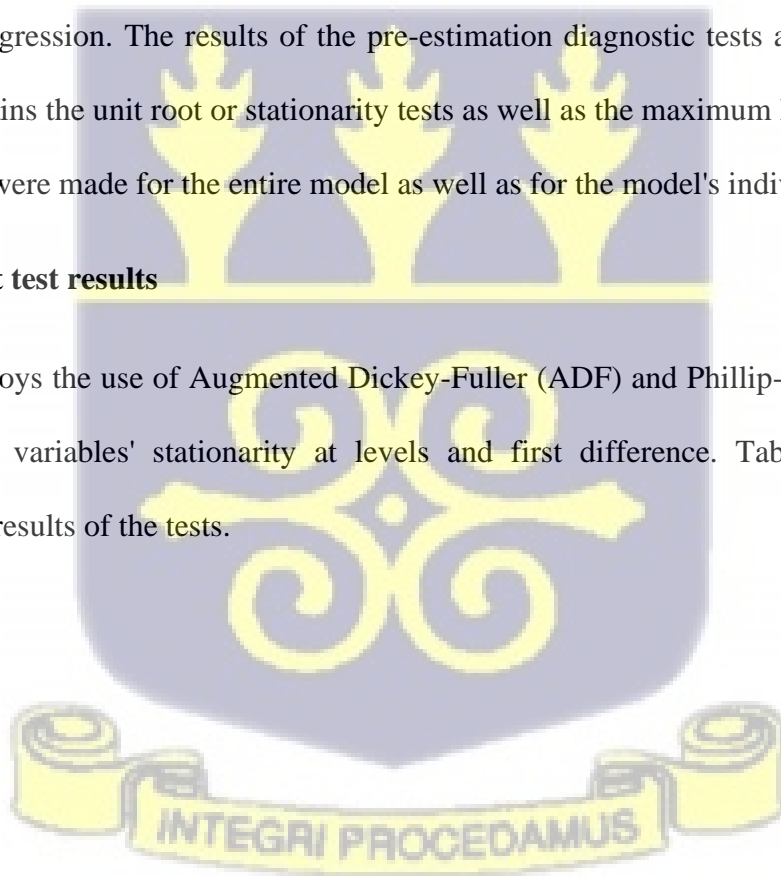
The population growth rate in Ghana for the period 1983 – 2020 averaged about 2.58 percent with a minimum value of 2.13 percent in 2020 and a maximum of 3.08 percent in 1985. This period had a standard deviation of 0.27 percent from the mean. This level of standard deviation around a mean of 2.58 suggests that Ghana's population growth has been relatively stable.

### **4.3 Diagnostic test results**

Certain pre-estimation diagnostic tests are required to ensure that estimation is free of bias and spurious regression. The results of the pre-estimation diagnostic tests are shown in this section. It contains the unit root or stationarity tests as well as the maximum lag selection test. Lag selections were made for the entire model as well as for the model's individual variables.

#### **4.3.1 Unit Root test results**

The study employs the use of Augmented Dickey-Fuller (ADF) and Phillip-Perron (PP) tests to identify the variables' stationarity at levels and first difference. Tables 4.2 and 4.3 summarize the results of the tests.



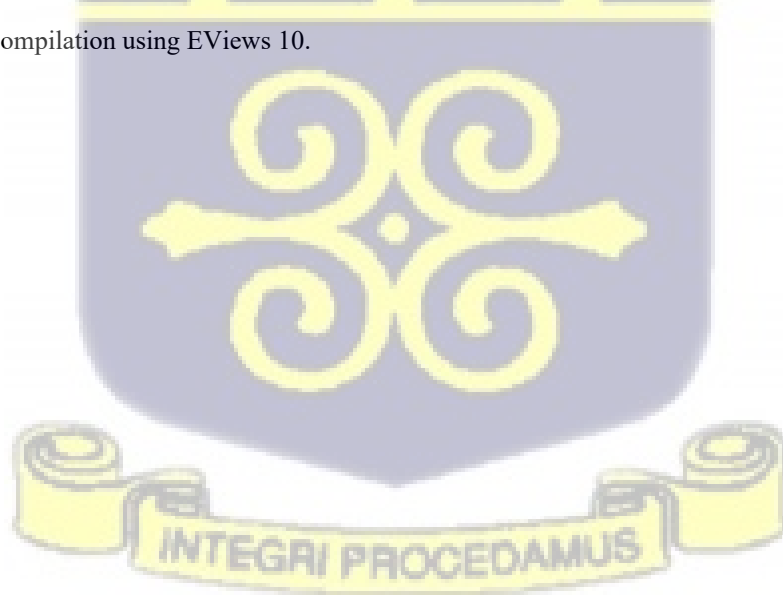
**Table 4.2: Results of the Augmented Dickey-Fuller Stationarity Test**

Variable	Level Form		First Difference		Order of Integration
	Test Statistics	5% critical value	Test Statistics	5% 10% Critical values	
GFCF	-2.791	-2.943	-5.867**	-2.946, -2.612	I (1)
ED	-1.243	-2.946	-4.809**	-2.948, -2.613	I (1)
EXP	-0.249	-2.943	-4.334**	-2.957, -2.617	I (1)
INV	-1.880	-2.943	-7.929**	-2.946, -2.612	I (1)
INF	-8.152**	-2.943			I (0)
EXR	-56.746**	-2.943			I (0)
TRADE	-2.490	-2.943	-5.640**	-2.948, -2.613	I (1)
POP	0.355	-2.951	-6.905**	-2.951, -2.614	I (1)

Null hypothesis ( $H_0$ ): has a unit root (non-stationary). Alternate Hypothesis ( $H_1$ ): no unit root (stationary).

\*\*, \* Rejecting the null hypothesis at 5% and 10% respectively.

Source: Author's compilation using EViews 10.



**Table 4.3 Results of the Phillip-Perron Stationarity Test**

Variable	Level form		First Difference		Order of Integration
	Test Statistics	5% critical value	Test Statistics	5% 10% Critical values	
GFCF	-2.772	-2.943	-6.036**	-2.946, -2.613	I (1)
ED	-1.576	-2.946	-4.868**	-2.948, -2.613	I (1)
EXP	-0.202	-2.943	-5.651**	-2.946, -2.612	I (1)
INV	-1.595	-2.943	-18.698**	-2.946, -2.612	I (1)
INF	-7.524**	-2.943			I (0)
EXR	-36.268**	-2.943			I (0)
TRADE	-2.490	-2.943	-6.073**	-2.946, -2.612	I (1)
POP	-0.593	-2.943	-3.450**	-2.946, -2.612	I (1)

Null hypothesis ( $H_0$ ): has a unit root (non-stationary). Alternate Hypothesis ( $H_1$ ): no unit root (stationary).

\*\*, \* Rejecting the null hypothesis at 5% and 10% respectively.

Source: Author's compilation using EViews 10.

The unit root test is employed to confirm the stationary nature of the variables and to prevent spurious regression. In time series analysis, variables' stationarity is crucial. The unit root was found using the ADF and PP tests, which are both variations of the classic Dickey-Fuller (DF) procedure. The ADF and PP tests, which detect autocorrelation, guarantee that the model's error components are independent of one another. Table 4.2 shows the results of an Augmented Dickey-Fuller test, and with the exception of INF and EXR, all variables are integrated of order 1. Results from the Phillips-Perron test also show that INF and EXR are in a stable, horizontal state. Cointegration estimation using the Autoregressive distributed Lag (ARDL) model is optimal because the variables in both sets of results include a mix of I(0)s and I(1)s.

### 4.3.2 Maximum lag length selection

A VAR model is run to determine the optimal lag duration according to the minimum Akaike Information Criterion before a cointegration test is performed (AIC). Due to a lack of data, we have limited the lag length selection method to a maximum of four lags. It has been determined using the AIC that four delays are optimal. The cointegration test is applied to the model once the number of lags has been established. It was decided to let E-Views choose the optimal lag structure automatically. With regards to lag structure, the Akaike Information Criterion (AIC) suggests that ARDL is the optimal choice for model estimate using ARDL (4, 2, 1, 2, 2, 2, 2, 2, 2).

### 4.4 NARDL Bounds F-test for cointegration

To test for cointegration between the model's variables, the NARDL Bounds F-test is used. Table 4.4 displays the collected data from the tests. In the NARDL cointegration method, it is assumed that the ED's (+) and (-) responses to changes in the GFCF are not equal (Shin et al. 2014). As opposed to the ARDL scenario, where the possible influence of the explanatory variable does not fluctuate, NARDL allows for the possibility of asymmetric impacts of both positive and negative changes in the explanatory variables that are associated to the dependent variable. By generating cumulative dynamic multiplier graphs, the NARDL approach makes it possible to see how variables respond to both positive and negative shocks. Whereas conventional ARDL takes for granted a symmetrical relationship between regressor and predictor variables, the NARDL approach keeps the asymmetry assumption in place. Therefore, the NARDL approach is preferable than the ARDL one (i.e., symmetric). This means that each will have a role in determining two of the NARDL's coefficients for a single regressor (Yongcheol Shin, Byungchul Yu, and Matthew Greenwood, 2014). The NARDL facilitates modeling the nonlinear influence of independent factors on the dependent

variable. However, when there is asymmetric effect, the standard ARDL may fail to capture it, and the limits test may indicate no cointegration exists. The model is refreshingly straightforward yet being comprehensive enough to accommodate any asymmetry in transitioning from the short to the long term.

**Table 4.4 Bounds F-test results for the model**

Country	F-Statistic value	Lag Length	Significance level	Bounds Critical Value	
				I(0)	I(1)
Ghana	14.870***	2	10%	1.95	3.06
			5%	2.22	3.39
			1%	2.79	4.1

Null hypothesis ( $H_0$ ): no cointegration. Alternate Hypothesis ( $H_1$ ): cointegration exists.

\*\*\*, \*\*, \* Rejecting the null at 1%, 5% and 10% respectively.

Source: Author's compilation using EViews 10.

According to Table 4.4, the test has an F-statistic value of 14.870, which is greater than the upper bound critical value at the 1 percent (4.1) significance level. This indicates that the variables in the Model are cointegrated, implying the existence of both long and short run coefficients. Therefore, the study concludes that when asymmetry is taken into account, the variables are cointegrated.

#### 4.5 Long Run Estimation

Due to the cointegration of the variables in the model, it is necessary to estimate how closely the variables are related over the long term. Table 4.5 enumerates the outcomes of the model's long run estimations.

**Table 4.5 Model Results – Long Run Level Regression**

Variables	Coefficient	Standard Error
ED_POS	3.921426**	1.407143
ED_NEG	2.585422***	0.639467
EXP	9.063820***	2.094537
INV	1.864248***	0.362223
EXR	4.247440**	1.610379
INF	1.182617***	0.249528
TRADE	-4.435675***	0.939330
POP	16.38166**	5.591375
Intercept	-33.78708***	11.72553

\*, \*\*, and \*\*\* indicating a significant level of 10%, 5%, and 1% respectively.

Source: Author's compilation using EViews 10.

From Table 4.5, the long run level equation shows that External debt (ED), Public expenditure (EXP), Private investment (INV), Inflation rate (INF), Exchange rate (EXR), Trade openness (TRADE), and Population growth rate (POP) are all statistically significant at 1 and 5 percent significant levels. While the other factors in the equation indicate a positive association with the dependent variable (public infrastructure investment), trade openness shows a negative relationship. In the long term, at the 1% and 5% significance levels, there is a positive asymmetric link between public infrastructure investment and foreign debt. Keeping everything else the same, public infrastructure investment (GFCF) rises 3.92 percent for every 1 percent increase in external debt (ED POS) and falls 2.59% for every 1 percent drop in external debt (ED NEG). It follows that a rise in foreign debt has a higher effect on public infrastructure investment in the long term than a reduction in external debt. This finding suggests that state infrastructure spending in Ghana is propelled by foreign debt. This

finding accords with research evaluating the effect of public debt on public investment and economic development in Mexico, such as that of Sanchez-Juarez and Garcia-Almada (2016). The analysis found that higher levels of public debt are associated with more public investment and faster economic development.

Public spending and public infrastructure investment are positively related in the long run investment model for Ghana, with a significance level of 1%. Assuming no changes in other variables, an increase of 1% in public spending (EXP) will result in a 9.06% rise in public infrastructure investments. This finding implies that public infrastructure expenditures will be funded by government spending.

There is a positive correlation between private investment and government spending on infrastructure over the long term, as shown by the investment model. Investment in public infrastructure rises by 1.86 percent for every one percent increase in public investment. This further implies that public investment crowds out government investment, albeit the two are mutually supportive.

In addition, at the 5% level of significance, the long run investment model reveals a positive correlation between exchange rate (EXR) and government-funded capital expenditures (GFCF). To keep everything else the same, if the exchange rate goes up by one-point, public infrastructure spending will go up by 4.25 percent. This conclusion is consistent with the work of Gluzmann et al. (2012) and Mbaye (2012) but contradicts the work of Atkins (2000) and Kamin and Rogers (2002).

At the 1% level of significance, the long run investment model reveals a positive correlation between inflation and government spending on infrastructure. All other things being equal, a 1% rise in inflation will result in a 1.18 % rise in government spending on infrastructure. This

suggests that rising costs are not seen as a deterrent to investment in the nation, but rather as an incentive (Akram, 2011; Asab, 2017; Al-Tarawneh, 2018).

There is a negative correlation between trade openness and government spending on infrastructure in Ghana, according to the long run investment model. Assuming the other variables remain the same, a 1% increase in trade openness is associated with a 4.4% decrease in infrastructure investment. This result does not support the hypothesis that commerce is crucial to attracting investment to Ghana (Barik, 2013; Kamaundia, 2005). Finally, at the 5% level of significance, the long run investment model demonstrates a positive link between POP and public infrastructure investment. A 1 percent increase in population results in a 16.38 percent increase in public infrastructure spending, everything else being equal. This indicates that rising populations are one of the primary causes of increased government spending (Chang et al., 2014; Lartey et al., 2018).

Below are the long run asymmetric coefficients.

**Asymmetric cointegrating equation:**

$$LGFCF = 3.921LED\_POS + 2.585LED\_NEG$$

GFCF is a positive function of both POS and NEG changes in LED. If LED increases (LED\_POS), LGFCF also increases by about 4%. Also, if LED decreases (LED\_NEG), LGFCF also decreases by about 2.6%.

**4.6 Long Run Asymmetry: Wald Test**

If a long run relationship exists (bounds test), the study proceeds to test if the difference in the asymmetric coefficients are statistically significant.

**Table 4.6 Stepwise Regression Results**

<b>Variables</b>	<b>Coefficient</b>	<b>Standard Error</b>
LGFCF(-1)	-0.688240***	0.134072
LED_POS(-1)	-1.125648***	0.297123
LED_NEG(-1)	0.123718*	0.068556
LEXP(-1)	0.262656	0.171552
LINV(-1)	0.364636***	0.106287
LEXR(-1)	-1.319148***	0.336775
LINF(-1)	-0.097045*	0.051314
LTRADE(-1)	-0.668552***	0.167288
LPOP(-1)	-4.417523***	1.206294
Intercept	15.60299***	3.444799
D(LINV)	0.391993***	0.072991
D(LTRADE(-1))	0.374900**	0.138346
D(LTRADE)	-0.390617**	0.156158
D(LGFCF(-3))	0.240855**	0.098549

\*, \*\*, and \*\*\* indicating a significant level of 10%, 5%, and 1% respectively.

Source: Author's compilation using EViews 10.

Table 4.6 shows the results for the stepwise regression which gives the parsimonious asymmetric error correction output. The long run terms are above the horizontal line while the short run terms are below the line. Once more, note that all short run terms that are not significant are excluded, but all long run terms are kept, regardless of whether they are significant or not (Shin et al, 2014). Therefore, there is no evidence of short run asymmetric relationship between LGFCF and LED since its statistically not significant. The table also shows that POS changes in ED have a long run negative impact on LGFCF while NEG changes in ED have a corresponding long run positive impact on LGFCF. The above table will help the study to perform the Wald test. Wald test is a coefficient test to determine whether there exists a short or long run asymmetry relationship. That is, are the two impacts

(ED\_POS and ED\_NEG) of the same magnitude (symmetric effect) or are they different (asymmetric effect).

Accordingly, the null hypothesis is that the two impacts are the same:

H<sub>0</sub>: No Long run asymmetry

H<sub>A</sub>: There is long run asymmetry

Alternatively:

$$H_0: \frac{-\phi^+}{\rho} = \frac{-\phi^-}{\rho} \Leftrightarrow \frac{-C(3)}{C(2)} = \frac{-C(4)}{C(2)}$$

$$H_A: \frac{-\phi^+}{\rho} \neq \frac{-\phi^-}{\rho} \Leftrightarrow H_A: \frac{-C(3)}{C(2)} \neq \frac{-C(4)}{C(2)}$$

H<sub>0</sub> is rejected for LED. This shows evidence of long run asymmetry. P-value of the  $\chi^2$  statistic < 0.05 (Wald statistics for this hypothesis test follows an asymptotic  $\chi^2$  distribution (Shin et al, 2014; pp12 and 41). The degree of POS impact on borrowing monies externally for public infrastructure investment is greater than the degree of NEG impact in a debt distress situation.

**Table 4.7 Wald Test results**

Test Statistic	Value	df	Probability
t-statistic	-5.041987	20	0.0001
F-statistic	25.42163	(1, 20)	0.0001
Chi-square	25.42163	1	0.0000

Null Hypothesis:  $-C(3)/C(2) = -C(4)/C(2)$

Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
$-C(3)/C(2) + C(4)/C(2)$	-1.815305	0.360038

From Table 4.7, the Wald test results show evidence of the existence of a long run asymmetry with respect to external debt (ED). Therefore, there is a non-linear relationship between public infrastructure investment and public debt (external debt) in Ghana. There is cointegration between the variable because the probability value of the Chi-square is statistically significant at a 1% significance level.

#### 4.7 Short Run Estimation

In the study, the short run relationship between the variables is estimated using the NARDL cointegration method. The outcomes of the NARDL short run regression are shown in Table 4.8.

**Table 4.8 Short Run Regression Results**

Variables	Coefficient	Standard Error
ED_POS	1.408426**	0.566341
ED_NEG	0.831750***	0.192799
EXP	1.310444***	0.300446
INV	0.590354***	0.058798
EXR	-0.321689	0.378328
INF	-0.070381	0.052970
TRADE	-2.369006***	0.441961
POP	63.48436***	13.42648
ECT	-0.714693***	0.040444

\*, \*\*, and \*\*\* indicating a significant level of 10%, 5%, and 1% respectively.  
Source: Author's compilation using EViews 10.

The short run regression results in Table 4.8 show that the variables public expenditure (EXP), External debt (ED), Private investment (INV), Trade openness (TRADE), and Population growth rate (POP) are statistically significant in the short run.

The negative and statistically significant error correction term (ECT) indicated in the bottom half of Table 4.8 indicates that the economy eventually returns to long run equilibrium after a shock. The model's error correction term coefficients suggest that one year after an economic shock, the economy has returned to long run equilibrium to the extent of roughly 71.5%.

At both the 1% and 5% thresholds of importance, public infrastructure investment is positively affected by foreign debt in the near term. This confirms the favourable association found by long run regression analysis. Keeping everything else the same, public infrastructure investment (GFCF) rises 1.41 percent for every 1 percent increase in external debt (ED POS) and falls 0.83 percent for every 1 percent drop in external debt (ED NEG). Investment in public infrastructure thus suffers more from rising rather than falling levels of foreign debt. Therefore, this data also implies that public infrastructure investment in Ghana is boosted by the country's high level of foreign debt. Thailanka and Ranjith (2018), for example, looked at how state debt affected investment in the Sri Lankan economy between 1978 and 2015, and their findings are congruent with this one. Contrary to the cross-country results of Clements et al. (2003), which show that foreign debt discourages investment in Sri Lanka and other low-income nations, our data suggests the opposite. Investment in Sri Lanka's economy was shown to benefit from both local and foreign debt, as discovered by Thailanka and Ranjith (2018).

At the 1% level of significance, the link between public spending and public infrastructure investment was determined to be positive. The favourable correlation shown in the long run regression analysis is therefore validated. Public infrastructure investment (GFCF) is shown

to grow by 1.31 percentage points for every percentage point increase in EXP, as indicated by the coefficient. Cooray (2009), Ranjan (2008), Al-Yousif (2000), and Abdullah (2000) all found similar results; hence these findings are consistent with the literature. This indicates that public investment in public infrastructure will safeguard and provide certain public goods for residents, hence promoting growth.

In addition, at the 1% level of significance, a favourable correlation between private investment and governmental infrastructure spending was discovered. The favourable correlation found in the result of the long run regression analysis is therefore confirmed. An increase of 1 percent in private investment (INV), all else being equal, would result in an increase of around 0.60 percent in public infrastructure investment, according to the coefficient (GFCE). Results like these point to a crowding-in effect of private investment on public spending. In particular, this result emphasizes the symbiotic relationship between public and private investments.

At the 1% level of significance, the short run estimate shows that the growth rate of the population positively affects public infrastructure spending. A 1% rise in POP is associated with a 63.48% increase in public infrastructure expenditure, provided that all other variables remain the same (coefficient). That means rising populations are a key factor in justifying increased spending on infrastructure. Consistent with previous research by groups like Chang et al. (2014) and Lartey et al. (2018).

Finally, at the 1% level of significance, the short run output demonstrates a negative association between trade openness and public infrastructure investment. The coefficient shows that public infrastructure investment decreases by 2.37 percentage points for every percentage point that trade openness (TRADE) increases. Investment equations over the long

run confirm the short run link between trade liberalization and spending on public infrastructure.

#### **4.8 Summary of Main Findings**

The thesis' primary source of inspiration was the neoclassical growth model, which considers how public debt indicators affect investments in public infrastructure within an economy. It explains the necessity of obtaining external funding to carry out government investments that can spur economic growth in order to close the domestic savings gap. Focusing on this growth theory, it is determined that the effect of public debt on investment is ambiguous, meaning that it largely depends on the size of the benefits gained from the borrowed money and the amount of private investment that is crowded out. The thesis conducts an empirical investigation based on World Bank and IMF data from 1983 to 2020. Based on the results of the performed stationarity tests, the variables were identified as a mix of I(0)s and I(1)s. This suggests that the Nonlinear Autoregressive Distributed Lag (NARDL) cointegration method was effective for determining the short and long run impact of public debt on investments in public infrastructure in Ghana.

Estimations of the long run investment equation showed that the variables of external debt, state spending, private investment, inflation rate, currency rate, trade openness, and population growth rate all had statistically significant coefficients. The results of the Bounds test show a long run relationship between the model's public investment variables. Public infrastructure investment was shown to have a positive correlation with foreign debt and an asymmetrical positive link. Public infrastructure investment is more sensitive to rising than falling foreign debt, as shown by the cointegration. According to these numbers, governmental infrastructure investment in Ghana is funded entirely by external debt. The anticipated long term investment equation favours private investment in the public

investment model of Ghana's economy. Evidenced by a positive and statistically significant association between private investment and public infrastructure investment, crowding-in effects may be shown on government investment. Long run investment strategy in Ghana has shown a positive correlation between public infrastructure investment and government spending. This finding is consistent with the idea that public investment in infrastructure yields positive returns. Trade liberalization was also shown to have a negative effect on state infrastructure spending in the Ghanaian version of the long run investment model. Contrary to popular belief, this data suggests that Ghana's commercial sector is not crucial for drawing FDI. According to the predictions of the long run investment model, public infrastructure investment is positively and strongly connected with monetary value, inflation, population growth, and overall governmental spending.

Public spending, foreign debt, private investment, trade openness, and population growth rate were all emphasized as important in the near run by the investment regression. It's impossible to deny the positive and uneven impact of external debt on public infrastructure spending over the near run. Public infrastructure expenditure was shown to be far more sensitive to changes in foreign debt than domestic debt was, as shown by this research. These figures demonstrate how Ghana is able to invest heavily on public infrastructure despite its high level of foreign debt. Both the absolute size and the rate of expansion of government budgets were shown to be positively affected by public infrastructure investment in this study's short and medium-term horizons. Essential public services and infrastructure upkeep are made possible by taxation (public infrastructure investment). There is evidence that public investment in infrastructure boosts private investment, at least in the near run. Therefore, our findings suggest that private investment will ease pressure on public spending. In the next years, a growing population is likely to coincide with an increase in public spending on infrastructure. The rising number of people in need of services seems to be the primary driver of rising

government expenditures. Evidence from studies that only look at the near future shows a negative and statistically significant link between trade liberalization and government investment in infrastructure. This information calls into question the theory that foreign investors are lured to Ghana's thriving economy. Short run statistical study of the exchange rate and inflation coefficients indicated they were not significant. Residuals from the calculated model were found to be "white noise" after being statistically processed, showing the lack of serial correlation and heteroskedasticity. There is more proof that the model residuals follow a normal distribution. The robustness of the developed model is shown by the CUSUM of squares plot provided as an appendix.

In view of the recent decline in public investment, it is crucial to comprehend the factors that influence spending on Ghana's public infrastructure. Investment in public infrastructure is a topic of frequent conversation in Ghana, although little is understood about the factors that shape funding for this area. The third major contribution of this thesis is an analysis of the factors that may affect the Ghanaian government's propensity to finance and execute public infrastructure projects. A long run investment model predicts that public infrastructure investment in Ghana will be affected by the country's level of external debt, government spending, private investment, inflation rate, currency rate, trade openness, and population growth rate. Short run concerns include things like current spending and debt levels in the public sector, private investment, the liberalization of trade, and the growth of the population.



## CHAPTER FIVE

### CONCLUSION AND POLICY IMPLICATION

#### 5.1 Conclusion

This chapter summarizes the thesis by discussing the general conclusions and providing policy implications. Areas for future research are also presented.

The relationship between public debt and public infrastructure investment (gross fixed capital formation) in Ghana was studied using a 38-year NARDL model (1983-2020). According to the neoclassical growth model, which this research is based on, if economic growth outpaces interest rate increases, the economy will create enough new capital to balance the reduced level of investment necessitated by the rate hikes. Long run and short run outcomes were the primary foci of the empirical estimations.

Ghana's ongoing increase in debt to GDP beyond the 60% sustainability ceiling mandated by the West African Monetary Zone motivates this argument (WAMZ). The nation's history of underinvesting in public infrastructure doesn't improve matters. In light of these two instances, further investigation into the link between public debt and infrastructure spending is required. The vast majority of empirical articles for Ghana make no effort to analyse the link between these issues, despite the enormous potential they represent for advancing the field of research. Despite extensive research, there is still no consensus on whether or not a country's public debt affects its ability to invest in public infrastructure. The purpose of this thesis was, in part, to synthesize the most current results from empirical investigations of the debt-investment dynamic in Ghana. Thus, we want to assess the impact of debt servicing on the efficiency of Ghana's public sector in making investments in physical infrastructure. This study aims to assess the long- and short run effects of public debt on public infrastructure investment in addition to analyzing the effect of public debt on public infrastructure

investment in Ghana. The third goal was to examine the factors that have the most bearing on public infrastructure investment in Ghana.

The NARDL report finds that there is a positive asymmetric association between public infrastructure spending and external debt. Evidence from the cointegration analysis suggests that growing rather than dropping levels of foreign debt are detrimental to public infrastructure investment. Government spending on infrastructure in Ghana is revealed to be mostly financed by the country's external debt. Parameters such as total debt, government spending, private investment, inflation rate, currency rate, trade openness, population growth rate, and the rate of capital availability were proven to be statistically significant in the long run investment equation. Public spending, foreign debt, private investment, trade openness, and population growth rate are all key indicators of short run investment. A multitude of long run economic factors, such as Ghana's external debt, government spending, private investment, inflation rate, currency rate, trade openness, and population growth rate, all impact the country's ability to invest in public infrastructure. Examples of difficulties having a short time horizon include government spending and debt, private investment, trade liberalization, and population increase.

## **5.2 Policy Recommendations**

According to the study, infrastructure expansion leads to an increase in exchange rates. Therefore, the impact of debt payment that results in exchange rate depreciation will be lessened if more of the contracted foreign debt is diverted into infrastructure development. The study adds to the limited and diverse body of research on the relationship between public infrastructure, public debt, and exchange rates in Ghana, a developing region, since prior studies concentrated on developed countries.

The public debt has had a positive asymmetric impact on public infrastructure investment in Ghana. Therefore, the study recommends that political and economic decision-makers work to enhance the expansion of public debt and to increase its positive effects on public infrastructure in Ghana. The research also suggests that governments should put safeguards in place to monitor the use of borrowed money. Moreover, it motivates them to improve their debt management so that more money may be spent on public infrastructure, which is essential for advancing society and the economy.

Predictions suggest that foreign money should go toward self-sustaining companies. Foreign loans taken out by the Ghanaian government must be invested in projects that provide sufficient returns to pay back the principal and any interest accrued. Money that has to be borrowed should not be spent on frills like new furniture, paying off existing debt, or paying for extravagant salaries and perks for employees.

Government officials in Ghana should keep working to get debt relief from international lending institutions like the International Monetary Fund and the World Bank, as well as take steps to correct the economy's structural imbalances and rein in its ever-expanding budget deficits.

### **5.3 Areas for further studies**

Ghana's overall debt stock took on a new shape in 2006, when the country's first domestic credit market debuted. Previously, domestic debt made up around 15.92% of the public debt stock; presently, it makes up roughly 46.67%. (Bank of Ghana, 2021). Based on the latest data, it now seems prudent to incorporate domestic debt in the debt measures currently in use. Since respectable sources like the World Bank and the IMF did not collect sufficient data for the time period in question, the ratio of domestic debt to GDP was omitted from this thesis.

Future research may find it helpful to include this consideration when examining the link between government debt and investment in Ghana.

There is no investigation into what causes what between government borrowing and investment in this idea. Several analyses of public debt and investment made use of the "lone impact" notion (public debt on investment). Additional study is needed to determine the direction of causation between these factors.



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**APPENDIX**

**A: Breusch-Godfrey LM Test Result for Autocorrelation**

Lags (p)	Chi2	df	Prob > Chi2
1	22.720	1	0.0000

H<sub>0</sub>: no serial correlation

H<sub>1</sub>: presence of serial correlation

Source: Author’s compilation using EViews 10.

**B: ARCH’s Test Result for Heteroscedasticity**

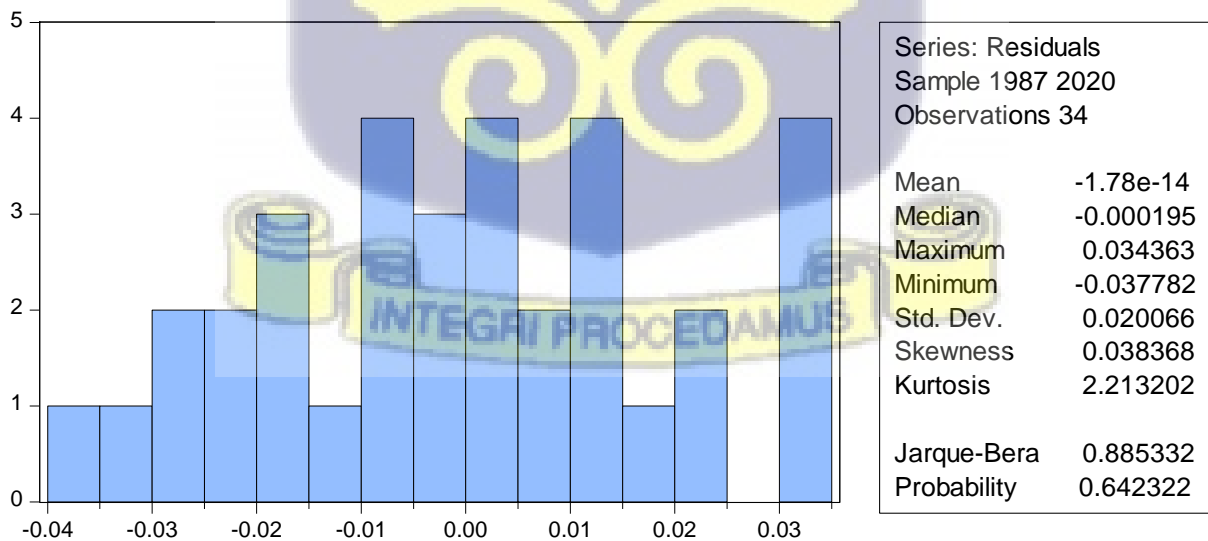
<b>Chi2 (35) = 37</b>
<b>Prob &gt; chi2 = 0.9727</b>

H<sub>0</sub>: Homoscedasticity

H<sub>1</sub>: unrestricted heteroscedasticity

Source: Author’s compilation using EViews 10.

**C: Normality Test Result**

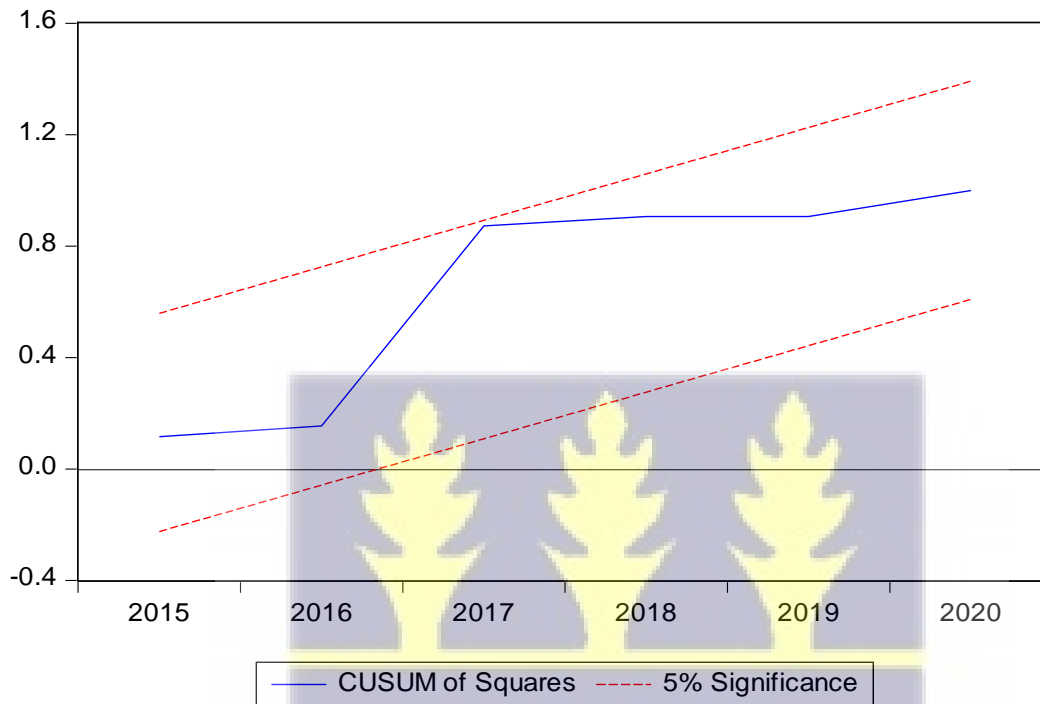


H<sub>0</sub>: Normally Distributed

$H_A$  : Non-normality

Source: Author's derivation using EViews 10.

### D: CUSUM Test Results



Source: Author's derivation using EViews 10.

